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From: jvolker <jvolker@volkerlaw.com>
Sent: Saturday, March 05, 2011 12:00 AM
To: catulewind@blm.gov; ECOSUB
Subject: ECO/Tule/ESJ DEIR/DEIS Comments of Backcountry Against Dumps et al.
Attachments: Fisher-Thomsen Comments of BAD et al. on ECO_Tule_ESJ_DEIR_DEIS .pdf

Mr. Thomsen and Mr. Fisher,

Attached please find the comments of Backcountry Against Dumps, The Protect Our Communities Foundation, the East County Community Action Coalition and Donna Tisdale on the ECO Substation Project, Tule Wind Project and ESJ Project DEIR/DEIS.

The exhibits to our comments will follow in a separate email, given their size.

We have also mailed you both a copy of the comments and all accompanying exhibits.

Thank you,

Jamey Volker

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March 4, 2011

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Re: Comments of Backcountry Against Dumps, The Protect Our Communities Foundation, East County Community Action Coalition and Donna Tisdale on the Draft Environmental Impact Report/Draft Environmental Impact Statement for East County Substation Project, the Tule Wind Project and the Energia Sierra Juarez Gen-Tie Project

Dear Officials:

Pursuant to the California Environmental Quality Act ("CEQA"), California Public Resources Code ("P.R.C.") section 21000 *et seq.*, and the National Environmental Policy Act ("NEPA"), 42 U.S.C. section 4321 *et seq.*, and in accordance with the public notices provided by the California Public Utilities Commission ("CPUC") and the Bureau of Land Management ("BLM") (collectively "reviewing agencies"), Backcountry Against Dumps, The Protect Our Communities Foundation, East County Community Action Coalition and Donna Tisdale (hereinafter "Conservation Groups") submit the following Comments on the reviewing agencies' joint Draft Environmental Impact Report/Draft Environmental Impact Statement ("DEIR") for the East County ("ECO") Substation Project, the Tule Wind Project and the Energia Sierra Juarez Gen-Tie Project ("ESJ Project") (collectively, "the Project"). These comments follow Conservation Groups' scoping comments on the Project, submitted on February 15, 2010 (attached hereto as Exhibit 1).

At the outset, Conservation Groups wish to express their opposition to this Project as an unnecessary industrialization of pristine desert wilderness areas. Echoing a growing chorus of opinions on this subject, Conservation Groups reiterate their suggestion that the reviewing agencies adopt as an alternative to the proposed project the development of wide-spread non-fossil fuel distributed generation projects near demand centers in already-disturbed areas.[1] The reviewing

[1] Distributed generation has been recently referred to by CPUC as electricity provided by "non-centralized electricity power production facilities less than 20 MW interconnected at the distribution side of the electricity system. [Distributed generation] technologies include solar,

agencies dismiss this alternative in the DEIR as being infeasible and unable to fulfill the Project objectives, but as discussed below these conclusions are erroneous. The EIR must provide a robust analysis of DG alternatives that would obviate the need for all three components of the project.

Additionally, Conservation Groups believe that this environmental review process will not adequately address impacts because it has been improperly segmented from the environmental reviews of other energy development and transmission projects, including, most notably, the Sunrise Powerlink Transmission Line ("Powerlink") EIR/EIS, which was approved by CPUC on December 18, 2008 and by BLM on January 20, 2009. The projects here are intimately linked to the Powerlink project and other large-scale energy development projects in the works. Conservation Groups therefore request that, before continuing with the environmental review and approval process for the Project, the reviewing agencies prepare a comprehensive, programmatic-level EIR/EIS. The programmatic EIR/EIS should (1) study the impacts of widespread industrial-scale energy developments in the southern California deserts and elsewhere in the Southwest, (2) provide guidance on where, if anywhere, to locate the developments, and (3) analyze alternatives to developing renewable energy facilities in sensitive desert ecosystems far from load centers, including locally distributed generation such as roof-top solar arrays. In further expression of these two major concerns and others, Conservation Groups offer the following comments on the DEIR.

I. Project Description

In its description of the ESJ Project, the DEIR asserts that "[o]nly renewable energy would be transmitted via the gen-tie line." DEIR at ES-11. At best, this statement is entirely unsupported by evidence. At worst, it is erroneous and misleading. While Sempra Generation (ESJ's parent company) requested in an August 28, 2009 letter to the federal Department of Energy ("DOE") that "power on [the gen-tie] line be limited to renewable energy projects," there is no evidence in the DEIR – or the Draft EIS prepared by DOE on the ESJ Project – that any such limitation has been or would be imposed.[2] Moreover, there are currently no CPUC-approved contracts for wind power in the Baja area. It thus appears that the statement is erroneous. The reviewing agencies must either strike the statement – and any conclusions based on it – from the EIR or explain its accuracy.

II. Project Purpose and Need

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wind and water-powered energy systems; and renewable and fossil-fueled internal combustion (IC) engines, small gas turbines, micro-turbines and fuel cells." CPUC, "Impacts of Distributed Generation, Final Report," January 2010, p. 3-3, available at: http://www.cpuc.ca.gov/NR/rdonlyres/750FD78D-9E2B-4837-A81A-6146A994CD62/0/ImpactsofDistributedGenerationReport_2010.pdf

[2] Sempra's letter is available at: http://esjprojecteis.org/docs/DOE_Presidential_Permit_clarification.pdf

NEPA requires EISs to show the "underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action." 40 C.F.R. § 1502.13. BLM must not "adopt[] private interests to draft a narrow purpose and need statement" because "the Department of Interior has promulgated no regulations emphasizing the primacy of private interests." *National Parks & Conservation Assn. v. U.S. Bureau of Land Mgmt* ("*NPCA v. BLM*"), 606 F.3d 1058, 1071, 1072 (9th Cir. 2010). The Department of the Interior's "NEPA handbook explains that the 'purpose and need statement for an externally generated action must describe the BLM purpose and need, *not an applicant's or external proponent's purpose and need.*'" *Id.* at 1071 n. 9 (emphasis in original).

Here, the DEIR states that BLM's purpose and need is merely to "respond to [San Diego Gas and Electric Company's ("SDG&E's")] and Pacific Wind Development's applications under Title V of the Federal Land Policy Management Act (FLPMA, 43 U.S.C. 1701 et seq.) for [a right-of-way ("ROW")] grant to construct, operate, and decommission a wind energy facility (Tule Wind Project) and a 138 kV transmission line on public lands (ECO Substation Project) in compliance with FLPMA, BLM ROW regulations, and other applicable federal laws." DEIR at ES-3. This is entirely inadequate for NEPA purposes. It is not enough for BLM to reiterate its statutory duty to review applications submitted to it. BLM must actually show the "*underlying* purpose and need" for the Project itself (40 C.F.R. section 1502.13 (emphasis added)), based on the agency's *own* purposes and needs, not those of the Project applicants. *NPCA v. BLM*, 606 F.3d at 1071.

III. A Programmatic EIR/EIS Should Be Prepared

In addition to requiring analysis of connected actions in project-specific ElSs, such as the Project DEIR here, NEPA requires agencies to prepare a programmatic EIS where the agency is considering a group of related actions, including actions that are connected, cumulative or similar. *Piedmont Environmental Council v. Federal Energy Regulatory Commission*, 558 F.3d 304 (4th Cir. 2009) (citing 40 C.F.R. § 1508.25(a)(1)-(3)); *see also* 14 Cal. Code Regs. ("CEQA Guidelines") § 15168 (discussing when a "Program EIR" can be prepared under CEQA). Agencies may not "unreasonably constrict[] the scope of . . . environmental evaluation" by segmenting review of an overall program or group of related actions. *National Wildlife Federation v. Appalachian Regional Commission*, 677 F.2d 883, 888 (D.C. Cir. 1981).

As discussed above, the Project is intimately linked to the Powerlink project and other energy development and transmission projects in the area. The ECO Substation Project, Tule Wind Project and ESJ Project are just three of the many proposed renewable energy projects in the southern deserts of California that either require BLM, CPUC and/or San Diego County's approval, or could not proceed without approval by one of those agencies of a related facility (such as the Powerlink). Other such projects include, *inter alia*, the Powerlink, the Ivanpah Solar Electric Generating System, the Esmeralda-San Felipe Geothermal Project, the Genesis Solar Energy Project, the Chevron Energy Solutions Lucerne Valley Solar Project, the Calico Solar Project, the Blythe Solar Project, and the Wind Zero Project.

These projects are interrelated in multiple ways. For one, as mentioned, all the projects are located in whole or in part in the California desert and require some form of BLM, CPUC and/or San Diego County approval. Additionally, all the projects would connect to the high-voltage wholesale power grid managed by the California Independent System Operator. Further, they are all intended to help California – and the utilities therein – meet their Renewables Portfolio Standard. The projects are also intended to help fulfill the Obama Administration's goal of harnessing renewable energy resources. Indeed, most of the projects are reliant on federal funds made available for renewable energy facilities by American Recovery and Reinvestment Act of 2009.

Before continuing with project-specific environmental review and approval processes for each of these interrelated renewable energy projects, like the Project here, BLM and CPUC should have, and must now, prepare a programmatic EIR/EIS to (1) study the impacts of widespread industrial-scale energy developments in the southern California deserts and elsewhere in the Southwest, (2) provide guidance on where, if anywhere, to locate the developments, and (3) analyze alternatives to developing renewable energy facilities in sensitive desert ecosystems far from load centers, including locally distributed generation such as roof-top solar arrays. Without such a programmatic EIR/EIS, BLM and CPUC have improperly segmented – and will continue to improperly segment – their environmental review of the unprecedented development of renewable energy facilities in the deserts of southern California and the greater Southwest.

BLM, along with the Office of Energy Efficiency and Renewable Energy, is currently developing a Solar Energy Development Programmatic EIS, but its zones of analysis do not include the Tule Wind Project site or many of the other sites in California for which renewable energy developments have been or are likely to be proposed. Thus, while commendable, the Solar Energy Development Programmatic EIS cannot satisfy NEPA with respect to the Project here and many other similar projects in California.

IV. Alternatives

NEPA requires that an EIS "[r]igorously explore and objectively evaluate all reasonable alternatives" so that "reviewers may evaluate their comparative merits." 42 U.S.C. §4332; 40 C.F.R. § 1502.14. "The existence of a viable but unexamined alternative renders an environmental impact statement inadequate." *Friends of Yosemite Valley v. Kempthorne*, 520 F.3d 1024, 1038 (9th Cir. 2008). Similarly, to comply with CEQA, agencies must consider a "reasonable range" of alternatives. CEQA Guidelines §15126.6(a); *Village of Laguna Beach, Inc. v. Board of Supervisors* (1982) 134 Cal.App.3d 1022, 1028. A project *cannot* be approved if its significant impacts can be feasibly reduced to insignificance through project alternatives or mitigation measures. P.R.C §§ 21002, 21081.

Here, the reviewing agencies unacceptably eliminated feasible – and less environmentally damaging – alternatives from careful review. Most notably, they dismissed the ECO System

Alternative 6 and the Distributed Generation alternative. DEIR at C-18 to 19, 24. As elucidated in the Declaration of Bill Powers (attached hereto as Exhibit 2), both of these alternatives are commercially and technically feasible. Moreover, they would both meet the Project objectives of increasing renewable energy development, meeting state Renewables Portfolio Standards and federal renewable energy mandates, and improving the reliability of power delivery to Boulevard, Jacumba and other nearby communities. DEIS at A-11. Engineer Bill Powers' expert conclusions are summarized and further substantiated below.

A. The ECO System Alternative 6

The ECO System Alternative 6 was proposed as an alternative to the ECO Substation and ESJ Project. The ECO System Alternative 6 is described in the DEIR as follows:

> Use existing Comision Federal de Electricidad (CFE) 230 kV line located in northern Mexico and Path 45 to transmit ESJ Energy, and upgrade East County 69 kV substations combined with upgrading existing East County 69 kV substation(s) and lines to accommodate local wind development combined with microgrid reinforcement of local transmission infrastructure to meet load requirements from rooftop solar or other local, small-scale resources.

DEIR at C-18. The DEIR dismisses this alternative because (1) there is not enough capacity on the CFE 230 kV line and Path 45 to "interconnect all of the ESJ Wind Project" in the La Rumorosa area of Mexico, or "all the region's planned renewable generation;" (2) the alternative "would not meet reliability objectives;" (3) upgrades to the CFE and Path 45 systems "may pose substantial regulatory and legal constraints to achieving delivery of renewable energy;" and (4) the "alternative may not meet environmental criteria because up to 100 miles of reconductering or rebuilding projects would be required to integrate planned renewable generation in the Boulevard area." *Id.* The DEIR is wrong; the ECO System Alternative 6 is feasible and would meet the Project objectives.

First, there is ample capacity. It is undisputed that Path 45 has at least 800 MW in unused capacity. *See* DEIR at C-18; Exhibit 2 at ¶¶ 3-6. However, the available capacity could be doubled if the lines were reconductered with composite conductors.[3] With a capacity of 1,600 MW, the "planned generation of 1,200 MW from the ESJ Wind Project" would be easily accommodated. DEIR at C-18. As for the other renewable generation planned in the region, some of it could be accommodated via upgrades to existing East County substations. *See* DEIR at C-55. And local distributed generation could supplant the need for any additional industrial-scale renewable generation facilities in the

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[3] *See* Bill Powers, "San Diego Smart Energy 2020: The 21st Century Alternative," October 2007, pp. 54-55, available at: http://www.sdsmartenergy.org/20-may-08_Smart%20Energy%202020_2nd%20printing_complete.pdf

region. *See* Exhibit 2 at ¶¶ 8-17.

Second, the alternative would meet the reliability objectives for the Boulevard and Jacumba area. As noted, upgrading the existing East County substations would improve reliability, as would increased distributed generation in the area. Further, as Bill Powers explains, the "reliability of the combined Boulevard/Jacumba area load could be completely assured with a 3 MW peak gas turbine at a cost of less than $4 million." Exhibit 2 at ¶ 7.

Third, the legal and regulatory barriers to implementation of the ECO System Alternative 6 are significantly overblown in the DEIR. As Bill Powers ably explains, "Sempra is clearly comfortable operating in the Baja California legal and regulatory environment," and "[i]t is not credible for CPUC and BLM to claim in the DEIR that there are sufficient capacity, legal, or regulatory impediments to exporting wind power from Baja California over Path 45 to make its use infeasible." Exhibit 2 at ¶ 6; *see also id.* at ¶¶ 3-5. Furthermore, jurisdictional irregularities are not enough to allow dismissal of an otherwise feasible alternative. Agencies are required by NEPA to consider alternatives they do not have the authority to implement. *Sierra Club v. Lynn*, 502 F.2d 43, 62 (5th Cir. 1974).

Fourth, the reviewing agencies provide no evidentiary support for their bare conclusion that the "alternative may not meet environmental criteria because up to 100 miles of reconductering or rebuilding projects would be required to integrate planned renewable generation in the Boulevard area." DEIR at C-55. It is unclear how the upgrading and reusing of existing infrastructure would be more environmentally damaging than the construction of new gen-tie lines, transmission lines, substations and other associated facilities.

In sum, the ECO System Alternative 6 is feasible and would meet the Project objectives. The reviewing agencies must fully examine this alternative.

B. The Distributed Generation Alternative

The DEIR describes the distributed generation alternative as follows:

> Under this alternative, the ECO Substation, Tule Wind and ESJ Gen-Tie projects would not be built. Instead, distributed generation including but not limited to residential and commercial rooftop solar panels, biofuels, hydrogen fuel cells, and other renewable distributed energy sources would be installed in the place of the Proposed PROJECT.

DEIR at C-60. The DEIR dismisses the distributed generation alternative on the grounds that it would (1) not meet renewable energy goals within the 2010-2020 time horizon; (2) only partially solve reliability issues to Boulevard and Jacumba communities; and (3) would be infeasible from a technical and commercial standpoint within the 2010-2020 time horizon. DEIR at C-24, 60 to 62. The DEIR is wrong; distributed generation is feasible and would meet the Project objectives.

First, as Bill Powers explains, "800-1,000 MW of distributed [photovoltaic solar generation] will be installed in SDG&E territory [by 2020] if the current 80-100 MW per year distributed PV installation rate is maintained." Exhibit 2 at ¶ 10; *see also id.* at ¶¶ 8-9. Furthermore, there is significantly more distributed generation potential with other sources, such as combined heat and power plants, of which there is "nearly 400 MW of cost-effective . . . potential in SDG&E's service territory" according to a 2005 study. *Id.* at ¶ 15. Combined, these and other distributed generation sources could meet renewable energy goals within the 2010-2020 time horizon.

Second, as Bill Powers' analysis shows, distributed generation sources – at least solar photovoltaics and combined heat and power plants – are more cost effective than most other generation sources, including those that the Project would tap. *Id.* at ¶¶ 11-17. Furthermore, distributed generation reduces the vulnerability of SDG&E's electrical grid to fires and other natural disasters. *Id.* at ¶¶ 11, 14.

Finally, as discussed above, distributed generation would aid the reliability of power supply in the Boulevard and Jacumba area. Moreover, the "reliability of the combined Boulevard/Jacumba area load could be completely assured with a 3 MW peak gas turbine at a cost of less than $4 million." Exhibit 2 at ¶ 7.

In sum, a distributed generation alternative is feasible and would meet the Project objectives. The reviewing agencies must fully examine this alternative.

V. Environmental Impacts

The EIR/EIS must take a "hard look" at the environmental impacts of proposed major federal actions and provide a "full and fair discussion" of those impacts. 40 C.F.R. § 1502.1; *see also National Parks & Conservation Ass'n v. Babbitt*, 241 F.3d 722, 733 (9th Cir. 2001). From a CEQA point of view, the EIR must inform the public and agency decisionmakers of all potentially significant environmental impacts prior to project approval. As the California Supreme Court has previously explained, "[t]he environmental impact report is the heart of CEQA and the environmental alarm bell whose purpose it is to alert the public and its responsible officials to environmental changes before they have reached ecological points of no return." *Sierra Club v. State Board of Forestry* (1994) 7 Cal.4th 1215, 1229 (quotations and citations omitted).

Here, the reviewing agencies must fully analyze all of the environmental impacts of the project. Accordingly, CPUC and BLM must evaluate the effects of the Project in both the United States *and* Mexico. *See, e.g., Hirt v. Richardson*, 127 F. Supp. 2d 833 (W.D. Mich. 1999); *National Organization for Reform of Marijuana Laws v. United States Department of State*, 452 F. Supp. 1226, 1232-33 (D.D.C. 1978); *cf.* Exec. Order No. 12114, 44 Fed. Reg. 1957 (1979), reprinted in 42 U.S.C.A. § 4321 app. However, the DEIR entirely fails to discuss the Project's effects in Mexico. Furthermore, its discussion of many environmental impacts in the United States is absent or inadequate, as explained below.

A. Noise Impacts

One of the DEIR's most glaring inadequacies is its omission of *any* analysis of infra- and low-frequency noise ("ILFN"), particularly as would be produced by the Tule Wind Project's wind turbines. The DEIR not only fails to analyze the impacts of ILFN, it fails to even calculate or discussion how much ILFN the Project would produce. The Project – and particularly the Tule Wind Project – is likely to produce enough ILFN to cause a significant adverse environmental impact, and the reviewing agencies' failure to identify, let alone analyze and mitigate, this impact flouts both CEQA and NEPA.

Wind turbine noise expert Richard James has submitted to CPUC and BLM an extensive wind turbine noise impact review of the Project. Carmen Krogh has also submitted comments on the DEIR detailing the adverse health impacts of industrial wind turbines. Conservation Groups generally agree with, and therefore incorporate by reference, Richard James' March 4, 2011 review and Carmen Krogh's March 1, 2011 comments. Conservation Groups also provide the following discussion of wind turbine noise impacts.

1. ILFN Can Produce Significant Adverse Health and Environmental Impacts

Health impacts from wind turbine noise can be severe. And as emerging research is consistently showing, the noise does not even have to be audible to cause substantial health impacts. As one researcher concluded, "non-aural physiological and psychological effects may be caused by levels of low frequency noise below the individual hearing threshold."[4] As another wind turbine noise research stated, "[t]here is no doubt that some humans exposed to infrasound experience abnormal ear, [central nervous system], and resource induced symptoms that are real and stressful."[5]

Health impacts from ILFN can include sleep disturbance, visceral vibratory vestibular disturbance, vertigo, headaches, dizziness, unsteadiness, tinnitus, ear pressure or pain, external

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[4] M. Schust, "Effects of low frequency noise up to 100 Hz," *Noise & Health*, 23(6):73-85, 2004, p. 73, available at: http://www.noiseandhealth.org/article.asp?issn=1463-1741;year=2004;volume=6;issue=23;spage=73;epage=85;aulast=Schust. *See also* Alec N. Salt & Timothy E. Hullar, "Responses of the ear to low frequency sounds, infrasound and wind turbines," *Hearing Research*, 268 (2010) 12-21 (attached hereto as Exhibit 3).

[5] Geoff Leventhal, "Review of Published Research on Low Frequency Noise and Its Effects," *prepared for* Defra (U.K. Department of Environment, Food and Rural Affairs), May 2003, p. 60, available at: http://www.defra.gov.uk/environment/quality/noise/research/lowfrequency/documents/lowfreqnoise.pdf.

auditory canal sensation, fatigue, irritability, memory and concentration effects, loss of motion, cardiac arrhythmias, stress and hypertension, among others.[6] "The energy generated by large turbines can be especially disturbing to the vestibular systems of some people, as well as cause other troubling sensations of the head, chest, or other parts of the body." Exhibit 4 at 24.

Here, there are dozens of residences within 1.25 miles of the Tule Wind Farm (*see* DEIR at D.10-109, D.8-25 to 27), a distance within which experts are increasingly finding wind turbine noise impacts, as discussed below. Thus, the impacts described above are likely to significantly and adversely impact Project area residents. Just because ILFN "is not yet [explicitly] recognized as a disease agent, is not covered by legislation" and "permissible exposure levels have not yet been established" does not mean the DEIR can *entirely* ignored this issue. *See Berkeley Keep Jets Over the Bay Committee v. Board of Port Commissioners* (2001) 91 Cal.App.4th 1344, 1370 ("The fact that a single methodology does not currently exist that would provide" the reviewing agencies with a "precise, or 'universally accepted,' quantification" of the Project's ILFN noise impacts "does not excuse the preparation of any health risk assessment"). CPUC and BLM must analyze and mitigate the Project's ILFN impacts.

2. A-Weighted and Averaged Noise Measurements Are Insufficient to Capture ILFN

As shown in DEIR Section D.8, all the noise measurements presented and analyzed are A-weighted. Furthermore, many of them are time-averaged. These types of measurements are inadequate for evaluating ILFN production and exposure.

With respect to A-weighting, as the DEIR itself states "the A-weighted scale . . . correlates well with human *perceptions* of the annoying aspects of noise." DEIR at D.8-2 (emphasis added). It does not correlate well with the impacts caused by inaudible sound pressures. Instead, the research uniformly shows that A-weighting underestimates the sound pressure level of noise with low-

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[6] *See, e.g.,* Punch, Jerry, Richard James & Dan Pabst, 2010, "Wind-Turbine Noise: What Audiologists Should Know," *Audiology Today*, July/August 2010, pp. 20-31 (attached to these comments as Exhibit 4); Pierpont, Nina, 2009, *Wind Turbine Syndrome: A Report on a Natural Experiment*, K-Selected Books: Santa Fé, NM; The Society for Wind Vigilance, January 2010, *Wind Industry Acknowledgment of Adverse Health Effects: An Analysis of the American/Canadian Wind Energy Association Sponsored "Wind Turbine Sound and Health Effects: An Expert Panel Review, December 2009*, available at http://www.windvigilance.com/awea_media.aspx.

frequency components. Exhibit 3 at 19.[7]

The problem with time-averaged measurements is that through them "information on fluctuations [is] lost."[8] This is an significant issue in measuring ILFN because "[m]any complaints of low frequency noise refer to its throbbing or pulsing nature."[9] Numerous studies have confirmed that "amplitude-modulated sound is more easily perceived an more annoying than constant-level sounds and that sounds that are unpredictable and uncontrollable are more annoying than any other sounds." Exhibit 4 at 23.

Thus, in order to better measure lLFN and fully take into account the impacts of inaudible sound pressures, the reviewing agencies should (1) use non-averaged noise measurements in addition to the averaged measurements they use for other purposes, and (2) use C-, G- and/or Z-weighted measurements, which give more weight to infrasound and lower frequencies, in addition to A-weighted measurements (which are useful for measuring audible noise impacts).

3. Even the A-Weighted Noise Impacts Will be Significant

Evidence demonstrates that "[a]nnoyance and sleep disruption are common when sound levels are 30 to 45 dBA."[10] And as Richard James explains on page 23 of his review, the "San Diego County

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[7] *See also,* World Health Organization, "Guidelines for Community Noise," 1999, section 2.3.3, available at: http://www.who.int/docstore/peh/noise/guidelines2.html; Minnesota Department of Health, Environmental Health Division, "Public Health Impacts of Wind Turbines," May 22, 2009, available at: http://www.health.state.mn.us/divs/eh/hazardous/topics/windturbines.pdf; M. Schust, "Effects of low frequency noise up to 100 Hz," *Noise & Health*, 23(6):73-85, 2004; HG Leventhall, "Low frequency noise and annoyance," *Noise & Health*, 23(6):59-72, 2004, available at: http://www.noiseandhealth.org/article.asp?issn=1463-1741;year=2004;volume=6;issue=23;spage=59;epage=72;aulast=Leventhall.

[8] Geoff Leventhal, "Review of Published Research on Low Frequency Noise and Its Effects," *prepared for* Defra (U.K. Department of Environment, Food and Rural Affairs), May 2003, p. 35.

[9] *Id.*

[10] Karen Rideout, Ray Copes and Constance Bos, "Wind Turbines and Health," *National Collaborating Centre for Environmental Health*, January 2010, p. 4, available at: http://www.ncceh.ca/sites/default/files/Wind_Turbines_January_2010.pdf. *See also* Eja Pedersen & Kerstin Persson Waye, "Perception and annoyance due to wind turbine noise – a does-response relationship," *Journal of the Acoustical Society of America*, 116(6), December

CNEL limit of 45 dBA for sensitive receivers will be exceeded at any location [where] the nighttime L_{Aeq} exceeds 38 dBA. This is likely to be most of the area within 1.25 miles of the perimeter of the Project." Since, there are dozens if not hundreds of sensitive receivers such as residences within 1.25 miles of the perimeter of the Project (*see* DEIR at D.8-25 to 27, D.10-107 to 109), the Project is likely to have significant *long-term* noise impacts. The DEIR is wrong in its conclusion that the ECO Substation and Tule Wind projects would only have *short-term* significant and adverse impacts, and that the ESJ projects would have *no* significant noise impacts. CPUC and BLM must revise their analysis to take these long-term noise impacts into account and mitigate them to the extent feasible.

4. Greater Mitigation Is Required

As shown in DEIR Section D.8, Project facilities, including wind turbines, the ECO Substation and others would be located well within 1.25 miles of residences and other sensitive receptors. As discussed above, this is an inadequate setback. To avoid the negative health impacts from wind turbines, Dr. Nina Pierpont recommends setbacks from large wind projects of at least *1.25 miles*.[11] A similar setback has been called for by the French National Academy of Medicine.[12] In his report for the Academy, Claude-Henri Chouard writes:

> The harmful effects of sound related to wind turbines are insufficiently assessed .... The sounds emitted by the blades being low frequency, which therefore travel easily and vary according to the wind, ... constitute a permanent risk for the people exposed to them. ... The Academy recommends halting wind turbine construction closer than 1.5 km from residences.[13]

Here too the setbacks should be 1.25 miles – at least the setbacks from the Tule Wind Project wind turbines.

B. Public Health Impacts – Dirty Electricity

2004, available at:
http://maine.gov/dep/blwq/docstand/sitelaw/Selected%20developments/Spruce_Mountain/additional_information/9_24_2010/fsm/exhibit_17.pdf.

[11] Nina Pierpont, 2009, *Wind Turbine Syndrome: A Report on a Natural Experiment*, K-Selected Books: Santa Fé, NM.

[12] Chouard, Claude-Henri, 2006, *Rapport: Le Retentissement du Fonctionnement des Éoliennes sur la Santé de l'Homme*.

[13] *Id.*

Another impact overlooked in the DEIR is that of dirty electricity. As electrical pollution expert David Colling describes in his Declaration (attached hereto as Exhibit 5), "dirty electricity refers to the electromagnetic energy that flows along a conductor and deviates from a pure 60-Hz sine wave." Exhibit 5 at 1. Mr. Colling has tested for electrical pollution at multiple wind farms and substations and has found that "[w]ind turbines can produce significant electrical pollution in the form of dirty electricity. Additionally, if not adequately filtered, dirty electricity can be propagated through the substations and onto transmission and distribution lines." Exhibit 5 at 8. As Mr. Colling has discovered, dirty electricity can travel significant distances both along power lines and through the ground, commonly impacting people and structures for more than 0.5 miles from the source (e.g. a wind turbine). Exhibit 5 at 3.

The impacts of dirty electricity, like those of ILFN, can be severe. Until recently, dirty electricity had not been widely studied by the scientific community, but this is beginning to change. Recent studies have linked dirty electricity with an increase in ailments such as diabetes, fibromyalgia, chronic fatigue syndrome and attention deficit disorder, among others.[14] Anecdotal evidence, such as the horrific stories recounted by Paul Thompson in his comments on the DEIR, also bears out the negative effects of dirty electricity.

Nonetheless, the DEIR "does not consider [electromagnetic frequencies ("EMFs")] in the context of CEQA/NEPA for determination of environmental impact because there is no agreement among scientists that EMFs create a health risk and because there are no defined or adopted CEQA/NEPA standards for defining health risks from EMFs." DEIR at D.10-93. However, as discussed above, "[t]he fact that a single methodology does not currently exist that would provide" the reviewing agencies with a "precise, or 'universally accepted,' quantification" of the Project's dirty electricity impacts "does not excuse the preparation of any health risk assessment." *Berkeley Keep Jets Over the Bay Committee v. Board of Port Commissioners* (2001) 91 Cal.App.4th 1344, 1370

Furthermore, even the "non-CEQA/NEPA" discussion that follows that pronouncement focuses solely on *magnetic fields* and not *electrical fields*, such as those propagated by dirty electricity. Thus, the DEIR omits any analysis of dirty electricity and lacks an adequate rationale for its omission. To comply with CEQA and NEPA, the reviewing agencies must analyze the Project's dirty electricity output and its impacts on people and the environment.

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[14] *See, e.g.,* Magda Havas, "Electromagnetic Hypersensitivity: Biological Effects of Dirty Electricity with Emphasis on Diabetes and Multiple Sclerosis," *Electromagnetic Biology and Medicine*, 25:259-268, 2006, available at: http://www.next-up.org/pdf/Magda_Havas_EHS_Biological_Effets_Electricity_Emphasis_Diabetes_Multiple_Sclerosis.pdf; The National Foundation for Alternative Medicine, "The health effects of electrical pollution," available at: http://d1fj3024k72gdx.cloudfront.net/health_effects.pdf.

C. Visual Impacts – Wind Turbine Shadow Flicker

Shadow flicker is one of the many side effects of wind turbines.[15] A Michigan State University paper describes shadow flicker thusly:

> Shadow flicker is caused by the sun rising or setting behind the rotating blades of a turbine. The shadow created by the rotating blades can cause alternating light and dark shadows to be cast on roads or nearby premises, including the windows of residences, resulting in distraction and annoyance to the residents. A related phenomenon, strobe effect, is caused by the chopping of sunlight behind moving blades, similar to the effect of the setting sun behind trees when driving along a roadway in the winter.[16]

The Minnesota Department of Health has also found that the "[r]hythmic light flicker from the blades of a wind turbine casting intermittent shadows has been reported to be annoying in many locations."[17] Shadow flicker can also present numerous dangers, such as distracting drivers on roads close to turbines. As a result of this road hazard, Ireland established guidelines requiring wind turbines to be set back at least 300 meters from roads.[18] Other mitigation measures for shadow flicker include shutting down the wind turbines during the time when shadow flicker would occur.

Here, the DEIR entirely fails to analyze shadow flicker, let alone mitigation measures to reduce the impact. CPUC and BLM must now do so.

D. Biological Impacts

There are numerous biological impacts the reviewing agencies failed to adequately analyze in the DEIR. First, the DEIR improperly dismisses impacts to the Peninsular bighorn sheep, stating that the "Proposed PROJECT area is located outside of [the regional Peninsular bighorn sheep corridors]." DEIR D.2-59. Contrary to the DEIR's statement, the ESJ Project and the associated wind energy

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[15] For a video of shadow flicker at a rural residence in Illinois, see: http://lifewithdekalbturbines.blogspot.com/2010/05/shadow-flicker-videos.html.

[16] Michigan State University, "Land Use and Zoning Issues Related to Site Development for Utility Scale Wind Turbine Generators," 2004, p. 1, available at: http://web1.msue.msu.edu/cdnr/otsegowindflicker.pdf.

[17] Minnesota Department of Health, Environmental Health Division, "Public Health Impacts of Wind Turbines," May 22, 2009, p. 14.

[18] Michigan State University, "Land Use and Zoning Issues Related to Site Development for Utility Scale Wind Turbine Generators," 2004, p. 1.

projects in the La Rumorosa region of Baja California would be located adjacent to and, in some places, on top of an international migration corridor for the Peninsular bighorn sheep. The ESJ gen-tie transmission route and portions of the three phases of the ESJ Wind Project in Baja California would be located directly adjacent to and/or overlap with the Peninsular Ranges of Mexico, an area which the United States Fish and Wildlife Service views as "the *only possible route* for a natural connection with other bighorn sheep populations for the [distinct population segment of sheep] in the U.S." 74 Fed.Reg. 17288, 17311 (2009) (emphasis added). For example, the two Mexican lease areas where the subsequent phases of the ESJ Wind Project would occur are situated on the Sierra de Juarez and Cordillera Molina mountain ranges, both of which are part of the Peninsular Ranges of Mexico. Thus, both the ESJ Gen-Tie Project and the related ESJ Wind Project in Baja California have the potential to substantially impact Peninsular bighorn sheep genetic diversity and long-term population viability in the United States.

Second, the DEIR fails to properly analyze the Project's noise impact on birds. As discussed in DEIR Section D.8, the Project's construction noise levels would be very high, reaching 80 dBA at a distance of 50 feet from the ECO Substation construction equipment and 75 dBA within 200-feet of various construction activities for the ECO Substation Southwest Powerlink Loop-in, for example. In addition, the Project's operation noise levels could exceed 60 dBA at close distances and during storms. These noise levels present a potentially significant adverse effect for avian species in the area.

The threshold for noise significance is substantially lower for some sensitive avian species than what the Project will likely produce. Particularly sensitive species in – or potentially in – the Project area include the horned lark, loggerhead shrike, least Bell's vireo, gray vireo and Southwestern willow flycatcher. DEIR Appendix 1-37 to 39, 42, 43. Expert testimony from Dr. Travis Longcore, given in the CPUC proceeding on the SDG&E's application for a certificate of public convenience and necessity for the Powerlink and attached as Exhibit 6 hereto, shows that the threshold for significant negative impacts on bird species similar to the birds just listed is much lower than 60 dBA. After summarizing studies of other small passerine birds, like the California horned lark, loggerhead shrike, least Bell's vireo and southwestern willow flycatcher, Dr. Longcore concludes that "[f]rom the published literature . . . a reasonable threshold based on similar species for least Bell's vireo and southwestern willow flycatcher would be 40 dB(A) or below." Exhibit 6 at 12. Dr. Loncore then goes on to discuss empirical data from California "indicating with certainty that territory occupancy is reduced by sound levels in the 50 - 60 Db(A) range" for the southwestern willow flycatcher (*id.* at 13), which is similarly susceptible to noise impacts as the California horned lark and loggerhead shrike since all three species are "small songbirds that rely on hearing songs to attract mates and defend territories." *Id.* at 12.

These noise impacts on birds must be taken particularly seriously given that all five species listed above are special-status species that have been observed or are reasonably likely to occur the Project site. DEIR Appendix 1-37 to 39, 42, 43. Unless the Project's noise levels are reduced much

below 60 dBA, the Project would have significant impacts on these and other avian species, impacts that must be analyzed and mitigated.

Another consideration that should have been omitted from the DEIR's biological impact analysis is the color of the Tule Wind Project wind turbines. While lighter color turbines may be visually preferable for humans, at least one report concludes that white, light gray and yellow turbines may attract the most flying insects – and hence birds and bats that feed on those insects.[19] The report found that purple was the color least likely to attract insects. The reviewing agencies should further analyze the choice of Project facility colors.

A final inadequacy of the DEIR's biological resources analysis is its deferral of Quino checkerspot butterfly protocol surveys until "within 1 year prior to project construction acitivities in occupied habitat." DEIR at ES-30.

E. Conservation Initiatives

The DEIR fails to discuss the Project's negative impacts on the region's conservation initiatives. The construction of the Project, and all of the other energy production facilities dependent upon the ESJ gen-tie line and the ECO and Boulevard substations, would substantially impair the ecological value of the ECO Substation, Tule Wind and ESJ project sites themselves as well as miles of surrounding mountains and high desert. This degradation of the mountain and desert ecosystems in the region will likely affect conservation decisionmaking, turning money and protection away from the area as conservationists look for less-developed lands to preserve. Some of the conservation initiatives that could be affected by the Project but were not discussed in the DEIR include The Nature Conservancy's purchase of the Jacumba-Eade property in January 2008 for inclusion into the Anza Borrego State Park, the Las Californias Binational Conservation Initiative, and the Parque to Park proposal, which seeks to connect Anza Borrego State Park (and the Jacumba property purchased for the Park mentioned above) with Baja Mexico's Parque Nacional Constitucion de 1857 and the Parque Nacional San Pedro Martir. This omission violates CEQA and NEPA and must be remedied by the reviewing agencies.

F. Fire Impacts

As discussed in the DEIR, the ECO Substation, Tule Wind and ESJ projects would all have significant adverse environmental impacts. DEIR at Section D.15. Conservation Groups agree with,

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[19] Laura Roberts, "Wind turbines should be painted purple to deter bats, scientists claim," *The Telegraph*, October 15, 2010, available at: http://www.telegraph.co.uk/earth/earthnews/8066012/Wind-turbines-should-be-painted-purple-to-deter-bats-scientists-claim.html.

and therefore incorporate by reference, the February 8, 2001 comments of Boulevard/Jacumba/La Posta Fire Safe Council on additional fire dangers and mitigation measures that CPUC and BLM should analyze in their environmental review of the Project.

G. Hydrological Impacts

The proposed location of the ECO Substation, Tule Wind and ESJ projects is very arid and water supplies are limited. Therefore it is critically important that the reviewing agencies ensure that the Project would have minimal impacts to the region's surface and groundwater supplies. This entails analysis and mitigation of the Project's potential water quality impacts, as well as identification of sufficient water supplies to meet the Project's needs and analysis of the impacts of procuring that water. *See Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova* (2007) 40 Cal.4th 412, 446 (EIRs must "demonstrate a reasonable likelihood that water will be available for the project from an identified source").

With respect to water supplies, the DEIR is deficient because it does not demonstrate with reasonable certainty that water will be available for the Project. For instance, the only somewhat assured source of water identified for the ECO Substation Project is the Sweetwater Authority's "[c]onfirmation" that it has "sufficient water capacity to provide 25-million-gallons of water to [the project] during construction." DEIR at D.12-27. However, this is *5 million gallons less* than the identified water demand during construction. *Id.* Furthermore, the DEIR says nothing about the ECO Substation Project's operational water demands except that the "insulators" would not need to be washed. This is unacceptable. The DEIR also fails to identify a reasonably assured water source for the ESJ Project, noting that if the Jacumba Community Services District does not provide the requisite water a well could be sunk instead, but failing to discuss the feasibility of doing so. *See* DEIR at B-162.

Instead of fully analyzing the Project's water supplies, the DEIR merely includes a mitigation measure providing that "[p]rior to construction, the applicant will prepare comprehensive documentation that identifies one or more confirmed, reliable water sources that when combined meet the project's full water supply *construction* needs." DEIR at 12-28 (emphasis added). This is inadequate – water supplies must be identified *now* for both construction *and* operational demand for the ECO Substation, Tule Wind and ESJ projects.

With respect to water quality, the DEIR states that the ECO Substation would involve the construction of two retention ponds, the lining of which would "either be removed or punctured to allow water seepage into the ground." DEIR at B-22. However, nowhere does the DEIR discuss the potential for groundwater pollution when the liners are removed, exposing the soils to potentially toxics-laden water, sludge and/or residual dust. The reviewing agencies must analyze this impact.

H. Climate Change Impacts

The reviewing agencies assert in the DEIR that the ESJ Project would only transmit "renewable energy." DEIR at ES-11. However, as discussed, this statement is left wholly unsupported and is likely false. Unless the reviewing agencies provide concrete evidence that the ESJ Project would only transmit renewable energy, they must address the likelihood that the gen-tie lines and the ECO and Boulevard substations would cause more fossil-fuel-based generating facilities to be built in Mexico or near the substation in the United States. Notably, Sempra's Bajanorte Gasducto liquified natural gas ("LNG") line and a newly constructed water line run through Sempra's leased land directly south of the proposed location for the ECO Substation. With the construction of the ESJ gen-tie line, Sempra will have all the necessary ingredients for a new gas-fired power plant on the Mexican side of the international border: gas, water, and transmission. Sempra has previously indicated that LNG will serve as its primary fuel for decades to come and has invested billions in its LNG infrastructure in Baja, including the construction of the Energia Costa Azul LNG terminal near Ensenada, Mexico. The reviewing agencies should fully investigate the potential for the Project to increase fossil fuel consumption and analyze the consequent effects on greenhouse gas emissions, global warming, and air quality in the Project area and elsewhere.

I. Cultural Resource Impacts

As the DEIR states, there are at least 40 previously recorded archaeological sites within the right-of-way proposed for the Tule Wind Project, and more than 30 archaeological investigations that have taken place previously within the proposed right-of-way. DEIR at D.7-3. There are "traditional cultural properties" in the footprints of all three projects, and the DEIR states that the impacts to those cultural resources would be significant and unmitigable. DEIR at D.7-113.

To help mitigate these devastating and tragic impacts, the reviewing agencies should analyze the feasible mitigation measure of creating a permanent fund for the creation and continued operation of one or more museums in San Diego County. The museums would contain cultural artifacts discovered in the Project area and surrounding lands that would otherwise be removed and sent to museums, universities and government offices elsewhere. The Native Americans in and around the Project area have the right to preserve their cultural heritage and it is the government's duty to ensure that it is not taken from them.

J. Economic Impacts

Environmental reviews under CEQA and NEPA cannot ignore economic impacts. Under CEQA, a "social or economic change related to a physical change may be considered in determining whether the physical change is significant." CEQA Guidelines § 15382; *see also Bakersfield Citizens for Local Control v. City of Bakersfield* (2004) 124 Cal.App.4th 1184, 1208 (court concluded that the proposed Supercenter project could result in business closures and economic problems that would potentially cause "urban decay," which the respondent city had failed to consider in the EIR). Similarly, under NEPA "[w]hen an environmental impact statement is prepared and economic or social

and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment." 40 C.F.R. § 1508.14.

Here, the Project would have significant and adverse noise, EMF and visual impacts. As a result of and hence intimately "interrelated" with these impacts, property values in the Project area would likely decline substantially. These likely property value declines are thoroughly analyzed in property appraisal expert Michael McCann's evaluation of the Project (attached hereto as Exhibit 7). In his professional opinion, the "Project will cause substantial diminution and injury to property values in the area, averaging approximately 25% as far as 2 to 3 miles, and with approximately 5% value loss from the nearest turbines [of the Tule Wind Project] out to as far as 5 miles." Exhibit 7 at 2. Furthermore, Michael McCann explains how the literature review relied on by the reviewing agencies to discount the property value impacts of wind turbines actually *supports* the conclusion that this Project *would have substantial impacts*. Exhibit 7 at 12-15. Moreover, as the DEIR notes, at least one residence would be destroyed and its occupants relocated. DEIS at D.16-13.

These property value and forced relocation impacts are significant and must be identified and analyzed as such by the reviewing agencies. Instead, the DEIR states that "social and economic effects are not treated as significant effects on the environment in this analysis and, therefore, no CEQA significance conclusions are presented for such effects." DEIR at D.16-11. Further, the DEIR states that any "decrease in property values" occasioned by all the construction and operation of the three projects would be "Not Adverse." DEIR at D.16-12. This flouts CEQA, NEPA and common sense.

K. Growth-Inducing Impacts

The DEIR's discussion of growth related to the provision of additional electric power consists of just one short paragraph. DEIR at G-2 to 3. The DEIR admits that "the Proposed PROJECT is an important element in developing additional renewable energy resources required to meet the current and future California Renewable Portfolio Standard and federal Energy Policy Act goals for developing renewable energy." *Id.* Nonetheless, the DEIR omits any analysis of the type, number and impacts of the energy development the Project would induce. Instead, the DEIR concludes that "the Proposed Project would not directly induce growth related to provision of additional electric power in a predictable manner or defined location." DEIR at G-3. This is evasive maneuver is unacceptable. It impermissibly sidesteps both NEPA's and CEQA's requirement that growth-inducing impacts be discussed. 40 C.F.R. § 1508.8(b); CEQA Guidelines § 15126.2(d).

At the very least, the EIR must acknowledge the extent to which the Project would enable future development of energy facilities, as well as the type of such facilities. As the DEIR states, the ECO Substation would be designed to ultimately expand to include "[f]our 500/230 kV, 1,120 megavolt ampere (MVA) transformer banks with two single-phase operational spares." DEIR at B-21. This equates to the capacity to accommodate as much energy throughput as 4,480 MW. Yet the DEIR

never discusses this fact, nor the substantial energy-related development it would induce. BLM and CPUC must remedy this gross omission.

VI. Improper Deferred Specification of Mitigation Measures

The DEIR improperly deferred specification of numerous mitigation measures until after the completion of environmental review. The improperly deferred measures include, among others, the Noxious Weeds and Invasive Species Control Plan, Habitat compensation, the Stormwater Pollution Prevention Plan, the Dust Control Plan, Avian Protection Plans, the Cultural Resources Treatment Program, the traffic control plan, the Construction Fire Prevention/Protection Plan and site-specific noise mitigation plans. This flouts CEQA and NEPA and must be remedied by CPUC and BLM.

VII. Conclusion

Conservation Groups again emphasize their concern that the environmental impacts of the projects that threaten to industrialize eastern San Diego County and western Imperial County must be comprehensively reviewed in a programmatic EIR/EIS before any further project-specific actions are taken. The combined effects of all of the energy projects proposed in the deserts of Southern California and the Southwest in general, including the present Project, the Powerlink project, and all other reasonably foreseeable energy developments in the area will fundamentally alter the region in ways that have not been fully revealed or analyzed to date. The best way to provide for the future energy needs of Southern Californians – and the United States as a whole – is not through destructive development of their irreplaceable wildlands, but rather through the deployment of distributed generation facilities at already disturbed locations within or near the urban demand centers.

Sincerely,

Stephan C. Volker

Attorney for Backcountry Against Dumps,

The Protect Our Communities Foundation, East County Community Action Coalition and Donna Tisdale

EXHIBIT 1

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February 15, 2010

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Re: Scoping Comments of Backcountry Against Dumps, The Protect Our Communities Foundation, East County Community Action Coalition and Donna Tisdale on the East County (ECO) Substation Project, the Energia Sierra Juarez Generator Tie-Line Project, and the Tule Wind Project

Dear Officials:

In accordance with the public notices provided by the California Public Utilities Commission ("CPUC") and the Bureau of Land Management ("BLM") (collectively "reviewing agencies"), Backcountry Against Dumps, The Protect Our Communities Foundation, East County Community Action Coalition and Donna Tisdale (hereinafter "Conservation Groups") submit the following Scoping Comments on the East County ("ECO") Substation Project, the Energia Sierra Juarez Generator Tie-Line Project ("ESJ Project"), and the Tule Wind Project (collectively, "ECO/ESJ/Tule Project" or the "project").

Out the outset, Conservation Groups wish to express their opposition to this project as an unnecessary industrialization of pristine desert wilderness areas. Echoing a growing chorus of opinions on this subject, Conservation Groups suggest as an alternative to the proposed project wide-spread non-fossil fuel distributed generation ("DG") projects near demand centers in already-disturbed areas.[1] The Environmental Impact Report/Environmental Impacts Statement ("EIR/EIS") should

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[1] Distributed generation has been recently referred to by the CPUC as electricity provided by "non-centralized electricity power production facilities less than 20 MW interconnected at the distribution side of the electricity system. DG technologies include solar, wind and water-powered energy systems; and renewable and fossil-fueled internal combustion (IC) engines, small gas turbines, micro-turbines and fuel cells." *Impacts of Distributed Generation, Final Report*, California Public Utilities Commission, January 2010, p. 3-3, available at: http://www.cpuc.ca.gov/NR/rdonlyres/750FD78D-9E2B-4837-A81A-6146A994CD62/0/ImpactsofDistributedGenerationReport_2010.pdf

provide a robust analysis of DG alternatives that would obviate the need for all three components of the project.

Additionally, Conservation Groups believe that this environmental review process will not adequately address impacts because it has been improperly segmented from the environmental reviews of other energy development and transmission projects, including, most notably, the Sunrise Powerlink Transmission Line ("Powerlink") EIR/EIS, which was approved by the CPUC on December 18, 2008 and by BLM on January 20, 2009. The projects here are intimately linked to the Powerlink project and other large-scale energy development projects in the works, and thus all of these should be addressed together in a single EIR/EIS process. Conservation Groups therefore ask the reviewing agencies to prepare a comprehensive, programmatic-level EIR/EIS that will reveal all of the intense, wide-spread impacts of the near-future industrial development of desert areas of Eastern San Diego County and Imperial County. In further expression of these two major concerns, Conservation Groups offer the following scoping comments.

I. Project Purpose and Need

The reviewing agencies must discuss and take a hard look at the purpose of and need for the ECO/ESJ/Tule project in the EIR/EIS. 40 C.F.R. § 1502.13; *see also Colorado Environmental Coalition v. Dombeck*, 185 F.3d 1162, 1175 (10th Cir. 1999) (the permitting agency retains the ultimate "responsibility for defining the objectives of [and need for the] action"). Among other things, the CPUC and BLM must analyze where the electricity transported by the project would be used and whether there is in fact an existing or projected capacity shortfall or other condition in that area that necessitates importation of energy.

A discussion of supply and demand should address the growing consensus that energy production facilities must be located near urban centers – not in remote, sparsely populated, and ecologically valuable areas like Eastern San Diego County. Large-scale, urban, photovoltaic projects are being proposed and approved in SDG&E's and Southern California Edison's territories. The increasing importance of these locally distributed generation projects should be thoroughly reviewed and analyzed in the environmental review of the project.

The EIR/EIS must also fully address the reliability issues with wind energy production and fully analyze recent events at the Campo Indian Reservation, which caused operators to shut down 25 turbines for the past two months because of weather-related damage.[2] A comprehensive reliability analysis should be conducted comparing these large-scale energy production facilities and DG alternatives prior to approval of the project.

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[2] http://www.eastcountymagazine.org/node/2734

In addition, in regard to the ESJ component of the project, reviewing agencies must explain why there is a need for additional transmission infrastructure when it is eminently feasible to transmit electricity produced in the La Rumorosa area along *existing* transmission lines that are already interconnected directly to the SDG&E electrical grid and have at least 800 MW of spare transmission capacity[3] – a number that could likely be doubled if the lines were reconductored with composite conductors.[4] These transmission lines are jointly owned and operated by SDG&E and the Comisión Federal de Electricidad ("CFE") and comprise one tie connecting CFE's Tijuana Uno Substation to SDG&E's Miguel Substation and one joining CFE's La Rosita Substation with SDG&E's Imperial Valley Substation. Together, the ties are called Western Electricity Coordinating Council ("WECC") Path 45. The EIR/EIS must fully analyze current transmission capacity and analyze whether and to what extent the ESJ project it necessary.

Finally, the reviewing agencies must clarify whether the purpose of the ESJ project is to facilitate the importation into the United States of *solely* wind energy and/or other renewable energy. The EIR/EIS must make clear whether the cross-border transmission line could and potentially would be used to transmit energy produced from natural gas, coal or other fossil fuel-based resources. Comprehensive coordination with all Mexican governmental agencies with jurisdiction over the project, related developments, and their environmental effects should be conducted as early as feasible in the planning process to assure that the project's stated purpose and need are accurate and realistic, and are accepted as such by the relevant Mexican regulatory bodies.

II. Sunrise Powerlink

As discussed above, the project is intimately linked to the Powerlink project and other energy development and transmission projects in the area. Environmental review of all of the proposed projects should have been conducted on a programmatic level prior to more focused reviews of the individual projects. In light of the fact that no programmatic review has taken place, Conservation Groups ask that the present review process include a comprehensive treatment of cumulative impacts, which would include discussion of the Powerlink impacts in combination with the impacts from the present project on the desert resources of Eastern San Diego County and Imperial County.

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[3] *See* California Energy Commission Report No. CEC-600-2008-004, June 2008, "Challenges and Opportunities to Deliver Renewable Energy from Baja California Norte to California" (CEC Report), prepared by KEMA Inc. and Bates-White, LLC, *available at* http://www.energy.ca.gov/2008publications/CEC-600-2008-004/CEC-600-2008-004.PDF.

[4] *See* Bill Powers, October 2007, "San Diego Smart Energy 2020: The 21st Century Alternative," *available at* http://www.etechinternational.org/new_pdfs/smartenergy/52008_SmE2020_2nd.pdf, pp. 54-55.

III. Project and Alternatives Descriptions

The project description must be clear, concise, and accurate from the start. Descriptions of complex, multifaceted projects such as the present project often fail to meet this standard. Further, descriptions of alternatives similarly should be complete and comprehensive or the comparative analysis can easily become excessively confusing and incomplete, as exemplified by the alternatives analysis in the EIR/EIS for the Powerlink project. Thus, Conservation Groups urge the reviewing agencies to clearly describe the proposed project and alternatives thereto in the EIR/EIS.

IV. Alternatives

The EIR/EIS must address a reasonable range of alternatives. *City of Carmel-by-the-Sea v. U.S. Department of Transportation*, 123 F.3d 1142, 1155 (9th Cir. 1997). The reasonable range of alternatives required by NEPA should include a "reasonable number of examples covering the full range of alternatives." CEQ Forty Questions, No. 1b. Furthermore, an agency may not limit its consideration to only those alternatives it believes it has the authority to implement. Rather, the alternatives should be wide-ranging and include options that may require additional approvals or participation by others. *Sierra Club v. Lynn*, 502 F.2d 43, 62 (5th Cir. 1974); *see also Alaska Wilderness Recreation and Tourism Ass'n v. Morrison*, 67 F.3d 723, 729 (9th Cir. 1995). The reviewing agencies' analysis of the full range of alternatives to the proposed project should include, among others, the alternatives discussed below.

First, the CPUC and BLM should consider the alternative of providing and promoting increased distributed generation and increasing conservation measures in the urban load centers that would be served by the project. Expanding distributed generation would serve the same purposes as the project, including increased electricity generation and supply of renewable energy. Increasing conservation decreases demand to further close any forecast gaps between supply and demand. This alternative is eminently feasible, as the California Renewable Energy Transmission Initiative ("RETI") has determined that there is up to 27,500 MW of potential distributed generation in small-scale (1-20 MW projects on less than 160 acres) photovoltaic facilities alone (in California).[5]

Furthermore, developing distributed generation facilities would have fewer environmental impacts and be far less expensive than constructing and operating the project's new wind farms, transmission lines, and substations. As CPUC Commissioner John Bohn has acknowledged, "[u]nlike other generation sources, [distributed generation] projects can get built quickly and without the need for expensive new transmission lines. And . . . these projects are extremely benign from an

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[5] California RETI, January 2009, "Phase 1B Final Report," *available at* http://www.energy.ca.gov/reti/documents/index.html, p. 1-12.

environmental standpoint, with neither land use, water, or air emission impacts."[6] Further, the cost for most DG installations continues to plummet, making DG the economically preferably option. Moreover, distributed generation facilities pose a significantly lower risk of shut-offs and damage from wildfire and thus would improve electrical reliability.

Second, the EIR/EIS should analyze the alternative of undergrounding all or portions of the proposed transmission lines. The benefits of this alternative include reduced fire danger, risk to aircraft, avian mortality and other biological impacts, and improved aesthetics.

Third, specifically related to the ESJ component of the project, CPUC and BLM must examine the alternative of transmitting the wind power from the La Rumorosa area along existing CFE and SDG&E lines (the WECC Path 45) instead of through a newly constructed generation tie and substation (the ECO Substation and expanded Boulevard Substation). As discussed in the Purpose and Need section of these scoping comments, the CFE lines are *already* directly connected to the SDG&E electrical grid and have at least 800 MW of *spare* transmission capacity. Furthermore, the amount of spare capacity could likely be doubled if the lines were reconductored with composite conductors. While CFE would charge a small wheeling fee for use of its lines, the charge could be reduced in exchange for Energia Sierra Juarez U.S. Transmission, LLC ("ESJ" - formerly Baja Wind U.S. Transmission, LLC, and a subsidiary of Sempra Energy) reconductoring the lines. In addition, by using the existing lines ESJ would be saving substantially on construction costs. Overall, this alternative is eminently feasible and would likely have fewer environmental impacts and cost less than the proposed project.

Fourth, the reviewing agencies should evaluate the possibility of limiting the use of the project's transmission infrastructure to only allow transmission of power from renewable energy projects, particularly wind and solar, and not from fossil fuel-based generation. Placing such a condition in the project approvals would not only be feasible and environmentally beneficial, it has already been supported, at least in part, by ESJ and its parent corporation, Sempra Energy.[7]

V. Environmental Impacts

The EIR/EIS must take a "hard look" at the environmental impacts of proposed major federal actions and provide a "full and fair discussion" of those impacts. 40 C.F.R. § 1502.1; *see also National Parks & Conservation Ass'n v. Babbitt*, 241 F.3d 722, 733 (9th Cir. 2001). From a CEQA

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[6] CPUC, 6/18/2009, "CPUC Approves Edison Solar Roof Program," Press Release, *available at* http://docs.cpuc.ca.gov/published/News_release/102580.htm.

[7] *See* U.S. Department of Energy, 9/22/2009, "Energia Sierra Juarez Transmission Line Project: Scoping Report" (Scoping Report), *available at* http://www.esjprojecteis.org/documents.htm, p. 5.

point of view, the EIR must inform the public and agency decisionmakers of all potentially significant environmental impacts prior to project approval. As the California Supreme Court has previously explained, "[t]he environmental impact report is the heart of CEQA and the environmental alarm bell whose purpose it is to alert the public and its responsible officials to environmental changes before they have reached ecological points of no return." *Sierra Club v. State Board of Forestry* (1994) 7 Cal.4th 1215, 1229, quotations and citations omitted. Here, the reviewing agencies must fully analyze all of the environmental impacts of the project. Accordingly, the CPUC and BLM must evaluate the effects of the project in both the United States *and* Mexico. *See, e.g., Hirt v. Richardson*, 127 F. Supp. 2d 833 (W.D. Mich. 1999); *National Organization for Reform of Marijuana Laws v. United States Department of State*, 452 F. Supp. 1226, 1232-33 (D.D.C. 1978); *cf.* Exec. Order No. 12114, 44 Fed. Reg. 1957 (1979), reprinted in 42 U.S.C.A. § 4321 app. Among others, the EIR/EIS must thoroughly analyze the impacts discussed below.

A. Fire

Ironically, SDG&E recently sought permission from the CPUC to turn off electrical power in the area of the ECO and Boulevard substations when fire dangers are high – a drastic measure from any perspective – yet it claims in its August 10, 2009 Proponent's Environmental Assessment ("PEA" or "ECO PEA") for the ECO project that construction of extensive, additional electricity infrastructure in the exact same area will not present a significant fire hazard. If existing lines are dangerous enough that SDG&E wants to shut off the power to thousands of people on windy days (potentially causing school shutdowns, disrupting emergency alert systems, and disabling hospital operations), how can the construction of even *more* substations and transmission lines be properly categorized as having an *insignificant* impact? Clearly, the fire dangers presented by this project are significant and must be subjected to a full and accurate analysis in an EIS/EIR.

In their review of fire hazards, the reviewing agencies must incorporate all relevant wildfire occurrence information, including historic fire frequency, duration, and magnitude data. The agencies should ensure that a complete understanding of the fire hazards in light of the region's fire history is produced in the EIS/EIR.

In addition to the direct impacts of the described components of the project, the EIR/EIS will also have to address the indirect fire hazard impacts of the multiple wind farm or other energy production projects that the ECO substation will accommodate. The indirect fire hazard impacts could potentially devastate the area and therefore must be categorized as significant.

The fire risk analysis must also include thorough discussion of the cumulative impacts of the project with all other relevant projects in the area, including the Powerlink project and related energy development projects dependent on that transmission line. The cumulative impacts of the industrialization of the East County area have the potential to permanently alter the fragile desert ecosystem through a process called type conversion, described below:

> Plant invasions are widely recognized as significant threats to biodiversity conservation worldwide. One way invasions can affect native ecosystems is by changing fuel properties, which can in turn affect fire behavior and, ultimately, alter fire regime characteristics such as frequency, intensity, extent, type, and seasonality of fire. If the regime changes subsequently promote the dominance of the invaders, then an invasive plant–fire regime cycle can be established. As more ecosystem components and interactions are altered, restoration of preinvasion conditions becomes more difficult.[8]

In short, once the fire-resistant native chaparral is converted to invasive annual grasses and other highly flammable plants that become tinder-dry each summer, the fire regime shifts – irrevocably – to a much shorter fire recurrence interval, potentially as short as every year. Once established, a short fire recurrence regime effectively destroys wildlife habitat and creates such an extreme annual fire danger as to preclude safe human habitation. The EIR/EIS must therefore present a comprehensive analysis of the effects of past and future fires on the vitality of the remaining acreage of native chaparral and other disappearing mountain and desert ecosystems in light of the cumulative impacts of the project and other energy development and transmission projects that are planned in Eastern San Diego County and Imperial County.

Additionally, the project could present significant obstacles to firefighters responding to wildfires. For example, the proposed transborder transmission line for the ESJ component of the project would create a substantial hazard for low-flying spotter and bomber aircraft that apply aerial retardant or water. It would be impossible to see those power lines in smoke filled canyons, and either pilots would be forced to risk their lives by flying when the lines are not clearly visible or aerial fire suppression would be stymied. Furthermore, in some cases the transborder line and other project-related transmission lines would need to be de-energized before firefighters could enter certain areas, giving the fire more time to spread.

In light of the many fire-related impacts, reviewing agencies should give serious consideration to an alternative that avoids these impacts, such as the undergrounding of the new transmission lines or the preferably, pursuit of DG alternatives as discussed more thoroughly above.

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[8] *Effects of Invasive Alien Plants on Fire Regimes*, Brooks, M.L., C.M. D'Antonio, D.M. Richardson, J.M. DiTomaso, J.B. Grace, R.J. Hobbs, J.E. Keeley, M. Pellant, D. Pyke, 2004, Bioscience 54:677-688, available at: http://www.californiachaparral.com/images/Brooks_et_al_Effects_of_Invasives_on_Fire_Regimes.pdf

B. Biological Impacts

There are many potential biological impacts of the project that the reviewing agencies must address in the EIR/EIS. In all of their biological analyses, the CPUC and BLM should develop and utilize current population and habitat surveys and up-to-date scientific studies. Similarly, all required surveys of the proposed project areas must be completed before preparation of the EIR/EIS, not afterward as occurred with the majority of the biological surveys for the Powerlink project. The EIR/EIS must analyze the impacts of the project on threatened, endangered or special status species, including the Quino checkerspot butterfly and the Peninsular bighorn sheep, both of which have proposed, suitable, inhabited, and/or designated critical habitat that overlaps with or is adjacent to the proposed project sites. Tragically for the Peninsular bighorn sheep, the proposed La Rumorosa wind projects and ESJ project transmission route would be located directly adjacent to (and perhaps overlap with) the Peninsular Ranges of Mexico, an area which the U.S. Fish and Wildlife Service views as "the *only* possible route for a natural connection with other bighorn sheep populations for the [distinct population segment of sheep] in the U.S." 74 Fed. Reg. 17288, 17311 (2009) (emphasis added).

Additionally and relatedly, the EIR/EIS must also evaluate the effects of the project on avian injury and mortality, including impacts on both special status birds (such as the California condor) and others (such as the golden eagle, which is protected by the Bald and Golden Eagle Protection Act). In its discussion of avian impacts, the EIR/EIS must address risks associated with wind turbines and power lines (e.g. electrocution). It must also assess how the light and noise pollution associated with the project would impact birds and other species.

Specific to the Tule Wind Project, construction and operation of the project will adversely affect numerous endangered or threatened species in the McCain Valley, including but not limited to the Arroyo toad, Quino checkerspot butterfly, Peninsular bighorn sheep, least Bell's Vireo, barefoot banded gecko, Swainson's hawk, and southwestern willow flycatcher. There is also additional sensitive and locally important wildlife in the area that must be evaluated. Furthermore, there are endangered, rare, and sensitive plant species in the area that must be protected as well.

The EIR/EIS must not only identify the species that may be affected, but it must also analyze the potential impacts and provide for mitigation where feasible. First and foremost, highly trained and experienced biologists should be involved in the entire process to survey for and mitigate damage to all biological resources in the area. It is extremely important that those surveying for these resources be knowledgeable and have up-to-date information on the species being surveyed. For example, there have been recent scientific discoveries regarding the distribution and habitat needs of the Quino checkerspot butterfly. New host plants for the Quino checkerspot butterfly have just been discovered. 74 FR 28775, 28776. The butterfly has been documented at higher elevations than ever before, as well as near granitic rather than clay soils. *Id.* Most biologists do not have experience surveying under the newly developed survey guidelines. *Id.* These factors must be taken into account as the reviewing agencies prepare the EIR/EIS.

C. Habitat Fragmentation and Related Edge Effects

Habitat fragmentation is the breaking up contiguous natural habitats into small patches that are isolated from intact areas of habitat. The project's plans for construction, staging, and building of access roads and structures will result in direct loss of habitat, division of the remaining habitat into isolated patches, and reduced size of habitat patches. These fragmentation impacts, when spread across a large area, are almost invariably accompanied by localized extirpation of species. Here, the project will fragment scrub and chaparral habitats. Local species sensitive to the developed or altered edge and species that have large area requirements are among the first to disappear from habitat fragments, triggering cascading impacts to ecological communities. The fragmentation of habitats inhibits movement of species and disrupts necessary interactions among species. These adverse impacts decrease the viability of species in the area and degrade habitat value as species become more isolated in contained areas. The project will fragment habitat within the project area, particularly through the construction of access roads, and will potentially cause significant impacts to may species within the area. These impacts must be fully discussed in the EIR/EIS.

Further, fragmentation causes edge effects that also degrade the local habitat near power lines and maintenance roads. An edge marks where natural habitat conditions transition to a human-altered condition. Edge effects decrease the net, biologically functional area of habitats left undeveloped within landscapes fragmented by roads, cleared areas, or development structures. These edge effects further reduce available habitat for native species, while creating new habitats for non-native, human-tolerant species. The construction of the project will cut directly through acres of important habitat currently undisturbed by human activity. The EIR/EIS must therefore thoroughly discuss the fragmentation and edge effect impacts of the project.

D. Soil and Invasive Species

An estimated 140,000 cubic yards of soil may be imported to fill the ECO project site alone. The EIR/EIS must analyze the project's likely importation of invasive plant species within the fill soil. Further, invasive species may be transported through construction and maintenance vehicle use and increased public access. The reviewing agencies must identify, analyze, and, if necessary, develop mitigation measures for these impacts in their environmental study of the project.

E. Visual and Aesthetic Impacts

The project will severely diminish the serene aesthetics and expansive unobstructed vistas in the region. The EIR/EIS must consider these impacts, including the sheer height and overall size of the facilities, the wide geographic scope and visual incongruity of the project, and the obtrusive effects of the facilities' nighttime lighting fixtures. The reviewing agencies should analyze these viewshed impacts from multiple vantage points, including popular scenic vistas as well as the places (homes, roads, etc.) frequented by residents of the region, such as the citizens of Boulevard, California.

Further, as discussed above, the EIR/EIS should give serious consideration to an alternative that undergrounds any new transmission lines or preferably to a DG alternative, which would obviate the need for this project altogether.

F. Noise

The introduction of industrial noise levels during construction, operation, and maintenance of the project will be significant. These significant noise impacts will disturb adjacent property owners and the endangered and sensitive species that occupy and pass through the area. These noise impacts are even more significant given Eastern San Diego County's quiet, rural setting.

In addition to the immediate noise impacts of the project itself, the EIR/EIS must address the noise impacts of the construction of the multiple additional energy generation facilities that will connect to the ECO, ESJ and Tule components of the project. The cumulative construction impacts of the project with the Powerlink project and other area projects will be significant and should be fully analyzed in an EIR/EIS.

G. Visual & Night Sky Resources

The EIR/EIS should address the significant impacts of the project on visual and night sky resources. First, the project will significantly affect the area's visual resources by introducing massive new industrial projects – including most prominently the enormous wind turbines planned for the ESJ and Tule components of the project – with industrial-scale lighting, new roads, graded pads, water tanks, and 10-foot-high barbed wire fencing into a scenic, rural area. The scarring of the landscape will be visible from many locations as graded portions of the desert never resume their natural appearance once cleared. The project will affect scenic and historic roadways and will detract from local, small businesses that rely on a tourist- and recreation-based economy, including the nearby Desert View Tower and the Jacumba Hot Springs Spa.

Additionally, the EIR/EIS must fully address the combined aesthetic effects of the project with the Powerlink project and other proposed energy production facilities in the area. Maps and photo simulations must fully reveal the intensive visual impacts of the proposed Powerlink infrastructure and related wind farms, including the industrial-scale wind turbines that will be located directly behind the ECO Substation. When added together, the Powerlink, the various new wind and solar facilities, the existing Southwest Power Link ("SWPL"), and the proposed project will drastically degrade the visual context of the area's rural communities and vast undeveloped public lands. These cumulative visual impacts must be thoroughly evaluated by the reviewing agencies.

Further, the EIR/EIS must fully account for the significant impacts of the project on night skies. The fifty, 300-watt tungsten-quartz lamps proposed for the ECO substation will significantly impair the night skies in one of the last dark sky areas left in Southern California. As with visual resources,

the EIR/EIS should address all of the other indirect night sky impacts from the other planned energy production facilities that will connect to the SWPL through the ECO and Boulevard substations. These light pollution impacts will likely be individually and cumulatively significant.

H. Geology

The EIR/EIS should fully review and evaluate the geological impacts of placing wind turbines in the project area. Despite having small footprints relative to other types of energy developments, wind turbines require high levels of slope stability and a solid foundation to prevent safety disasters. In order to safely site wind turbines, a significant amount of drilling is often required. The EIR/EIS must evaluate the impact of such drilling on seismic, slope, and soil stability, as well as groundwater contamination that may be caused by deep penetration drilling.

I. Conservation Initiatives

The EIR/EIS must discuss the project's negative impacts on the region's conservation initiatives. The construction of the project and all of the other energy production facilities dependent on the ECO and Boulevard substations will impair the ecological value of the project sites themselves as well as miles of surrounding mountains and high desert. This degradation of the mountain and desert ecosystems in the region will likely affect conservation decisionmaking, turning money and protection away from the area as conservationists look for less-developed lands to preserve. Some of the conservation initiatives that could be affected by the project include The Nature Conservancy's purchase of the Jacumba-Eade property in January 2008 for inclusion into the Anza Borrego State Park, preservation programs in the County of San Diego's East County Multiple Species Conservation Plan, the Las Californias Binational Conservation Initiative, and the Parque to Park proposal, which seeks to connect Anza Borrego State Park (and the Jacumba property purchased for the Park mentioned above) with Baja Mexico's Parque Nacional Constitucion de 1857 and the Parque Nacional San Pedro Martir.

J. Economic Consequences and Rural Blight

Local tourism and recreation are a major source of income for the region's local businesses. The project's threatened transformation of the area from an open-space, recreational mecca to an industrial landscape will cause the closure of many small businesses that provide recreation-based services. These empty storefronts and deserted commercial areas present significant impacts in the form of rural blight. The fall in property values in the area due to the degraded rural landscape may cause homes and neighborhoods to become abandoned, further exacerbating rural blight. These impacts should be discussed in the reviewing agencies' EIR/EIS.

K. Wilderness Experience

The EIR/EIS must also evaluate the project's effects on the region's wilderness areas. Of particular concern are impacts to the Carrizo Gorge Wilderness area, which is located north of both the proposed ECO Substation and Boulevard Substation expansion. Other potentially impacted wilderness and environmentally sensitive areas include the Jacumba Wilderness Area, the Table Mountain Area of Critical Environmental Concern, and the Anza Borrego Desert State Park.

L. Recreational Resources and Public Access

Because the project will involve the cutting of new roads into previously inaccessible areas, public use of these areas, whether authorized or unauthorized, may increase dramatically. This increase in use is likely to result in increased fire danger, invasive species distribution, vandalism, and disruption of habitat in remote, currently unaltered natural resource areas. These impacts due to increased public access should be fully addressed in the EIR/EIS.

Relatedly, the EIR/EIS must clearly and consistently describe the public's recreational access to the project sites and accurately analyze the impacts of that designated level of access. For example, the Tule Wind Project proponent asserts that a mere 2% of the land in the project area will be occupied by wind power production equipment and the rest will remain open for existing recreational uses. But access for recreational users may in fact be limited. In the Powerlink approval, mitigation measures require that current and new access roads are to be closed to the public due to safety, invasive species, and fire hazard concerns. If reviewing agencies follow the Powerlink example, then large portions of the project area will be closed to recreational activities, limiting the ability of recreationists to legally use and enjoy the area. On the other hand, if these newly constructed access roads are not closed to the public, the additional public access will increase fire hazards, the risk of introducing invasive species, and the likely degradation of the surrounding environment, as discussed above. Furthermore, there is no guarantee that the public will remain on the access roads; resulting off-road vehicle use will in turn cause further habitat destruction in and around the project area.

M. Cultural Resources

The project location is rich with significant cultural resources, including Native American sacred sites, burial/cremation areas, and traditional cultural properties. For example, there are at least 40 previously recorded archeological sites within the right of way proposed for the Tule Wind Project. Furthermore, there are more than 30 archaeological investigations that have previously taken place within that proposed right of way. Disruption of these areas will result in significant impacts that must be fully explained in the EIR/EIS, and analyzed in an appropriate National Historic Preservation Act review process. The reviewing agencies must evaluate and set forth mitigation measures to address these significant impacts to cultural and archaeological resources.

N. Rural Character and Quality of Life of Backcountry Communities

The EIR/EIS must thoroughly discuss the effects of the project on the rural character and quality of life of backcountry communities. The industrialization of Eastern San Diego County will adversely affect the lives of the residents who have chosen to live in rural communities in part because of their close connection to nature. The reviewing agencies should therefore address this important issue.

O. Environmental Justice

The reviewing agencies should assess the environmental justice issues raised by the construction of massive, industrial facilities and infrastructure for the provision of power to urban consumers within and surrounding low-income, rural communities. These important and often-overlooked issues are critical here, where urban electricity users seek to export the environmental costs of their electricity usage to poor rural communities.

P. Climate Change Impacts

1. Use of Excess Capacity to Transport Fossil-fuel Based Electricity

The EIR/EIS must also address the likelihood that the new substation and transmission lines will cause more fossil-fuel-based generating facilities to be built in Mexico or near the substation in the United States. Notably, Sempra's Bajanorte Gasducto LNG line and a newly constructed water line run through Sempra's leased land directly south of the new ECO substation. With the construction of the project's new cross-border ESJ tie-line, Sempra will have all the necessary ingredients for a new gas-fired power plant on the Mexican side of the international border: gas, water, and transmission. Sempra has previously indicated that LNG will serve as its primary fuel for decades to come and has invested billions in its LNG infrastructure in Baja, including the construction of the Energia Costa Azul LNG terminal near Ensenada, Mexico. The reviewing agencies should fully investigate the potential for the project to increase fossil fuel consumption and analyze the consequent effects on greenhouse gas emissions, global warming, and air quality in the project area.

2. Additional Climate Change Impacts

In addition to the potential increase in fossil-fuel based energy production, the EIR/EIS must also address other climate change impacts. For example, SDG&E's ECO PEA admits that "fugitive emissions of SF6 — a potent [greenhouse gas] with a [global warming potential] of 23,900—will result from the operation of transmission-line equipment that will be installed at the ECO and Boulevard substations." ECO PEA, p. 4.3-24. SDG&E plans to implement a SF6 monitoring and reduction plan, but the plan will only "reduce emissions of SF6 by approximately 5 percent." *Id.* The ECO PEA concludes that the plan will mitigate the impact of SF6 emissions to less-than-significant

levels, but a reduction by 5 percent does not mitigate this significant impact to a less-than-significant level. A full discussion of SF6 emissions by all components of the project must be present in the EIR/EIS. Further the environmental review should discuss the cumulative impacts of these emission on climate change.

Additionally, studies have begun to show that undisturbed alkaline desert areas, such as the Mojave Desert, eastern San Diego County and western Imperial County, sequester carbon-dioxide in surprising quantities.[9] This new understanding of deserts as important carbon sinks should be discussed in the reviewing agencies' analysis of this project's impacts on greenhouse gas emissions. The project will disturb and open up vast stretches of currently untrammeled desert lands to large-scale industrial development. These huge desert areas may do more good in reversing global warming if left alone than if they are fully developed into renewable energy generation facilities. This is particularly true where, as here, distributed photovoltaic energy production near the energy demand centers could eliminate or substantially reduce the need for the project. A complete analysis of this indirect adverse impact of the project should be conducted prior to the reviewing agencies' decision.

Q. Air Quality

In addition to greenhouse gases, the EIR/EIS must also evaluate the impacts of the project on local air quality and public health. Most specifically, the reviewing agencies must analyze the particulate matter emissions that would occur during construction of the project from, among other things, excavation, grading and off-road vehicle use.

R. Ground and Surface Water

The EIR/EIS must contain an adequate analysis of the impacts of the project on ground and surface water resources. As for groundwater, the project's short- and long-term demands on the region's groundwater resources will be a key part of the analysis. If the project draws down groundwater levels to a significant degree, neighbors' wells will be negatively affected. Such a drop in groundwater could also adversely impact any local springs or seeps connected to the aquifer, which could, in turn, affect desert animals reliant on those springs and seeps. These impacts must be thoroughly studied.

Further, the EIR/EIS must adequately analyze the potential for contamination of the underlying aquifers from the 569,800 gallons of oil that will be used at the ECO substation and the 25,660 gallons at the Boulevard substation due to operator error, equipment malfunction, fire, earthquake, windstorm, landslide, vandalism, sabotage, or other causes. Contamination of the fractured rock aquifers in Eastern San Diego County is notoriously difficult, if not impossible, to remediate. Contamination can

[9] http://www.ecostudies.org/press/Schlesinger_Science_13_June_2008.pdf

be transported off site via high-flow fractures at unknown rates and in unknown directions. The reviewing agencies must analyze these potentially significant impacts in the EIR/EIS prior to making a decision on the project.

Turning to surface water, the project's impacts on local water courses should be fully evaluated. Construction of the ECO substation component of the project alone will require 30 million gallons of water. Even if this water is to be pumped out of the aquifer, purchased from nearby water districts, or trucked in from the City of El Centro, surface water supplies affected by these sources may be compromised. The ECO PEA does not analyze the availability of water for construction or the project's impacts on surface water supplies. Further, apart from short-term construction water needs, it is not clear to what extent long-term *operation* of the facility will require surface water supplies. In an area as dry as the proposed project site, water supply and demand must be very carefully evaluated prior to approval of any new project.

Also, construction of the project has the potential to affect surface runoff. By altering the slope and changing the topography where the project's wind turbines are to be placed, the traditional path that water follows in the area may be obstructed. This will not only cause changes in the quantity of runoff that reaches downslope streams and watercourses, but it will certainly affect the quality of such water as well. Runoff following construction activities will pick up large amounts of sediment, subsequently degrading the downslope streams. The EIR/EIS must address all of these hydrologic impacts.

S. Impacts on Boulevard

The Boulevard Substation will increase in size by approximately 600 percent *See, e.g.,* ECO PEA, Figure 3-17. This increase in size is particularly significant since the property is located in a residentially zoned area. The reviewing agencies must conduct a complete study of the impacts of the much larger substation on the community of Boulevard.

VI. Other Projects that Should Be Considered in this EIR/EIS

The ECO PEA states that it will be designed to "accommodate additional renewable generation in the future, beyond what is currently in the CAISO Queue." ECO PEA, p. 2-7. To the extent that the impacts from these projects and their generation tie-lines are "reasonably foreseeable," they must be addressed in the EIR/EIS as indirect impacts. CEQA Guidelines §§ 15064, 15126.2, 15130. As noted above, the large-scale projects (in addition to the ESJ and Tule Wind Projects) that are dependent on the construction of the ECO substation will have significant impacts on the region's environment, prompting the need for thorough and comprehensive environmental review of all such related projects, such as Invenergy's plans to construct a 160 MW wind energy project on the Campo Indian

Reservation.[10] Massive wind farms such as this have the proven capacity to kill thousands of birds each year. Similarly, large scale solar-thermal projects that may tie in to the ECO substation can create superheated zones around the collector towers that can reach ambient temperatures of 800 degrees, hot enough to literally cook birds in mid-flight. Endangered species, such as the Peninsular bighorn sheep and the Quino checkerspot butterfly, inhabit the area and will be adversely affected by the construction and operation of these types of renewable energy projects. The EIR/EIS must accordingly address these and many other significant indirect impacts.

VII. Cumulative Impacts

As discussed throughout these comments, the cumulative impacts of this project, along with the Powerlink and the multiple other planned energy production facilities that will rely on its new infrastructure, will be significant. The EIR/EIS must fully address these cumulative impacts. Previous attempts to address the cumulative impacts of the energy developments proposed in this remote region have failed. Most notably, the Powerlink EIR/EIS did not discuss and analyze the substantial environmental changes that the proposed development of eastern San Diego County and Imperial County for energy production will cause.

One of the most important impacts to address is the increased cumulative fire danger. Southern California is already struggling to develop solutions to its rapidly growing fire vulnerability. Each year, massive wildfires devastate vast areas of Southern California. Many of these fires have been caused by electricity generation and transmission facilities. SDG&E's recent proposal to turn off the power to Eastern San Diego residents during high fire danger periods is further proof of the depth of the fire hazard problem. An explosion of new energy facilities in this fire-prone area presents an extreme danger to the health and welfare of the area's citizens and threatens the very existence of small, rural communities such as Boulevard and Jacumba. These impacts are significant and should be addressed appropriately.

Also important, the cumulative construction impacts of the project together with all of the other related infrastructure and energy development are likely to disturb sensitive desert animals, including the Peninsular bighorn sheep, which require the areas contemplated for development for their continued survival. Similarly, the Quino checkerspot butterfly's critical habitat will be directly impacted by the construction of both the new transmission lines for this project and the Powerlink as well as other potential new energy development facilities in the area. These impacts should be avoided by relocating or disapproving these facilities.

The project's cumulative impacts to visual, water, soil, biological, air quality, noise, and cultural resources will be significant. The EIR/EIS must not ignore these cumulative impacts – as the

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[10] http://www.signonsandiego.com/news/2009/jun/11/wind-farm-project-set-campo-reservation/

Powerlink EIR/EIS did – or otherwise attempt to trivialize the proposed energy developments' potential to transform much of eastern San Diego County and western Imperial County into a permanently scarred, ecologically degraded, industrial zone.

VIII. Growth Inducing Impacts

The EIR/EIS must address the industrial growth that the project will spur. The reviewing agencies must consider the impacts of all future projects that may connect to or depend upon the Tule Wind and ESJ projects, or with the increased capacity of the ECO and Boulevard substations. If the reviewing agencies determine that the impacts of these projects are not indirect impacts, then they must consider these impacts in a separate chapter on growth-inducing impacts. The effects of the new energy development projects will be significant and pervasive and must be addressed in an EIS/EIR prior to approval of the project.

In particular, the reviewing agencies must examine the ESJ project's capacity to induce increased population, as well as the industrial growth the project would spur, including an evaluation of the likelihood of and impacts from the future use of the project's transboundary transmission line to carry electricity generated from fossil fuels. As discussed above, unless the CPUC or BLM places a condition in the permit prohibiting the transmission over the new line of fossil-fuel-based electricity, there is a distinct possibility that a new *gas-fired* power plant would be built in the vicinity of the La Rumorosa area and transport electrical output to the U.S. via the ESJ project transmission line and ECO and Boulevard Substations. These potential growth inducing impacts of the new transmission capacity provided by this project must be full described and analyzed by the reviewing agencies.

IX. Mitigation

Should this project be approved notwithstanding its potentially catastrophic effects on the natural ecosystems of a vast area of eastern San Diego County, every economically and legally feasible mitigation measure that might reduce these impacts should be given thorough consideration and, if found effective, implemented fully. Such mitigations would include, but not be limited to, requiring the complete decommissioning of these projects, and restoration of the surrounding environment to its preexisting, natural condition, once the projects have reached the end of their useful life. Given the rapid emergence of new and improved technologies for the generation and conservation of energy, including DG alternatives such as the installation of thin-film photovoltaic rooftop solar systems, early retirement of these projects due to their obsolete technology and excessive cost should be anticipated. Substantial bonds should be required of all project proponents in order to secure complete removal of the projects and restoration of the natural environment promptly after these projects are retired.

Additional mitigations required during the operation of the project should include acquisition of the replacement habitat on at least a 3-to-1 ratio for wildlife habitat disturbed by the project. Under no circumstances should habitat for any threatened or endangered species be reduced or degraded for the project, however.

X. Consultation

The EIR/EIS must list and discuss all "Federal permits, licenses, and other entitlements which must be obtained in implementing the proposal" (40 C.F.R. § 1502.25(b)), and analyze the consistency of the project with state and local laws and conduct joint environmental review with state and local agencies to the "fullest extent possible." 40 C.F.R. § 1506.2. Formal consultation under ESA will be required. The project's proposed transmission line will cut directly through Quino checkerspot butterfly critical habitat. Also, the project location overlaps with or is immediately adjacent to critical habitat for Peninsular bighorn sheep. As noted in the ECO PEA, the effects of the substation on the continued survival of these endangered species must be fully analyzed in coordination with the California Department of Fish and Game ("DFG"), BLM, and the U.S. Fish and Wildlife Service ("FWS"). Conservation Groups request that such consultation take place at the earliest point possible in the planning process so that the views of DFG and FWS on the project's effects on endangered species can be fully integrated into the CEQA and NEPA review for this project. Similarly, consultation with local Native American tribes should commence early in the review process given the importance of the cultural resources in the area.

The project will need to obtain multiple additional permits or other entitlements before it can proceed. For example, approvals will be necessary from San Diego County, the U.S. Army Corps of Engineers, and the San Diego or Colorado River Regional Water Quality Control Board under the federal Clean Water Act and the California Porter-Cologne Water Quality Control Act. The reviewing agencies must describe these and other required permits and explicate the anticipated interagency review of the project.

XI. Conclusion

Conservation Groups again emphasize their concern that the environmental impacts of the projects that threaten to industrialize eastern San Diego County and western Imperial County must be comprehensively reviewed in a programmatic EIR/EIS. The combined effects of all of the projects proposed, including the present project, the Powerlink project, and all other reasonably foreseeable energy developments in the area will fundamentally alter the region in ways that have not been fully

revealed or analyzed to date. The best way to provide for the future energy needs of Southern Californians is not through destructive development of their irreplaceable wildlands, but rather through the deployment of distributed generation facilities at already disturbed locations within or near the urban demand centers.

Sincerely,

Stephan C. Volker
Attorney for Backcountry Against Dumps, The Protect Our Communities Foundation, East County Community Action Coalition and Donna Tisdale

SCV:taf

EXHIBIT 2

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

In the Matter of the Application of SAN DIEGO GAS & ELECTRIC COMPANY (U902 E) for a Permit to Construct Electrical Facilities with Voltages between 50 kV and 200 kV and New Substations with High Side Voltages Exceeding 50 kV: The East County Substation Project	Application 09-08-003 (Filed August 10, 2009)

DECLARATION OF BILL POWERS IN SUPPORT OF BACKCOUNTRY AGAINST DUMPS' COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT REPORT/ENVIRONMENTAL IMPACT STATEMENT FOR THE EAST COUNTY SUBSTATION, TULE WIND AND ENERGIA SIERRA JUAREZ GEN-TIE PROJECTS

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Backcountry Against Dumps

March 4, 2011

I, Bill Powers, declare as follows:

Qualifications:

1. I am a principal of Powers Engineering. I hold a masters degree in environmental sciences from the University of North Carolina, Chapel Hill and a bachelors degree in mechanical engineering from Duke University. I have been a registered professional mechanical engineer in California since 1986. I am a member of two professional organizations, the Air & Waste Management Association and the American Society of Mechanical Engineers. I have extensive expertise in power generation systems and regional energy planning. I am the author of a report entitled "San Diego Smart Energy 2020: The 21st Century Alternative," which presents a comprehensive, peer-reviewed plan to provide clean, reliable, affordable energy for San Diego. San Diego Smart Energy 2020 emphasizes local photovoltaic ("PV") power and high efficiency distributed gas-fired generation to reduce San Diego's greenhouse gas footprint from power generation by 50 percent by 2020.[1] My curriculum vitae is attached hereto as Exhibit 1

2. I have reviewed the California Public Utilities Commission's ("CPUC's") and the Bureau of Land Management's ("BLM's") joint Draft Environmental Impact Report/Draft Environmental Impact Statement ("DEIR") for the East County ("ECO") Substation Project, the Tule Wind Project and the Energia Sierra Juarez ("ESJ") Gen-Tie Project (collectively, "the Project") and offer the following professional evaluation of the viability of two Project alternatives that the DIER dismisses: (1) using the existing Comision Federal de Electricidad ("CFE") 230 kV lines and the Western Electricity Coordinating Council ("WECC") Path 45 instead of the ESJ gen-tie line and the ECO Substation to transport Baja wind energy to San Diego Gas & Electric Company's ("SDG&E's") electrical grid, and (2) developing distributed generation as an alternative

[1] The report is available at: http://www.sdsmartenergy.org/20-may-08_Smart%20Energy%202020_2nd%20printing_complete.pdf

to the Project as a whole.

Using CFE's 230 kV Line and the WECC Path 45 Is a Viable Project Alternative:

3. It its initial December 18, 2007 application to the Department of Energy ("DOE") to build the ESJ gen-tie line, Sempra (ESJ's parent company) specifically stated it would use the Mexican transmission lines to move wind power from Baja California to SDG&E.[2] Sempra states "As an initial activity, Baja Wind, a wholly-owned subsidiary of Sempra Energy Mexico, will install up to 10 MW of wind generation, consisting of up to five wind turbines, interconnected locally to the CFE electrical grid (the Jacumbe Project). These generators will not interconnect to the proposed 230/500 kV transformer substation in Mexico, or to any transmission lines connected to the United States transmission system, and therefore, the Presidential Permit is not required for the Jacumbe Project." The CFE electrical grid Sempra identified in this statement is Path 45, and the CFE transmission lines are electrically connected to the SDG&E system.[3] Path 45 connects the SDG&E and CFE transmission systems at two points, Mexicali and Tijuana.[4]

4. The export limit on the existing CFE 230 kV system passing through the ESJ wind development area in Mexico to the SDG&E system is 800 MW. These lines

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[2] Sempra Generation, Submittal of Baja Wind U.S. Transmission LLC Application for Presidential Permit, December 18, 2007, p. 3. Application available at: http://esjprojecteis.org/docs/Sempra_Application_(PP-334).pdf

[3] See Western Electricity Coordinating Council, Historic Path Data Description, p. 2, available at: http://www.wecc.biz/library/WECC%20Documents/Historical%20Path%20Data/Historical%20Path%20Data%20Description.pdf. Path 45, CAISO (California Independent System Operator) – CFE, 800 MW transfer limit, south-to-north.

[4] CFE, *Generation and Transmission Expansion Plan Baja California System 2003-2007*, March 2003, p. 14 (attached hereto as Exhibit 2). Green line on map is SDG&E's 500 kV Southwest Powerlink. The two 230 kV brown lines between Valley and Coast are the two CFE lines that pass though the ESJ wind development. The CFE lines are electrically interconnected with the SDG&E system as shown. The existing Sempra 600 MW natural gas-fired power plant in Mexicali is also shown on the map, along with a proposed second 600 MW Sempra plant that has not yet been built.

are used by U.S. electricity suppliers to transmit electricity to the SDG&E/U.S. grid.[5] As reported in the California energy trade press, "For exports alone, developers could move (wind) power along Path 45, which CFE and Coral Energy use for short-term exports to California. The report estimated that Path 45 has 800 MW in unused capacity, but developers would have to execute long-term wheeling contracts through CFE's system."[6]

5. Transmission wheeling contracts are routine. "Wheeling" means moving electricity through one or more interim transmission operator territories in route to a final delivery destination. The California Independent System Operator, the entity responsible for maintaining grid reliability in California, publishes wheeling rates. The wheeling rate in force as of January 1, 2011 between SDG&E and CFE is $6.5672/MWh.[7]

6. It is not credible for CPUC and BLM to claim in the DEIR that there are sufficient capacity, legal, or regulatory impediments to exporting wind power from Baja California over Path 45 to make its use infeasible. The existing unused export capacity is 800 MW. There is an existing protocol and wheeling fee schedule between SDG&E and CFE for exports over the CFE transmission system to SDG&E. SDG&E's parent company Sempra Energy owns a liquefied natural gas plant, a natural gas pipeline network, and a 600 MW power plant in Baja California. Sempra is clearly comfortable operating in the Baja California legal and regulatory environment. Sempra has been a public advocate for placing electricity generation assets in Baja California.[8]

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[5] Ibid. See map on p. 10, titled "WECC Path 45 Capability."

[6] California Energy Markets, Mexico Could Be Wind Hotspot If Wires, Border Issues Are Solved, June 17, 2008 (attached hereto as Exhibit 3)

[7] CAISO, Wheeling Access Charges – Rates Effective January 1, 2011, available at: http://www.caiso.com/2b33/2b33847338d0.pdf

[8] Gas Turbine World, Sempra Energy - Mexicali plant spurs surge of capacity, Vol. 34, No. 2, April – May 2004, p. 36 (attached hereto as Exhibit 4).

Neither the WECC 45 Alternative nor the Distributed Generation Alternative Would Preclude Reliability Improvements in the Boulevard Area:

7. The combined population of Boulevard and Jacumba is approximately 2,000. SDG&E serves a population of over 3 million.[9] On a proportionate basis, the combined populations of Boulevard and Jacumba represent less than 0.1 percent of SDG&E's total demand. The highest 1-hour load every recorded in SDG&E service territory was 4,643 MW from 2-3 pm on September 27, 2010.[10] The proportionate peak load for Boulevard and Jacumba would be (2,000/3,000,000) x 4,643 MW = 3 MW. The reliability of the combined Boulevard/Jacumba area load could be completely assured with a 3 MW peaking gas turbine at a cost of less than $4 million.[11] It is not credible to assert that the 500 kV ECO substation, costing hundreds of millions of dollars, is necessary to assure the reliability of such a small load.

Distributed Solar PV Generation Alone Could Satisfy Most of SDG&E's Load Demand and Renewables Portfolio Standard Goals by 2020:

8. SDG&E's service territory has approximately 7,000 MW of urban and suburban PV potential.[12] As noted previously, the highest peak load recorded to date in SDG&E's service territory is 4,643 MW.

9. SDG&E received authorization from CPUC in September 2010 to

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[9] U.S. Census Bureau, 2009 statistics, San Diego County, available at: http://quickfacts.census.gov/qfd/states/06/06073.html. SDG&E also serves a portion of Orange County.

[10] CAISO OASIS database, September 27, 2010, available at http://oasis.caiso.com/mrtu-oasis/home.jsp?doframe=true&serverurl=http%3a%2f%2farptp10%2eoa%2ecaiso%2ecom%3a8000&volume=OASIS

[11] California Energy Commission ("CEC"), *Comparative Costs of California Central Station Electricity Generation – Final Staff Report*, January 2010, Table 14, p. 54, available at: http://www.energy.ca.gov/reports/2003-06-06_100-03-001F.PDF. Capital cost of small simple cycle gas turbine is $1,292/kW. Therefore, a 3 MW (3,000 kW) simple cycle gas turbine would cost: 3,000 kW x $1,292/kW = $3.9 million.

[12] Powers, *San Diego Smart Energy 2020: The 21st Century Alternative*, October 2007, p. 48.

construct 100 MW of distributed PV over the next four years.[13] CPUC approved a statewide 1,000 MW distributed PV program in December 2010 known as the Renewable Auction Mechanism (RAM) program. SDG&E's RAM program allotment is 80 MW. This capacity will be built over the next 3-4 years.[14] The tariffs under the 750 MW SB 32 feed-in tariff distributed PV program are in development and expected to be finalized sometime in 2011.[15] SDG&E's allotment under SB 32 will be approximately 50 MW.[16] Approximately 180 MW of distributed PV capacity will be added in SDG&E territory by the end of 2016 under the ongoing California Solar Initiative "million solar roofs" program.[17] In total, approximately 410 MW of distributed PV capacity will be added to SDG&E territory through existing approved distributed PV programs. This is a PV installation rate of 80 – 100 MW per year over the next 4 – 5 years.

10. 800 – 1,000 MW of distributed PV will be installed in SDG&E territory over the next decade if the current 80 - 100 MW per year distributed PV installation rate is maintained in SDG&E territory over the entire 2011 – 2020 period.

Distributed Solar PV Generation Is Commercially Feasible and Would Improve System Reliability:

11. SDG&E currently imports approximately two-thirds of the San Diego

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[13] CPUC September 2, 2010 press release, available at: http://docs.cpuc.ca.gov/PUBLISHED/NEWS_RELEASE/122975.htm

[14] CPUC Decision Adopting the Renewable Auction Mechanism, December 16, 2010, p. 30, available at: http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/128432.pdf

[15] CPUC feed-in tariff website, description of SB 32, available at: http://www.cpuc.ca.gov/PUC/energy/Renewables/feedintariffssum.htm

[16] CEC, 2007 Integrated Energy Policy Report, December 2007, Figure 1-11, p. 27, available at: available at: http://www.energy.ca.gov/2007publications/CEC-100-2007-008/CEC-100-2007-008-CMF.PDF. SDG&E accounts for 7 percent of statewide electricity demand. Therefore 750 MW x 0.07 = 52.5 MW.

[17] California Center for Sustainable Energy, Overview of Solar Incentive Programs, October 9, 2009, p. 7, available at: http://www.slideshare.net/ccsemedia/overview-of-solar-incentive-programs

region's power needs.[18] This high ratio of imported power leaves little robustness in the current SDG&E system to meet unexpected emergency conditions. The firestorms that occurred in late October 2007 temporarily forced both major transmission import corridors off-line at a time when the SDG&E load reached approximately 3,200 MW.[19] SDG&E was forced to import several hundred MW of power from CFE, along Path 45, to avoid partial blackouts due to insufficient local generation.[20] Major blackouts in SDG&E's service territory would have been unavoidable had the October 2007 firestorm occurred during a period of peak load with loads well above 4,000 MW.

12. SDG&E's parent company Sempra Energy identifies solar PV as less costly than other forms of solar power.[21] The added benefit of local solar PV is that it is reliable distributed local power that will remain available during fire emergencies. A case in point is the 500 MW urban PV project proposed by Southern California Edison and approved by CPUC on June 18, 2009. CPUC Commissioner John Bohn is quoted in CPUC press release on the decision stating:[22]

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[18] Powers, *San Diego Smart Energy 2020: The 21st Century Alternative*, October 2007, p. 23.

[19] California Independent System Operator OASIS, System Forecast Database – by Utility, 2007 (attached hereto as Exhibit 5). Peak one-hour load on October 22, 2007 was 2,972 MW. Peak one-hour load on October 23, 2007 was 3,003 MW. Peak one-hour load on October 24, 2007 was 3,180 MW.

[20] See Craig D. Rose, "Power links in peril? Fires nearly caused electricity crisis for which San Diego wasn't prepared," *San Diego* Tribune, November 13, 2007, available at: http://www.signonsandiego.com/uniontrib/20071113/news_1n13grid.html

[21] Ucilia Wang, "Sempra Wants 300 MW Plus of Solar in Arizona," *Greentech Media*, April 22, 2009, available at: http://www.greentechmedia.com/articles/read/sempra-wants-300-megawatts-plus-of-solar-in-arizona-6074/. "Sempra has also evaluated solar thermal power technologies, which use a field of mirrors to concentrate the sunlight to produce heat for electricity generation. The company has found that using solar panels is the cheaper option, (Sempra Generation president) Allman said. He noted that some of the solar thermal power technologies, such as the use of a central tower for harvesting the heat and generating steam, have yet to be proven commercially."

[22] CPUC Press Release - Docket #: A.08-03-015, *CPUC Approves Edison Solar Roof Program*, June 18, 20 (attached hereto as Exhibit 6).

"Unlike other generation resources, these projects can get built quickly and without the need for expensive new transmission lines. And since they are built on existing structures, these projects are extremely benign from an environmental standpoint, with neither land use, water, or air emission impacts."

Other Technically, Commercially and Legally Feasible Distributed Generation Exists that Would Help Meet Project Objectives:

13. Distributed biogas-fired generation is also a viable, Renewables Portfolio Standard ("RPS")-eligible, and cost-effective alternative for the San Diego area that has been largely ignored by SDG&E. The California Energy Action Plan prioritizes distributed combined heat and power ("CHP") plants over conventional utility central plants.[23] These are small distributed gas-fired projects that typically produce on the order of a few MW at hospitals, campuses, and office complexes. Biogas or biomethane-fired CHP plants are RPS-eligible. There is up to 1,700 MW of biogas and/or biomethane potential in California to provide fuel to these CHP plants.[24]

14. Local CHP demonstrated its value in the October 2007 firestorm when the University of California San Diego CHP plant began exporting to SDG&E to provide grid stability when SDG&E's two main transmission corridors were simultaneously down due to fire.[25]

15. The Electric Power Research Institute identified nearly 400 MW of cost-effective CHP potential in SDG&E's service territory in a 2005 study.[26] The state's AB

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[23] See CEC California Energy Action Plan webpage: http://www.energy.ca.gov/energy_action_plan/index.html

[24] CEC PIER Program, *Distributed Renewable Energy Assessment – Final Report*, August 11, 2009, Appendix Bio-Power, p. 49, available at: http://www.clean-coalition.org/storage/references/11-aug-09_Navigant_distributed%20renewable%20energy%20assessment_final%20report.pdf.

[25] San Diego Union Tribune, *Generation of power outside of SDG&E grid* (letter by UCSD Vice-Chancellor Gary Matthews), November 17, 2007 (attached hereto as Exhibit 7).

[26] In the Matter of the Application of San Diego Gas & Electric Company (U 902-E) for a

32 greenhouse gas compliance strategy calls for 4,000 MW of new CHP by 2020.[27] SDG&E supplies about 7 percent of the state's electricity.[28] As a result, about 280 MW of new CHP should be added in SDG&E territory by 2020 to comply with the AB 32 CHP target. Yet SDG&E currently projects no significant growth in CHP in its service territory.[29]

16. CHP is a base load, round-the-clock generation resource intended to operate at or near its rated capacity on a continuous basis. Wind power is intermittent, and even at good to excellent wind sites only produces power at rate equivalent to its full capacity operating about one-third of the time.. The California Energy Commission and California Public Utilities Commission assign a capacity factor of 92 percent to CHP.[30] CPUC assigns a capacity factor of 33 percent to wind resources.[31] What this means in practical terms is that the annual electrical output from 280 MW of base load CHP capacity is equivalent to the annual electrical output from 781 MW of wind power.[32]

Certificate of Public Convenience and Necessity for the Sunrise Powerlink Transmission Project, Application A.06-08-010, *Phase II Reply Brief of Powers Engineering on Behalf of Bill Powers, P.E.*, June 13, 2008, p. 9, (excerpts attached hereto as Exhibit 8)

[27] CPUC Decision D.10-12-035, Decision Adopting Qualifying Facility and CHP Program Settlement Agreement, December 16, 2010. See attachment - CHP Program Settlement Agreement Term Sheet, October 8, 2010, p. 31.

[28] CEC, *2007 Integrated Energy Policy Report*, Figure 1-11, p. 27.

[29] See Powers, *San Diego Smart Energy 2020: The 21st Century Alternative*, October 2007, pp. 60-61.

[30] CEC/CPUC, AB 32 Scoping Plan assumptions, January 13, 2010, available at: http://www.energy.ca.gov/reti/steering/2010-01-19_meeting/documents/04-Load-modifier_Assumptions_for_33-Percent_RPS_Planning_2010-01-14.pdf

[31] Energy and Environmental Economics, Inc., *Inputs and Assumptions to 33% Renewables Portfolio Standard Implementation Analysis*, prepared For CPUC, July 1, 2009 (updated January 2010), Table 7, p. 12, available at: http://www.cpuc.ca.gov/NR/rdonlyres/932CFFAA-0610-474E-905D-30CD1D76C651/0/InputsandAssumptions_UPDATE.pdf.

[32] (92/33) x 280 MW = 781 MW.

17. Examples are the biogas-fired fuel cell CHP plants at the University of California San Diego ("UCSD") and City of San Diego. A 2.8 MW biogas-fired fuel cell will be online at UCSD by mid-2011 to supply power to the campus electrical grid. A 1.4 MW biogas-fired fuel cell will also come online at the City of San Diego's South Bay Water Reclamation Plant. UCSD will use the byproduct heat from the fuel cell generation as a continuous source for 320 tons of chilling capacity (air conditioning) for its buildings.[33] The UCSD fuel cell will be paired with an additional 2.8 MW advanced energy storage system, which will allow UCSD to store off-peak power and discharge the energy during peak-demand hours. These projects receive the maximum Self Generator Incentive Program fuel cell incentive because they use renewable fuel. Biogas from the City of San Diego Point Loma wastewater treatment facility will be piped to UCSD and the South Bay Water Reclamation Plant for use in the fuel cells. The cost of electricity will be in the range of $0.12/kWh under a long-term power purchase agreement with the turnkey supplier of the fuel cell systems.[34] The base SDG&E residential retail electricity rate is approximately $0.14 to 0.16/kWh.[35]

Conclusions:

18. Based on the foregoing evidence and analysis, it is my professional opinion that it would be technically, commercially and legally feasible to (1) use the existing CFE 230 kV line and the WECC Path 45 instead of the ESJ gen-tie line and the

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[33] California Center for Sustainable Energy (San Diego) press release, San Diego Gets Clean Energy - $23.5 million secured to fund nation's largest fuel cell project, December 14, 2010, available at: https://energycenter.org/index.php/incentive-programs/self-generation-incentive-program/sgip-news/2399-san-diego-gets-clean-energy.

[34] Telephone communication between B. Powers, Powers Engineering, and F. Mazanec, Biofuels Energy LLC, January 12, 2011.

[35] See SDG&E webpage: http://www.sdge.com/nem/rates.shtml

ECO Substation to transport Baja wind energy to SDG&E's electrical grid, and (2) develop sufficient distributed generation in San Diego County to meet the Project objectives without developing the Project.

I declare, under penalty of perjury, that the foregoing is true and correct based on my personal knowledge and best professional judgment, and that this declaration was executed on March 4, 2011 in San Diego, California.

Bill Powers, P.E.

BILL POWERS, P.E.

EXHIBIT 1

BILL POWERS, P.E.

PROFESSIONAL HISTORY

Powers Engineering, San Diego, CA 1994-
ENSR Consulting and Engineering, Camarillo, CA 1989-93
Naval Energy and Environmental Support Activity, Port Hueneme, CA 1982-87
U.S. Environmental Protection Agency, Research Triangle Park, NC 1980-81

EDUCATION

Master of Public Health – Environmental Sciences, University of North Carolina
Bachelor of Science – Mechanical Engineering, Duke University

PROFESSIONAL AFFILIATIONS

Registered Professional Mechanical Engineer, California (Certificate M24518)
American Society of Mechanical Engineers
Air & Waste Management Association

TECHNICAL SPECIALTIES

Twenty-five years of experience in:

- Power plant air emission control system and cooling system assessments
- Regional renewable energy planning
- Combustion equipment permitting, testing and monitoring
- Air pollution control equipment retrofit design/performance testing
- Petroleum refinery air engineering and testing
- Latin America environmental project experience

POWER PLANT EMISSION CONTROL AND COOLING SYSTEM CONVERSION ASSESSMENTS

Biomass Plant NO_x and CO Air Emissions Control Evaluation. Lead engineer for evaluation of available nitrogen oxide (NO_x) and carbon monoxide (CO) controls for a 45 MW Aspen Power biomass plant in Texas where proponent had identified selective non-catalytic reduction (SNCR) for NO_x and good combustion practices for CO as BACT. Identified the use of tail-end SCR for NO_x control at several operational U.S. biomass plants, and oxidation catalyst in use at two of these plants for CO and VOC control, as BACT for the proposed biomass plant. Administrative law judge concurred in decision that SCR and oxidation catalyst is BACT. Developer added SCR and oxidation catalyst to project in subsequent settlement agreement.

Biomass Plant Air Emissions Control Consulting. Lead expert on biomass air emissions control systems for landowners that will be impacted by a proposed 50 MW biomass to be built by the local East Texas power cooperative. Public utility agreed to meet current BACT for biomass plants in Texas, SCR for NOx and oxidation catalyst for CO, in settlement agreement with local landowners.

Combined-Cycle Power Plant Startup and Shutdown Emissions. Lead engineer for analysis of air permit startup and shutdown emissions minimization for combined-cycle power plant proposed for the San Francisco Bay Area. Original equipment was specified for baseload operation prior to suspension of project in early 2000s. Operational profile described in revised air permit was load following with potential for daily start/stop. Recommended that either fast start turbine technology be employed to minimize start/stop emissions or that "demonstrated in practice" operational and control software modifications be employed to minimize startup/shutdown emissions.

IGCC as BACT for Air Emissions from Proposed 960 MW Coal Plant. Presented testimony on IGCC as BACT for air emissions reduction from 960 MW coal plant. Applicant received air permit for a pulverized coal plant to be equipped with a baghouse, wet scrubber, and wet ESP for air emissions control. Use of IGCC technology at the emission rates permitted for two recently proposed U.S. IGCC projects, and demonstrated in practice at a Japanese IGCC plant firing Chinese bituminous coal, would substantially reduce potential emissions of NO_x, SO_2, and PM. The estimated control cost-effectiveness of substituting IGCC for pulverized coal technology in this case was approximately $3,000/ton.

Analysis of Proposed Air Emission Limits for 600 MW Pulverized Coal Plant. Project engineer tasked with evaluating sufficiency of air emissions limits and control technologies for proposed 600 MW coal plant Arkansas. Determined that the applicant had: 1) not properly identified SO_2, sulfuric acid mist, and PM BACT control levels for the plant, and 2) improperly utilized an incremental cost effectiveness analysis to justify air emission control levels that did not represent BACT.

Eight Pulverized Coal Fired 900 MW Boilers – IGCC Alternative with Air Cooling. Provided testimony on integrated gasification combined cycle (IGCC) as a fully commercial coal-burning alternative to the pulverized coal (PC) technology proposed by TXU for eight 900 MW boilers in East Texas, and East Texas as an ideal location for CO2 sequestration due to presence of mature oilfield CO2 enhanced oil recovery opportunities and a deep saline aquifer underlying the entire region. Also presented testimony on the major increase in regional consumptive water use that would be caused by the evaporative cooling towers proposed for use in the PC plants, and that consumptive water use could be lowered by using IGCC with evaporative cooling towers or by using air-cooled condensers with PC or IGCC technology. TXU ultimately dropped plans to build the eight PC plants as a condition of a corporate buy-out.

Utility Boilers – Conversion of Existing Once-Through Cooled Boilers to Wet Towers, Parallel Wet-Dry Cooling, or Dry Cooling. Provided expert testimony and preliminary design for the conversion of four natural gas and/or coal-fired utility boilers (Unit 4, 235 MW; Unit 3, 135 MW; Unit 2, 65 MW; and Unit 1,65 MW) from once-through river water cooling to wet cooling towers, parallel wet-dry cooling, and dry cooling. Major design constraints were available land for location of retrofit cooling systems and need to maintain maximum steam turbine backpressure at or below 5.5 inches mercury to match performance capabilities of existing equipment. Approach temperatures of 12 °F and 13 °F were used for the wet towers. SPX Cooling Technologies F-488 plume-abated wet cells with six feet of packing were used to achieve approach temperatures of 12 °F and 13 °F. Annual energy penalty of wet tower retrofit designs is approximately 1 percent. Parallel wet-dry or dry cooling was determined to be technically feasible for Unit 3 based on straightforward access to the Unit 3 surface condenser and available land adjacent to the boiler.

Utility Boiler – Assessment of Air Cooling and Integrated Gasification/Combined Cycle for Proposed 500 MW Coal-Fired Plant. Provided expert testimony on the performance of air-cooling and IGCC relative to the conventional closed-cycle wet cooled, supercritical pulverized coal boiler proposed by the applicant. Steam Pro™ coal-fired power plant design software was used to model the proposed plant and evaluate the impacts on performance of air cooling and plume-abated wet cooling. Results indicated that a conservatively designed air-cooled condenser could maintain rated power output at the design ambient temperature of 90 °F. The IGCC comparative analysis indicated that unit reliability comparable to a conventional pulverized coal unit could be achieved by including a spare gasifier in the IGCC design, and that the slightly higher capital cost of IGCC was offset by greater thermal efficiency and reduced water demand and air emissions.

Utility Boiler – Assessment of Closed-Cycle Cooling Retrofit Cost for 1,200 MW Oil-Fired Plant. Prepared an assessment of the cost and feasibility of a closed-cycle wet tower retrofit for the 1,200 MW Roseton Generating Station. Determined that the cost to retrofit the Roseton plant with plume-abated closed-cycle wet cooling was well established based on cooling tower retrofit studies performed by the original owner (Central Hudson Gas & Electric Corp.) and subsequent regulatory agency critique of the cost estimate.

Also determined that elimination of redundant and/or excessive budgetary line items in owners cost estimate brings the closed-cycle retrofit in line with expected costs for comparable new or retrofit plume-abated cooling tower applications.

Nuclear Power Plant – Assessment of Closed-Cycle Cooling Retrofit Cost for 2,000 MW Plant. Prepared an assessment of the cost and feasibility of a closed-cycle wet tower retrofit for the 2,000 MW Indian Point Generating Station. Determined that the most appropriate arrangement for the hilly site would be an inline plume-abated wet tower instead of the round tower configuration analyzed by the owner. Use of the inline configuration would allow placement of the towers at numerous sites on the property with little or need for blasting of bedrock, greatly reducing the cost of the retrofit. Also proposed an alternative circulating cooling water piping configuration to avoid the extensive downtime projected by the owner for modifications to the existing discharge channel.

Kentucky Coal-Fired Power Plant – Pulverized Coal vs IGCC. Expert witness in Sierra Club lawsuit against Peabody Coal Company's plan to construct a 1,500 MW pulverized-coal fired power plant in Kentucky. Presented case that Integrated Gasification Combined Cycle (IGCC) is a superior method for producing power from coal, from environmental and energy efficiency perspective, than the proposed pulverized-coal plant. Presented evidence that IGCC is technically feasible and cost competitive with pulverized coal.

Power Plant Dry Cooling Symposium – Chair and Organizer. Chair and organizer of the first symposium held in the U.S. (May 2002) that focused exclusively on dry cooling technology for power plants. Sessions included basic principles of wet and dry cooling systems, performance capabilities of dry cooling systems, case studies of specific installations, and reasons why dry cooling is the predominant form of cooling specified in certain regions of North America (Massachusetts, Nevada, northern Mexico).

Utility Boiler – Best Available NO_x Control System for 525 MW Coal-Fired Circulating Fluidized Bed Boiler Plant. Expert witness in dispute over whether 50 percent NO_x control using selective non-catalytic reduction (SNCR) constituted BACT for a proposed 525 MW circulating fluidized bed (CFB) boiler plant. Presented testimony that SNCR was capable of continuous NO_x reduction of greater than 70 percent on a CFB unit and that tail-end selective catalytic reduction (SCR) was technically feasible and could achieve greater than 90 percent NO_x reduction.

Utility Boilers – Evaluation of Correlation Between Opacity and PM_{10} Emissions at Coal-Fired Plant. Provided expert testimony on whether correlation existed between mass PM_{10} emissions and opacity during opacity excursions at large coal-fired boiler in Georgia. EPA and EPRI technical studies were reviewed to assess the correlation of opacity and mass emissions during opacity levels below and above 20 percent. A strong correlation between opacity and mass emissions was apparent at a sister plant at opacities less than 20 percent. The correlation suggests that the opacity monitor correlation underestimates mass emissions at opacities greater than 20 percent, but may continue to exhibit a good correlation for the component of mass emissions in the PM_{10} size range.

Utility Boilers – Retrofit of SCR and FGD to Existing Coal-Fired Units.
Expert witness in successful effort to compel an existing coal-fired power plant located in Massachusetts to meet an accelerated NO_x and SO_2 emission control system retrofit schedule. Plant owner argued the installation of advanced NO_x and SO_2 control systems would generate > 1 ton/year of ancillary emissions, such as sulfuric acid mist, and that under Massachusetts Dept. of Environmental Protection regulation ancillary emissions > 1 ton/year would require a BACT evaluation and a two-year extension to retrofit schedule. Successfully demonstrated that no ancillary emissions would be generated if the retrofit NO_x and SO_2 control systems were properly sized and optimized. Plant owner committed to accelerated compliance schedule in settlement agreement.

Utility Boilers – Retrofit of SCR to Existing Natural Gas-Fired Units.
Lead engineer in successful representation of interests of California coastal city to prevent weakening of an existing countywide utility boiler NO_x rule. Weakening of NO_x rule would have allowed a merchant utility boiler plant located in the city to operate without installing selective catalytic reduction (SCR) NO_x control systems. This project required numerous appearances before the county air pollution control hearing board to successfully defend the existing utility boiler NO_x rule.

REGIONAL RENEWABLE ENERGY PLANNING

San Diego Smart Energy 2020 Plan. Author of October 2007 "San Diego Smart Energy 2020," an energy plan that focuses on meeting the San Diego region's electric energy needs through accelerated integration of renewable and non-renewable distributed generation, in the form of combined heat and power (CHP) systems and solar photovoltaic (PV) systems. PV would meet approximately 28 percent of the San Diego region's electric energy demand in 2020. CHP systems would provide approximately 47 percent. Annual energy demand would drop 20 percent in 2020 relative to 2003 through use all cost-effective energy efficiency measures. This target is based on City of San Diego experience. San Diego has consistently achieved energy efficiency reductions of 20 percent on dozens of projects. Existing utility-scale gas-fired generation would continue to be utilized to provide power at night, during cloudy whether, and for grid reliability support.

Photovoltaic technology selection and siting for SDG&E Solar San Diego project. Served as PV technology expert in California Public Utilities Commission proceeding to define PV technology and sites to be used in San Diego Gas & Electric (SDG&E) $250 million "Solar San Diego" project. Recommendations included: 1) prioritize use of roof-mounted thin-film PV arrays similar to the SCE urban PV program to maximize the installed PV capacity, 2) avoid tracking ground-mounted PV arrays due to high cost and relative lack of available land in the urban/suburban core, 3) and incorporate limited storage in fixed rooftop PV arrays to maximizing output during peak demand periods. Suitable land next to SDG&E substations capable of supporting 5 to 40 MW of PV (each) was also identified by Powers Engineering as a component of this project.

Photovoltaic arrays as alternative to natural gas-fired peaking gas turbines, Chula Vista. Served as PV technology expert in California Energy Commission (CEC) proceeding regarding the application of MMC Energy to build a 100 MW peaking gas turbine power plant in Chula Vista. Presented testimony that 100 MW of PV arrays in the Chula Vista area could provide the same level of electrical reliability on hot summer days as an equivalent amount of peaking gas turbine capacity at approximately the same cost of energy. The preliminary decision issued by the presiding CEC commissioner in the case recommended denial of the application in part due to failure of the applicant or CEC staff to thoroughly evaluate the PV alternative to the proposed turbines. No final decision has yet been issued in the proceeding (as of May 2009).

San Diego Area Governments (SANDAG) Energy Working Group. Public interest representative on the SANDAG Energy Working Group (EWG). The EWG advises the Regional Planning Committee on issues related to the coordination and implementation of the Regional Energy Strategy 2030 adopted by the SANDAG Board of Directors in July 2003. The EWG consists of elected officials from the City of San Diego, County of San Diego and the four subareas of the region. In addition to elected officials, the EWG includes stakeholders representing business, energy, environment, economy, education, and consumer interests.

Development of San Diego Regional Energy Strategy 2030. Participant in the 18-month process in the 2002-2003 timeframe that led to the development of the San Diego Regional Energy Strategy 2030. This document was adopted by the SANDAG Board of Directors in July 2003 and defines strategic energy objectives for the San Diego region, including: 1) in-region power generation increase from 65% of peak demand in 2010 to 75% of peak demand in 2020, 2) 40% renewable power by 2030 with at least half of this power generated in-county, 3) reinforcement of transmission capacity as needed to achieve these objectives. The SANDAG Board of Directors voted unanimously on Nov. 17, 2006 to take no position on the Sunrise Powerlink proposal primarily

because it conflicts the Regional Energy Strategy 2030 objective of increased in-region power generation. The Regional Energy Strategy 2030 is online at: http://www.energycenter.org/uploads/Regional_Energy_Strategy_Final_07_16_03.pdf

COMBUSTION EQUIPMENT PERMITTING, TESTING AND MONITORING

EPRI Gas Turbine Power Plant Permitting Documents – Co-Author.
Co-authored two Electric Power Research Institute (EPRI) gas turbine power plant siting documents. Responsibilities included chapter on state-of-the-art air emission control systems for simple-cycle and combined-cycle gas turbines, and authorship of sections on dry cooling and zero liquid discharge systems.

Air Permits for 50 MW Peaker Gas Turbines – Six Sites Throughout California.
Responsible for preparing all aspects of air permit applications for five 50 MW FT-8 simple-cycle turbine installations at sites around California in response to emergency request by California state government for additional peaking power. Units were designed to meet 2.0 ppm NO_x using standard temperature SCR and innovative dilution air system to maintain exhaust gas temperature within acceptable SCR range. Oxidation catalyst is also used to maintain CO below 6.0 ppm.

Kauai 27 MW Cogeneration Plant – Air Emission Control System Analysis. Project manager to evaluate technical feasibility of SCR for 27 MW naphtha-fired turbine with once-through heat recovery steam generator. Permit action was stalled due to questions of SCR feasibility. Extensive analysis of the performance of existing oil-fired turbines equipped with SCR, and bench-scale tests of SCR applied to naphtha-fired turbines, indicated that SCR would perform adequately. Urea was selected as the SCR reagent given the wide availability of urea on the island. Unit is first known application of urea-injected SCR on a naphtha-fired turbine.

Microturbines – Ronald Reagan Library, Ventura County, California.
Project manager and lead engineer or preparation of air permit applications for microturbines and standby boilers. The microturbines drive the heating and cooling system for the library. The microturbines are certified by the manufacturer to meet the 9 ppm NO_x emission limit for this equipment. Low-NO_x burners are BACT for the standby boilers.

Hospital Cogeneration Microturbines – South Coast Air Quality Management District.
Project manager and lead engineer for preparation of air permit application for three microturbines at hospital cogeneration plant installation. The draft Authority To Construct (ATC) for this project was obtained two weeks after submittal of the ATC application. 30-day public notification was required due to the proximity of the facility to nearby schools. The final ATC was issued two months after the application was submitted, including the 30-day public notification period.

Gas Turbine Cogeneration – South Coast Air Quality Management District. Project manager and lead engineer for preparation of air permit application for two 5.5 MW gas turbines in cogeneration configuration for county government center. The turbines will be equipped with selective catalytic reduction (SCR) and oxidation catalyst to comply with SCAQMD BACT requirements. Aqueous urea will be used as the SCR reagent to avoid trigger hazardous material storage requirements. A separate permit will be obtained for the NO_x and CO continuous emissions monitoring systems. The ATCs is pending.

Industrial Boilers – NO_x BACT Evaluation for San Diego County Boilers.
Project manager and lead engineer for preparation of Best Available Control Technology (BACT) evaluation for three industrial boilers to be located in San Diego County. The BACT included the review of low NO_x burners, FGR, SCR, and low temperature oxidation (LTO). State-of-the-art ultra low NO_x burners with a 9 ppm emissions guarantee were selected as NO_x BACT for these units.

Peaker Gas Turbines – Evaluation of NO_x Control Options for Installations in San Diego County.
Lead engineer for evaluation of NO_x control options available for 1970s vintage simple-cycle gas turbines proposed for peaker sites in San Diego County. Dry low-NO_x (DLN) combustors, catalytic combustors, high-

temperature SCR, and NO_x absorption/conversion ($SCONO_x$) were evaluated for each candidate turbine make/model. High-temperature SCR was selected as the NOx control option to meet a 5 ppm NO_x emission requirement.

Hospital Cogeneration Plant Gas Turbines – San Joaquin Valley Unified Air Pollution Control District. Project manager and lead engineer for preparation of air permit application and Best Available Control Technology (BACT) evaluation for hospital cogeneration plant installation. The BACT included the review of DLN combustors, catalytic combustors, high-temperature SCR and $SCONO_x$. DLN combustion followed by high temperature SCR was selected as the NO_x control system for this installation. The high temperature SCR is located upstream of the heat recovery steam generator (HRSG) to allow the diversion of exhaust gas around the HRSG without compromising the effectiveness of the NO_x control system.

1,000 MW Coastal Combined-Cycle Power Plant – Feasibility of Dry Cooling. Expert witness in on-going effort to require use of dry cooling on proposed 1,000 MW combined-cycle "repower" project at site of an existing 1,000 MW utility boiler plant. Project proponent argued that site was two small for properly sized air-cooled condenser (ACC) and that use of ACC would cause 12-month construction delay. Demonstrated that ACC could easily be located on the site by splitting total of up to 80 cells between two available locations at the site. Also demonstrated that an ACC optimized for low height and low noise would minimize or eliminate proponent claims of negative visual and noise impacts.

Industrial Cogeneration Plant Gas Turbines – Upgrade of Turbine Power Output. Project manager and lead engineer for preparation of Best Available Control Technology (BACT) evaluation for proposed gas turbine upgrade. The BACT included the review of DLN combustors, catalytic combustors, high-, standard-, and low-temperature SCR, and $SCONO_x$. Successfully negotiated air permit that allowed facility to initially install DLN combustors and operate under a NO_x plantwide "cap." Within two major turbine overhauls, or approximately eight years, the NO_x emissions per turbine must be at or below the equivalent of 5 ppm. The 5 ppm NO_x target will be achieved through technological in-combustor NO_x control such as catalytic combustion, or SCR or SCR equivalent end-of-pipe NO_x control technologies if catalytic combustion is not available.

Gas Turbines – Modification of RATA Procedures for Time-Share CEM. Project manager and lead engineer for the development of alternate CO continuous emission monitor (CEM) Relative Accuracy Test Audit (RATA) procedures for time-share CEM system serving three 7.9 MW turbines located in San Diego. Close interaction with San Diego APCD and EPA Region 9 engineers was required to receive approval for the alternate CO RATA standard. The time-share CEM passed the subsequent annual RATA without problems as a result of changes to some of the CEM hardware and the more flexible CO RATA standard.

Gas Turbines – Evaluation of NO_x Control Technology Performance. Lead engineer for performance review of dry low-NO_x combustors, catalytic combustors, high-, standard-, and low-temperature selective catalytic reduction (SCR), and NO_x absorption/conversion ($SCONO_x$). Major turbine manufacturers and major manufacturers of end-of-pipe NO_x control systems for gas turbines were contacted to determine current cost and performance of NO_x control systems. A comparison of 1993 to 1999 "$/kwh" and "$/ton" cost of these control systems was developed in the evaluation.

Gas Turbines – Evaluation of Proposed NO_x Control System to Achieve 3 ppm Limit. Lead engineer for evaluation for proposed combined cycle gas turbine NO_x and CO control systems. Project was in litigation over contract terms, and there was concern that the GE Frame 7FA turbine could not meet the 3 ppm NO_x permit limit using a conventional combustor with water injection followed by SCR. Operations personnel at GE Frame 7FA installatins around the country were interviewed, along with principal SCR vendors, to corroborate that the installation could continuously meet the 3 ppm NO_x limit.

Gas Turbines – Title V "Presumptively Approvable" Compliance Assurance Monitoring Protocol. Project manager and lead engineer for the development of a "presumptively approval" NO_x parametric emissions monitoring system (PEMS) protocol for industrial gas turbines. "Presumptively approvable" means that any gas turbine operator selecting this monitoring protocol can presume it is acceptable to the U.S. EPA. Close interaction with the gas turbine manufacturer's design engineering staff and the U.S. EPA Emissions Measurement Branch (Research Triangle Park, NC) was required to determine modifications necessary to the current PEMS to upgrade it to "presumptively approvable" status.

Environmental Due Diligence Review of Gas Turbine Sites – Mexico. Task leader to prepare regulatory compliance due diligence review of Mexican requirements for gas turbine power plants. Project involves eleven potential sites across Mexico, three of which are under construction. Scope involves identification of all environmental, energy sales, land use, and transportation corridor requirements for power projects in Mexico. Coordinator of Mexican environmental subcontractors gathering on-site information for each site, and translator of Spanish supporting documentation to English.

Development of Air Emission Standards for Gas Turbines - Peru. Served as principal technical consultant to the Peruvian Ministry of Energy in Mines (MEM) for the development of air emission standards for Peruvian gas turbine power plants. All major gas turbine power plants in Peru are currently using water injection to increase turbine power output. Recommended that 42 ppm on natural gas and 65 ppm on diesel (corrected to 15% O_2) be established as the NO_x limit for existing gas turbine power plants. These limits reflect NO_x levels readily achievable using water injection at high load. Also recommended that new gas turbine sources be subject to a BACT review requirement.

Gas Turbines – Title V Permit Templates. Lead engineer for the development of standardized permit templates for approximately 100 gas turbines operated by the oil and gas industry in the San Joaquin Valley. Emissions limits and monitoring requirements were defined for units ranging from GE Frame 7 to Solar Saturn turbines. Stand-alone templates were developed based on turbine size and NO_x control equipment. NO_x utilized in the target turbine population ranged from water injection alone to water injection combined with SCR.

Gas Turbines – Evaluation of NO_x, SO_2 and PM Emission Profiles. Performed a comparative evaluation of the NO_x, SO_2 and particulate (PM) emission profiles of principal utility-scale gas turbines for an independent power producer evaluating project opportunities in Latin America. All gas turbine models in the 40 MW to 240 MW range manufactured by General Electric, Westinghouse, Siemens and ABB were included in the evaluation.

Stationary Internal Combustion Engine (ICE) RACT/BARCT Evaluation. Lead engineer for evaluation of retrofit NO_x control options available for the oil and gas production industry gas-fired ICE population in the San Joaquin Valley affected by proposed RACT and BARCT emission limits. Evaluation centered on lean-burn compressor engines under 500 bhp, and rich-burn constant and cyclically loaded (rod pump) engines under 200 bhp. The results of the evaluation indicated that rich burn cyclically-loaded rod pump engines comprised 50 percent of the affected ICE population, though these ICEs accounted for only 5 percent of the uncontrolled gas-fired stationary ICE NO_x emissions. Recommended retrofit NO_x control strategies included: air/fuel ratio adjustment for rod pump ICEs, Non-selective catalytic reduction (NSCR) for rich-burn, constant load ICEs, and "low emission" combustion modifications for lean burn ICEs.

Development of Air Emission Standards for Stationary ICEs - Peru. Served as principal technical consultant to the Peruvian Ministry of Energy in Mines (MEM) for the development of air emission standards for Peruvian stationary ICE power plants. Draft 1997 World Bank NO_x and particulate emission limits for stationary ICE power plants served as the basis for proposed MEM emission limits. A detailed review of ICE

emissions data provided in PAMAs submitted to the MEM was performed to determine the level of effort that would be required by Peruvian industry to meet the proposed NO_x and particulate emission limits. The draft 1997 WB emission limits were revised to reflect reasonably achievable NO_x and particulate emission limits for ICEs currently in operation in Peru.

Air Toxics Testing of Natural Gas-Fired ICEs. Project manager for test plan/test program to measure volatile and semi-volatile organic air toxics compounds from fourteen gas-fired ICEs used in a variety of oil and gas production applications. Test data was utilized by oil and gas production facility owners throughout California to develop accurate ICE air toxics emission inventories.

AIR ENGINEERING/AIR TESTING PROJECT EXPERIENCE – GENERAL

Reverse Air Fabric Filter Retrofit Evaluation – Coal-Fired Boiler. Lead engineer for upgrade of reverse air fabric filters serving coal-fired industrial boilers. Fluorescent dye injected to pinpoint broken bags and damper leaks. Corrosion of pneumatic actuators serving reverse air valves and inadequate insulation identified as principal causes of degraded performance.

Pulse-Jet Fabric Filter Performance Evaluation – Gold Mine. Lead engineer on upgrade of pulse-jet fabric filter and associated exhaust ventilation system serving an ore-crushing facility at a gold mine. Fluorescent dye used to identify bag collar leaks, and modifications were made to pulse air cycle time and duration. This marginal source was in compliance at 20 percent of emission limit following completion of repair work.

Pulse-Jet Fabric Filter Retrofit - Gypsum Calciner. Lead engineer on upgrade of pulse-jet fabric filter controlling particulate emissions from a gypsum calciner. Recommendations included a modified bag clamping mechanism, modified hopper evacuation valve assembly, and changes to pulse air cycle time and pulse duration.

Wet Scrubber Retrofit – Plating Shop. Project engineer on retrofit evaluation of plating shop packed-bed wet scrubbers failing to meet performance guarantees during acceptance trials, due to excessive mist carryover. Recommendations included relocation of the mist eliminator (ME), substitution of the original chevron blade ME with a mesh pad ME, and use of higher density packing material to improve exhaust gas distribution. Wet scrubbers passed acceptance trials following completion of recommended modifications.

Electrostatic Precipitator (ESP) Retrofit Evaluation – MSW Boiler. Lead engineer for retrofit evaluation of single field ESP on a municipal solid waste (MSW) boiler. Recommendations included addition of automated power controller, inlet duct turning vanes, and improved collecting plate rapping system.

ESP Electric Coil Rapper Vibration Analysis Testing - Coal-Fired Boiler. Lead engineer for evaluation of ESP rapper effectiveness test program on three field ESP equipped with "magnetically induced gravity return" (MIGR) rappers. Accelerometers were placed in a grid pattern on ESP collecting plates to determine maximum instantaneous plate acceleration at a variety of rapper power setpoints. Testing showed that the rappers met performance specification requirements.

Aluminum Remelt Furnace Particulate Emissions Testing. Project manager and lead engineer for high temperature (1,600 °F) particulate sampling of a natural gas-fired remelt furnace at a major aluminum rolling mill. Objectives of test program were to: 1) determine if condensable particulate was present in stack gases, and 2) to validate the accuracy of the in-stack continuous opacity monitor (COM). Designed and constructed a customized high temperature (inconel) PM_{10}/Mtd 17 sampling assembly for test program. An onsite natural gas-fired boiler was also tested to provide comparative data for the condensable particulate portion of the test program. Test results showed that no significant levels of condensable particulate in the remelt furnace exhaust gas, and indicated that the remelt furnace and boiler had similar particulate emission rates. Test results also showed that the COM was accurate.

Aluminum Remelt Furnace CO and NO_x Testing. Project manager and lead engineer for continuous week-long testing of CO and NO_x emissions from aluminum remelt furnace. Objective of test program was to

characterize CO and NO_x emissions from representative remelt furnace for use in the facility's criteria pollution emissions inventory. A TECO Model 48 CO analyzer and a TECO Model 10 NO_x analyzer were utilized during the test program to provide ± 1 ppm measurement accuracy, and all test data was recorded by an automated data acquisition system.

PETROLEUM REFINERY AIR ENGINEERING/TESTING EXPERIENCE

Big West Refinery Expansion EIS. Lead engineer on comparative cost analysis of proposed wet cooling tower and fin-fan air cooler for process cooling water for the proposed clean fuels expansion project at the Big West Refinery in Bakersfield, California. Selection of the fin-fin air-cooler would eliminate all consumptive water use and wastewater disposal associated with the cooling tower. Air emissions of VOC and PM_{10} would be reduced with the fin-fan air-cooler even though power demand of the air-cooler is incrementally higher than that of the cooling tower. Fin-fan air-coolers with approach temperatures of 10 °F and 20 °F were evaluated. The annualized cost of the fin-fin air-cooler with a 20 °F approach temperature is essentially the same as that of the cooling tower when the cost of all ancillary cooling tower systems are considered.

Criteria and Air Toxic Pollutant Emissions Inventory for Proposed Refinery Modifications. Project manager and technical lead for development of baseline and future refinery air emissions inventories for process modifications required to produce oxygenated gasoline and desulfurized diesel fuel at a California refinery. State of the art criteria and air toxic pollutant emissions inventories for refinery point, fugitive and mobile sources were developed. Point source emissions estimates were generated using onsite criteria pollutant test data, onsite air toxics test data, and the latest air toxics emission factors from the statewide refinery air toxics inventory database. The fugitive volatile organic compound (VOC) emissions inventories were developed using the refinery's most recent inspection and maintenance (I&M) monitoring program test data to develop site-specific component VOC emission rates. These VOC emission rates were combined with speciated air toxics test results for the principal refinery process streams to produce fugitive VOC air toxics emission rates. The environmental impact report (EIR) that utilized this emission inventory data was the first refinery "Clean Fuels" EIR approved in California.

Development of Air Emission Standards for Petroleum Refinery Equipment - Peru. Served as principal technical consultant to the Peruvian Ministry of Energy in Mines (MEM) for the development of air emission standards for Peruvian petroleum refineries. The sources included in the scope of this project included: 1) SO_2 and NO_x refinery heaters and boilers, 2) desulfurization of crude oil, particulate and SO_2 controls for fluid catalytic cracking units (FCCU), 3) VOC and CO emissions from flares, 4) vapor recovery systems for marine unloading, truck loading, and crude oil/refined products storage tanks, and 5) VOC emissions from process fugitive sources such as pressure relief valves, pumps, compressors and flanges. Proposed emission limits were developed for new and existing refineries based on a thorough evaluation of the available air emission control technologies for the affected refinery sources. Leading vendors of refinery control technology, such as John Zink and Exxon Research, provided estimates of retrofit costs for the largest Peruvian refinery, La Pampilla, located in Lima. Meetings were held in Lima with refinery operators and MEM staff to discuss the proposed emission limits and incorporate mutually agreed upon revisions to the proposed limits for existing Peruvian refineries.

Air Toxic Pollutant Emissions Inventory for Existing Refinery. Project manager and technical lead for air toxic pollutant emissions inventory at major California refinery. Emission factors were developed for refinery heaters, boilers, flares, sulfur recovery units, coker deheading, IC engines, storage tanks, process fugitives, and catalyst regeneration units. Onsite source test results were utilized to characterize emissions from refinery combustion devices. Where representative source test results were not available, AP-42 VOC emission factors were combined with available VOC air toxics speciation profiles to estimate VOC air toxic emission rates. A risk assessment based on this emissions inventory indicated a relatively low health risk associated with refinery operations. Benzene, 1,3-butadiene and PAHs were the principal health risk related pollutants emitted.

Air Toxics Testing of Refinery Combustion Sources. Project manager for comprehensive air toxics testing program at a major California refinery. Metals, Cr^{+6}, PAHs, H_2S and speciated VOC emissions were measured from refinery combustion sources. High temperature Cr^{+6} stack testing using the EPA Cr^{+6} test method was performed for the first time in California during this test program. Representatives from the California Air Resources Board source test team performed simultaneous testing using ARB Method 425 (Cr^{+6}) to compare the results of EPA and ARB Cr^{+6} test methodologies. The ARB approved the test results generated using the high temperature EPA Cr^{+6} test method.

Air Toxics Testing of Refinery Fugitive Sources. Project manager for test program to characterize air toxic fugitive VOC emissions from fifteen distinct process units at major California refinery. Gas, light liquid, and heavy liquid process streams were sampled. BTXE, 1,3-butadiene and propylene concentrations were quantified in gas samples, while BTXE, cresol and phenol concentrations were measured in liquid samples. Test results were combined with AP-42 fugitive VOC emission factors for valves, fittings, compressors, pumps and PRVs to calculate fugitive air toxics VOC emission rates.

Oil and Gas Production Air Engineering/Testing Experience

Air Toxics Testing of Oil and Gas Production Sources. Project manager and lead engineer for test plan/test program to determine VOC removal efficiency of packed tower scrubber controlling sulfur dioxide emissions from a crude oil-fired steam generator. Ratfisch 55 VOC analyzers were used to measure the packed tower scrubber VOC removal efficiency. Tedlar bag samples were collected simultaneously to correlate BTX removal efficiency to VOC removal efficiency. This test was one of hundreds of air toxics tests performed during this test program for oil and gas production facilities from 1990 to 1992. The majority of the volatile air toxics analyses were performed at in-house laboratory. Project staff developed thorough familiarity with the applications and limitations of GC/MS, GC/PID, GC/FID, GC/ECD and GC/FPD. Tedlar bags, canisters, sorbent tubes and impingers were used during sampling, along with isokinetic tests methods for multiple metals and PAHs.

Air Toxics Testing of Glycol Reboiler – Gas Processing Plant. Project manager for test program to determine emissions of BTXE from glycol reboiler vent at gas processing facility handling 12 MM/cfd of produced gas. Developed innovative test methods to accurately quantify BTXE emissions in reboiler vent gas.

Air Toxics Emissions Inventory Plan. Lead engineer for the development of generic air toxics emission estimating techniques (EETs) for oil and gas production equipment. This project was performed for the Western States Petroleum Association in response to the requirements of the California Air Toxics "Hot Spots" Act. EETs were developed for all point and fugitive oil and gas production sources of air toxics, and the specific air toxics associated with each source were identified. A pooled source emission test methodology was also developed to moderate the cost of source testing required by the Act.

Fugitive NMHC Emissions from TEOR Production Field. Project manager for the quantification of fugitive Nonmethane hydrocarbon (NMHC) emissions from a thermally enhanced oil recovery (TEOR) oil production field in Kern County, CA. This program included direct measurement of NMHC concentrations in storage tank vapor headspace and the modification of available NMHC emission factors for NMHC-emitting devices in TEOR produced gas service, such as wellheads, vapor trunklines, heat exchangers, and compressors. Modification of the existing NMHC emission factors was necessary due to the high concentration of CO_2 and water vapor in TEOR produced gases.

Fugitive Air Emissions Testing of Oil and Gas Production Fields. Project manager for test plan/test program to determine VOC and air toxics emissions from oil storage tanks, wastewater storage tanks and produced gas lines. Test results were utilized to develop comprehensive air toxics emissions inventories for oil and gas production companies participating in the test program.

Oil and Gas Production Field – Air Emissions Inventory and Air Modeling. Project manager for oil and gas production field risk assessment. Project included review and revision of the existing air toxics emission inventory, air dispersion modeling, and calculation of the acute health risk, chronic non-carcinogenic risk and carcinogenic risk of facility operations. Results indicated that fugitive H_2S emissions from facility operations posed a potential health risk at the facility fenceline.

TITLE V PERMIT APPLICATION/MONITORING PLAN EXPERIENCE

Title V Permit Application – San Diego County Industrial Facility. Project engineer tasked with preparing streamlined Title V operating permit for U.S. Navy facilities in San Diego. Principal emission units included chrome plating, lead furnaces, IC engines, solvent usage, aerospace coating and marine coating operations. For each device category in use at the facility, federal MACT requirements were integrated with District requirements in user friendly tables that summarized permit conditions and compliance status.

Title V Permit Application Device Templates - Oil and Gas Production Industry. Project manager and lead engineer to prepare Title V permit application "templates" for the Western States Petroleum Association (WSPA). The template approach was chosen by WSPA to minimize the administrative burden associated with listing permit conditions for a large number of similar devices located at the same oil and gas production facility. Templates are being developed for device types common to oil and gas production operations. Device types include: boilers, steam generators, process heaters, gas turbines, IC engines, fixed-roof storage tanks, fugitive components, flares, and cooling towers. These templates will serve as the core of Title V permit applications prepared for oil and gas production operations in California.

Title V Permit Application - Aluminnm Rolling Mill. Project manager and lead engineer for Title V permit application prepared for largest aluminum rolling mill in the western U.S. Responsible for the overall direction of the permit application project, development of a monitoring plan for significant emission units, and development of a hazardous air pollutant (HAP) emissions inventory. The project involved extensive onsite data gathering, frequent interaction with the plant's technical and operating staff, and coordination with legal counsel and subcontractors. The permit application was completed on time and in budget.

Title V Model Permit - Oil and Gas Production Industry. Project manager and lead engineer for the comparative analysis of regional and federal requirements affecting oil and gas production industry sources located in the San Joaquin Valley. Sources included gas turbines, IC engines, steam generators, storage tanks, and process fugitives. From this analysis, a model applicable requirements table was developed for a sample device type (storage tanks) that covered the entire population of storage tanks operated by the industry. The U.S. EPA has tentatively approved this model permit approach, and work is ongoing to develop comprehensive applicable requirements tables for each major category of sources operated by the oil and gas industry in the San Joaquin Valley.

Title V Enhanced Monitoring Evaluation of Oil and Gas Production Sources. Lead engineer to identify differences in proposed EPA Title V enhanced monitoring protocols and the current monitoring requirements for oil and gas production sources in the San Joaquin Valley. The device types evaluated included: steam generators, stationary ICEs, gas turbines, fugitives, fixed roof storage tanks, and thermally enhanced oil recovery (TEOR) well vents. Principal areas of difference included: more stringent Title V O&M requirements for parameter monitors (such as temperature, fuel flow, and O_2), and more extensive Title V recordkeeping requirements.

RACT/BARCT/BACT EVALUATIONS

BACT Evaluation of Wool Fiberglass Insulation Production Line. Project manager and lead engineer for BACT evaluation of a wool fiberglass insulation production facility. The BACT evaluation was performed as a component of a PSD permit application. The BACT evaluation included a detailed analysis of the available control options for forming, curing and cooling sections of the production line. Binder formulations, wet electrostatic precipitators, wet scrubbers, and thermal oxidizers were evaluated as potential PM_{10} and VOC

control options. Low NO_x burner options and combustion control modifications were examined as potential NO_x control techniques for the curing oven burners. Recommendations included use of a proprietary binder formulation to achieve PM_{10} and VOC BACT, and use of low-NO_x burners in the curing ovens to achieve NO_x BACT. The PSD application is currently undergoing review by EPA Region 9.

RACT/BARCT Reverse Jet Scrubber/Fiberbed Mist Eliminator Retrofit Evaluation. Project manager and lead engineer on project to address the inability of existing wet electrostatic precipitators (ESPs) and atomized mist scrubbers to adequately remove low concentration submicron particulate from high volume recovery boiler exhaust gas at the Alaska Pulp Corporation mill in Sitka, AK. The project involved thorough on-site inspections of existing control equipment, detailed review of maintenance and performance records, and a detailed evaluation of potential replacement technologies. These technologies included a wide variety of scrubbing technologies where manufacturers claimed high removal efficiencies on submicron particulate in high humidity exhaust gas. Packed tower scrubbers, venturi scrubbers, reverse jet scrubbers, fiberbed mist eliminators and wet ESPs were evaluated. Final recommendations included replacement of atomized mist scrubber with reverse jet scrubber and upgrading of the existing wet ESPs. The paper describing this project was published in the May 1992 TAPPI Journal.

Aluminum Smelter RACT Evaluation - Prebake. Project manager and technical lead for CO and PM_{10} RACT evaluation for prebake facility. Retrofit control options for CO emissions from the anode bake furnace, potline dry scrubbers and the potroom roof vents were evaluated. PM_{10} emissions from the coke kiln, potline dry scrubbers, potroom roof vents, and miscellaneous potroom fugitive sources were addressed. Four CO control technologies were identified as technologically feasible for potline CO emissions: potline current efficiency improvement through the addition of underhung busswork and automated puncher/feeders, catalytic incineration, recuperative incineration and regenerative incineration. Current efficiency improvement was identified as probable CO RACT if onsite test program demonstrated the effectiveness of this approach. Five PM_{10} control technologies were identified as technologically feasible: increased potline hooding efficiency through redesign of shields, the addition of a dense-phase conveying system, increased potline air evacuation rate, wet scrubbing of roof vent emissions, and fabric filter control of roof vent emissions. The cost of these potential PM_{10} RACT controls exceeded regulatory guidelines for cost effectiveness, though testing of modified shield configurations and dense-phase conveying is being conducted under a separate regulatory compliance order.

RACT/BACT Testing/Evaluation of PM_{10} Mist Eliminators on Five-Stand Cold Mill. Project manager and lead engineer for fiberbed mist eliminator and mesh pad mist eliminator comparative pilot test program on mixed phase aerosol (PM_{10})/gaseous hydrocarbon emissions from aluminum high speed cold rolling mill. Utilized modified EPA Method 5 sampling train with portion of sample gas diverted (after particulate filter) to Ratfisch 55 VOC analyzer. This was done to permit simultaneous quantification of aerosol and gaseous hydrocarbon emissions in the exhaust gas. The mesh pad mist eliminator demonstrated good control of PM_{10} emissions, though test results indicated that the majority of captured PM_{10} evaporated in the mesh pad and was emitted as VOC.

Aluminum Remelt Furnace/Rolling Mill RACT Evaluations. Lead engineer for comprehensive CO and PM_{10} RACT evaluation for the largest aluminum sheet and plate rolling mill in western U.S. Significant sources of CO emissions from the facility included the remelt furnaces and the coater line. The potential CO RACT options for the remelt furnaces included: enhanced maintenance practices, preheating combustion air, installation of fully automated combustion controls, and energy efficiency modifications. The coater line was equipped with an afterburner for VOC and CO destruction prior to the initiation of the RACT study. It was determined that the afterburner meets or exceeds RACT requirements for the coater line. Significant sources of PM_{10} emissions included the remelt furnaces and the 80-inch hot rolling mill. Chlorine fluxing in the melting and holding furnaces was identified as the principal source of PM_{10} emissions from the remelt furnaces. The facility is in the process of minimizing/eliminating fluxing in the melting furnaces, and exhaust gases generated in holding furnaces during fluxing will be ducted to a baghouse for PM_{10} control. These modifications are

being performed under a separate compliance order, and were determined to exceed RACT requirements. A water-based emulsion coolant and inertial separators are currently in use on the 80-inch hot mill for PM_{10} control. Current practices were determined to meet/exceed PM_{10} RACT for the hot mill. Tray tower absorption/recovery systems were also evaluated to control PM_{10} emissions from the hot mill, though it was determined that the technical/cost feasibility of using this approach on an emulsion-based coolant had not yet been adequately demonstrated.

BARCT Low NO_x Burner Conversion – Industrial Boilers. Lead engineer for evaluation of low NO_x burner options for natural gas-fired industrial boilers. Also evaluated methanol and propane as stand-by fuels to replace existing diesel stand-by fuel system. Evaluated replacement of steam boilers with gas turbine co-generation system.

BACT Packed Tower Scrubber/Mist Eliminator Performance Evaluations. Project manager and lead engineer for Navy-wide plating shop air pollution control technology evaluation and emissions testing program. Mist eliminators and packed tower scrubbers controlling metal plating processes, which included hard chrome, nickel, copper, cadmium and precious metals plating, were extensively tested at three Navy plating shops. Chemical cleaning and stripping tanks, including hydrochloric acid, sulfuric acid, chromic acid and caustic, were also tested. The final product of this program was a military design specification for plating and chemical cleaning shop air pollution control systems. The hydrochloric acid mist sampling procedure developed during this program received a protected patent.

BACT Packed Tower Scrubber/UV Oxidation System Pilot Test Program. Technical advisor for pilot test program of packed tower scrubber/ultraviolet (UV) light VOC oxidation system controlling VOC emissions from microchip manufacturing facility in Los Angeles. The testing was sponsored in part by the SCAQMD's Innovative Technology Demonstration Program, to demonstrate this innovative control technology as BACT for microchip manufacturing operations. The target compounds were acetone, methylethylketone (MEK) and 1,1,1-trichloroethane, and compound concentrations ranged from 10-100 ppmv. The single stage packed tower scrubber consistently achieved greater than 90% removal efficiency on the target compounds. The residence time required in the UV oxidation system for effective oxidation of the target compounds proved significantly longer than the residence time predicted by the manufacturer.

BACT Pilot Testing of Venturi Scrubber on Gas/Aerosol VOC Emission Source. Technical advisor for project to evaluate venturi scrubber as BACT for mixed phase aerosol/gaseous hydrocarbon emissions from deep fat fryer. Venturi scrubber demonstrated high removal efficiency on aerosol, low efficiency on VOC emissions. A number of VOC tests indicated negative removal efficiency. This anomaly was traced to a high hydrocarbon concentration in the scrubber water. The pilot unit had been shipped directly to the jobsite from another test location by the manufacturer without any cleaning or inspection of the pilot unit.

Pulp Mill Recovery Boiler BACT Evaluation. Lead engineer for BACT analysis for control of SO_2, NO_x, CO, TNMHC, TRS and particulate emissions from the proposed addition of a new recovery furnace at a kraft pulp mill in Washington. A "top down" approach was used to evaluate potential control technologies for each of the pollutants considered in the evaluation.

Air Pollution Control Equipment Design Specification Development. Lead engineer for the development of detailed Navy design specifications for wet scrubbers and mist eliminators. Design specifications were based on field performance evaluations conducted at the Long Beach Naval Shipyard, Norfolk Naval Shipyard, and Jacksonville Naval Air Station. This work was performed for the U.S. Navy to provide generic design specifications to assist naval facility engineering divisions with air pollution control equipment selection. Also served as project engineer for the development of Navy design specifications for ESPs and fabric filters.

CONTINUOUS EMISSION MONITOR (CEM) PROJECT EXPERIENCE

Process Heater CO and NO_x CEM Relative Accuracy Testing. Project manager and lead engineer for process heater CO and NO_x analyzer relative accuracy test program at petrochemical manufacturing facility.

Objective of test program was to demonstrate that performance of onsite CO and NO_x CEMs was in compliance with U.S. EPA "Boiler and Industrial Furnace" hazardous waste co-firing regulations. A TECO Model 48 CO analyzer and a TECO Model 10 NO_x analyzer were utilized during the test program to provide ± 1 ppm measurement accuracy, and all test data was recorded by an automated data acquisition system. One of the two process heater CEM systems tested failed the initial test due to leaks in the gas conditioning system. Troubleshooting was performed using O_2 analyzers, and the leaking component was identified and replaced. This CEM system met all CEM relative accuracy requirements during the subsequent retest.

Performance Audit of NO_x and SO_2 CEMs at Coal-Fired Power Plant. Lead engineer on system audit and challenge gas performance audit of NO_x and SO_2 CEMs at a coal-fired power plant in southern Nevada. Dynamic and instrument calibration checks were performed on the CEMs. A detailed visual inspection of the CEM system, from the gas sampling probes at the stack to the CEM sample gas outlet tubing in the CEM trailer, was also conducted. The CEMs passed the dynamic and instrument calibration requirements specified in EPA's Performance Specification Test - 2 (NO_x and SO_2) alternative relative accuracy requirements.

LATIN AMERICA ENVIRONMENTAL PROJECT EXPERIENCE

Preliminary Design of Ambient Air Quality Monitoring Network – Lima, Peru. Project leader for project to prepare specifications for a fourteen station ambient air quality monitoring network for the municipality of Lima, Peru. Network includes four complete gaseous pollutant, particulate, and meteorological parameter monitoring stations, as well as eight PM_{10} and TSP monitoring stations.

Evaluation of Proposed Ambient Air Quality Network Modernization Project – Venezuela. Analyzed a plan to modernize and expand the ambient air monitoring network in Venezuela. Project was performed for the U.S. Trade and Development Agency. Direct interaction with policy makers at the Ministerio del Ambiente y de los Recursos Naturales Renovables (MARNR) in Caracas was a major component of this project.

Evaluation of U.S.-Mexico Border Region Copper Smelter Compliance with Treaty Obligations – Mexico. Project manager and lead engineer to evaluate compliance of U.S. and Mexican border region copper smelters with the SO_2 monitoring, recordkeeping and reporting requirements in Annex IV [Copper Smelters] of the La Paz Environmental Treaty. Identified potential problems with current ambient and stack monitoring practices that could result in underestimating the impact of SO_2 emissions from some of these copper smelters. Identified additional source types, including hazardous waste incinerators and power plants, that should be considered for inclusion in the La Paz Treaty process.

Development of Air Emission Limits for ICE Cogeneration Plant - Panamá. Lead engineer assisting U.S. cogeneration plant developer to permit an ICE cogeneration plant at a hotel/casino complex in Panama. Recommended the use of modified draft World Bank NO_x and PM limits for ICE power plants. The modification consisted of adding a thermal efficiency factor adjustment to the draft World Bank NO_x and PM limits. These proposed ICE emission limits are currently being reviewed by Panamanian environmental authorities.

Mercury Emissions Inventory for Stationary Sources in Northern Mexico. Project manager and lead engineer to estimate mercury emissions from stationary sources in Northern Mexico. Major potential sources of mercury emissions include solid- and liquid-fueled power plants, cement kilns co-firing hazardous waste, and non-ferrous metal smelters. Emission estimates were provided for approximately eighty of these sources located in Northern Mexico. Coordinated efforts of two Mexican subcontractors, located in Mexico City and Hermosillo, to obtain process throughput data for each source included in the inventory.

Translation of U.S. EPA Scrap Tire Combustion Emissions Estimation Document – Mexico. Evaluated the Translated a U.S. EPA scrap tire combustion emissions estimation document from English to Spanish for use by Latin American environmental professionals.

Environmental Audit of Aluminum Production Facilities – Venezuela. Evaluated the capabilities of existing air, wastewater and solid/hazardous waste control systems used by the aluminum industry in eastern Venezuela. This industry will be privatized in the near future. Estimated the cost to bring these control systems into compliance with air, wastewater and solid/hazardous waste standards recently promulgated in Venezuela. Also served as technical translator for team of U.S. environmental engineers involved in the due diligence assessment.

Assessment of Environmental Improvement Projects – Chile and Peru. Evaluated potential air, water, soil remediation and waste recycling projects in Lima, Peru and Santiago, Chile for feasibility study funding by the U.S. Trade and Development Agency. Project required onsite interaction with in-country decisionmakers (in Spanish). Projects recommended for feasibility study funding included: 1) an air quality technical support project for the Santiago, Chile region, and 2) soil remediation/metals recovery projects at two copper mine/smelter sites in Peru.

Air Pollution Control Training Course – Mexico. Conducted two-day Spanish language air quality training course for environmental managers of assembly plants in Mexicali, Mexico. Spanish-language course manual prepared by Powers Engineering. Practical laboratory included training in use of combustion gas analyzer, flame ionization detector (FID), photoionization detector (PID), and occupational sampling.

Stationary Source Emissions Inventory – Mexico. Developed a comprehensive air emissions inventory for stationary sources in Nogales, Sonora. This project requires frequent interaction with Mexican state and federal environmental authorities. The principal Powers Engineering subcontractor on this project is a Mexican firm located in Hermosillo, Sonora.

VOC Measurement Program – Mexico. Performed a comprehensive volatile organic compound (VOC) measurements program at a health products fabrication plant in Mexicali, Mexico. An FID and PID were used to quantify VOCs from five processes at the facility. Occupational exposures were also measured. Worker exposure levels were above allowable levels at several points in the main assembly area.

Renewable Energy Resource Assessment Proposal – Panama. Translated and managed winning bid to evaluate wind energy potential in Panama. Direct interaction with the director of development at the national utility monopoly (IRHE) was a key component of this project.

Comprehensive Air Emissions Testing at Assembly Plant – Mexico. Project manager and field supervisor of emissions testing for particulates, NO_x, SO_2 and CO at turbocharger/air cooler assembly plant in Mexicali, Mexico. Source specific emission rates were developed for each point source at the facility during the test program. Translated test report into Spanish for review by the Mexican federal environmental agency (SEMARNAP).

Air Pollution Control Equipment Retrofit Evaluation – Mexico. Project manager and lead engineer for comprehensive evaluation of air pollution control equipment and industrial ventilation systems in use at assembly plant consisting of four major facilities. Equipment evaluated included fabric filters controlling blast booth emissions, electrostatic precipitator controlling welding fumes, and industrial ventilation systems controlling welding fumes, chemical cleaning tank emissions, and hot combustion gas emissions. Recommendations included modifications to fabric filter cleaning cycle, preventative maintenance program for the electrostatic precipitator, and redesign of the industrial ventilation system exhaust hoods to improve capture efficiency.

Comprehensive Air Emissions Testing at Assembly Plant – Mexico. Project manager and field supervisor of emissions testing for particulates, NO_x, SO_2 and CO at automotive components assembly plant in Acuña, Mexico. Source-specific emission rates were developed for each point source at the facility during the test program. Translated test report into Spanish.

Fluent in Spanish. Studied at the Universidad de Michoacán in Morelia, Mexico, 1993, and at the Colegio de España in Salamanca, Spain, 1987-88. Have lectured (in Spanish) on air monitoring and control equipment at the Instituto Tecnológico de Tijuana. Maintain contact with Comisión Federal de Electricidad engineers responsible for operation of wind and geothermal power plants in Mexico, and am comfortable operating in the Mexican business environment.

EXPERT TESTIMONY

- On behalf of Attorney General of Iowa, In re Application of Interstate Power and Light Company for a Generating Facility Siting Certificate, Docket No. GCU-07-01, Iowa Utilities Board, November 9, 2007. Nature of testimony - IGCC with CO_2 control as alternative to pulverized coal-fired boiler.

- On behalf of individuals, the National Parks Conservation Association and Group Against Smog and Pollution, In the Matter of Greene Energy Resource Recovery Project, Plan Approval PA-30-00150A, Pennsylvania Department of Environmental Protection, June 2006. Nature of testimony – best available NO_x control for CFB boiler.

- On behalf of the Consumer Advocate Division of the Public Service Commission of West Virginia, Appalachian Power Company, Application for a Certificate of Public Convenience and Necessity to construct a 600 MW Integrated Gasification Combined Cycle Generating Station in Mason County, Public Service Commission of West Virginia, Case No. 06-0033-E-CN, November 19, 2007. Nature of testimony – challenges of converting IGCC designed without CO_2 capture for later retrofit to CO_2 capture.

- On behalf of Sierra Club, Sierra Club vs. Environment and Public Protection Cabinet and East Kentucky Power Cooperative, Inc., File No. DAQ-27974-037, October 30, 2006. Nature of testimony – best available NO_x control for CFB boiler.

- On behalf of Californians for Renewable Energy, In the Matter of Southern California Edison Company (U 338-E) for Approval of Results of Summer 2007 Track of its New Generation Request for Offers and for Cost Recovery, Application 06-11-007, Public Utilities Commission of California, November 30, 2006. Nature of testimony – cost to ratepayers of peaking gas turbines.

- On behalf of Utility Consumers' Action Network (UCAN), In the Matter of the Application of San Diego Gas & Electric Company (U 902-E) for a Certification of Public Convenience and Necessity for the Sunrise Powerlink Transmission Project, Application 06-08-010, Public Utilities Commission of California, May 2008. Nature of testimony – advantages of distributed generation alternative to new transmission line.

- On behalf of Environmental Health Coalition, In the Matter of: the Application for Certification for the Chula Vista Energy Upgrade Project, Docket No. 07-AFC-4, California Energy Resources Conservation and Development Commission, September 17, 2008. Nature of testimony – cost viability of distributed photovoltaics alternative to peaking gas turbine.

- On behalf of Sierra Club, Sierra Club v. Tennessee Valley Authority, Case No. CV-02-J-2279-NW (N.D. Ala. 2008). Nature of testimony – opacity issues and particulate controls for existing coal-fired boiler.

- In the PSD Air Quality Permit Application of Hyperion Energy Center South Dakota Department of Environment and Natural Resources, Board of Minerals and Environment, June 25, 2009. Nature of testimony – air emissions from proposed petroleum refinery and best available control technology.

- On behalf of Sierra Club and the National Audubon Society, In The Matter Of Southwestern Electric Power Company (SWEPCO) – Turk Power Plant, Docket No. 08-006-P, Arkansas Pollution Control and Ecology Commission. March 6, 2009. Nature of testimony – best available SO_2 and PM controls for proposed coal-fired boiler.

- On Behalf of Protestant Annie Mae Shelton, In the Matter of Applications of Aspen Power, LLC for TCEQ Air Quality Permit No. 81706, Prevention of Significant Deterioration Air Quality Permit PSD-TX-1089, and HAP 12, SOAH Docket No. 582-09-0636, TCEQ Docket No. 2008-1145-AIR, Before the Texas State Office of Administrative Hearings, March 3, 2009. Nature of testimony – best available NO_x, PM, and CO/VOC controls for biomass boiler.

- On Behalf of Sierra Club and No Coal Coalition, in the Matter of Applications of White Stallion Energy Center, LLC for State Air Quality Permit 86088; Prevention of Significant Deterioration Air Quality Permit Psd-Tx-1160 and for Hazardous Air Pollutant Major Source [FCAA § 112 (G)] Permit Hap-28 and Plant-wide Applicability Limit Pal-48, Texas State Office of Administrative Hearings, November 2, 2009. Nature of testimony – best available NO_x, PM, SO_2, and CO/VOC controls for CFB boilers.

- On behalf of Montana Environmental Information Center and Citizens for Clean Energy, In the Matter of: Southern Montana Electric Generation & Transmission Cooperative – Highwood Generating Station Air Quality Permit No. 3423-00, Montana Board of Environmental Review, Case No. BER 2007-07-AQ, October 2, 2007. Nature of testimony – IGCC with CO_2 control as alternative to coal-fired CFB boiler.

- On behalf of NRDC, Natural Resources Defense Council, Inc., v. Chris Korleski, Erac No. 996266, Erac No. 996267, State of Ohio Environmental Review Appeals Commission, May 11, 2010. Nature of testimony – best available air emission control levels for proposed coal-to-liquids plant.

- On Behalf of Save The Dunes Council, Inc., et al., In The Matter of Objection to the Issuance Of Significant Source Modification Permit No. 089-25484-00453 to BP Products North America Inc. Whiting Business Unit, Cause No. 08-A-J-4115. Nature of testimony – estimation of air emissions from proposed petroleum refinery expansion.

- On behalf of North Carolina Waste Awareness Reduction Network Inc., North Carolina Waste Awareness Reduction Network Inc. v. N.C. Department of Environment and Natural Resources, Division of Air Quality, 08-Ehr-0771, 0835 & 0836, 09-Ehr-3102, 3174 & 3176, North Carolina Office of Administrative Hearings, March 1, 2010. Nature of testimony – best available SO_2 and PM emission controls for proposed pulverized coal-fired boiler.

PUBLICATIONS

Bill Powers, "*San Diego Smart Energy 2020 – The 21st Century Alternative*," San Diego, October 2007.

Bill Powers, "*Energy, the Environment, and the California – Baja California Border Region*," Electricity Journal, Vol. 18, Issue 6, July 2005, pp. 77-84.

W.E. Powers, *"Peak and Annual Average Energy Efficiency Penalty of Optimized Air-Cooled Condenser on 515 MW Fossil Fuel-Fired Utility Boiler,"* presented at California Energy Commission/Electric Power Research Institute Advanced Cooling Technologies Symposium, Sacramento, California, June 2005.

W.E. Powers, R. Wydrum, P. Morris, *"Design and Performance of Optimized Air-Cooled Condenser at Crockett Cogeneration Plant,"* presented at EPA Symposium on Technologies for Protecting Aquatic Organisms from Cooling Water Intake Structures, Washington, DC, May 2003.

P. Pai, D. Niemi, W.E. Powers, *"A North American Anthropogenic Inventory of Mercury Emissions,"* presented at Air & Waste Management Association Annual Conference in Salt Lake City, UT, June 2000.

P.J. Blau and W.E. Powers, *"Control of Hazardous Air Emissions from Secondary Aluminum Casting Furnace Operations Through a Combination of: Upstream Pollution Prevention Measures, Process Modifications and End-of-Pipe Controls,"* presented at 1997 AWMA/EPA Emerging Solutions to VOC & Air Toxics Control Conference, San Diego, CA, February 1997.

W.E. Powers, et. al., *"Hazardous Air Pollutant Emission Inventory for Stationary Sources in Nogales, Sonora, Mexico ,"* presented at 1995 AWMA/EPA Emissions Inventory Specialty Conference, RTP, NC, October 1995.

W.E. Powers, *"Develop of a Parametric Emissions Monitoring System to Predict NO_x Emissions from Industrial Gas Turbines,"* presented at 1995 AWMA Golden West Chapter Air Pollution Control Specialty Conference, Ventura, California, March 1995.

W. E. Powers, et. al., *"Retrofit Control Options for Particulate Emissions from Magnesium Sulfite Recovery Boilers,"* presented at 1992 TAPPI Envr. Conference, April 1992. Published in *TAPPI Journal*, July 1992.

S. S. Parmar, M. Short, W. E. Powers, *"Determination of Total Gaseous Hydrocarbon Emissions from an Aluminum Rolling Mill Using Methods 25, 25A, and an Oxidation Technique,"* presented at U.S. EPA Measurement of Toxic and Related Air Pollutants Conference, May 1992.

N. Meeks, W. E. Powers, *"Air Toxics Emissions from Gas-Fired Internal Combustion Engines,"* presented at AIChE Summer Meeting, August 1990.

W. E. Powers, *"Air Pollution Control of Plating Shop Processes,"* presented at 7th AES/EPA Conference on Pollution Control in the Electroplating Industry, January 1986. Published in *Plating and Surface Finishing* magazine, July 1986.

H. M. Davenport, W. E. Powers, *"Affect of Low Cost Modifications on the Performance of an Undersized Electrostatic Precipitator,"* presented at 79th Air Pollution Control Association Conference, June 1986.

AWARDS

Engineer of the Year, 1991 – ENSR Consulting and Engineering, Camarillo
Engineer of the Year, 1986 – Naval Energy and Environmental Support Activity, Port Hueneme
Productivity Excellence Award, 1985 – U. S. Department of Defense

PATENTS

Sedimentation Chamber for Sizing Acid Mist, Navy Case Number 70094

EXHIBIT 2

CFE

COMISION FEDERAL DE ELECTRICIDAD

Generation and Transmission Expansion Plan
Baja California System

2003-2007

Florencio Aboytes PhD

March 2003

Overview

I. Baja California Bulk Electric System

II. Load Forecast 2003–2007

III. Total Installed Capacity (2002)

IV. Existing Transmission Grid (2002)

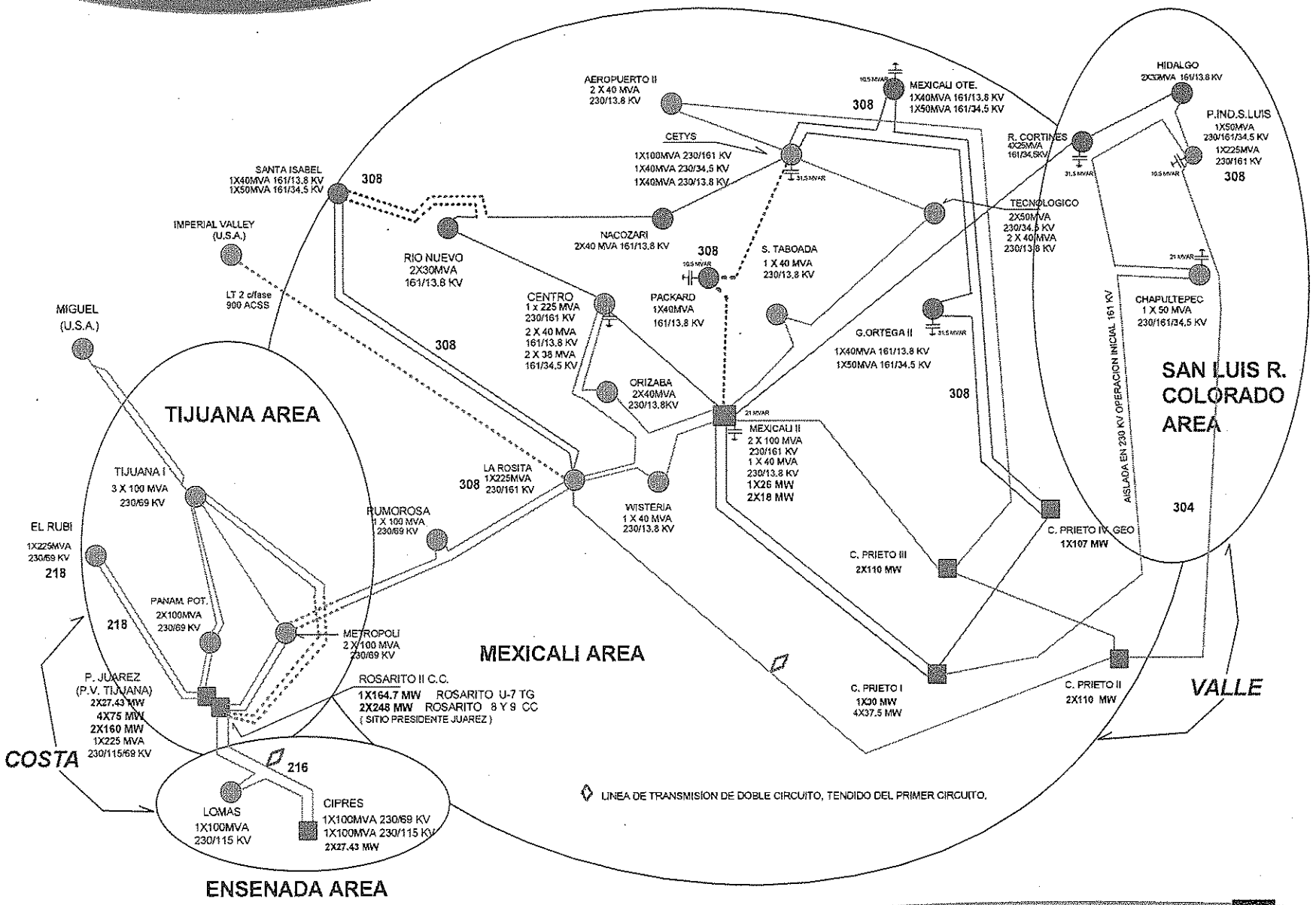
V. Transactions with WECC 1995-2002

VI. WECC Path 45

VII. Planned Generating Capacity Additions 2003-2007

VII. US/Mexico Border Joint System Impact Study 2003-2006

Baja California Bulk Electric System



Load Forecast 2002-2007

Areas	Load Growth 1997-2002	Peak Load MW		Expected Load Growth 2002-2007
		2002	2007	
Tijuana	8.52%	530	793	8.3%
Ensenada	5.71%	141	189	6.11%
Mexicali	6.77%	843	1,190	7.14%
San Luis R.C.	4.10%	155	211	6.36%
Tecate	6.68%	30	43	7.38%
Total	**6.94%**	**1,699**	**2,426**	**7.38%**

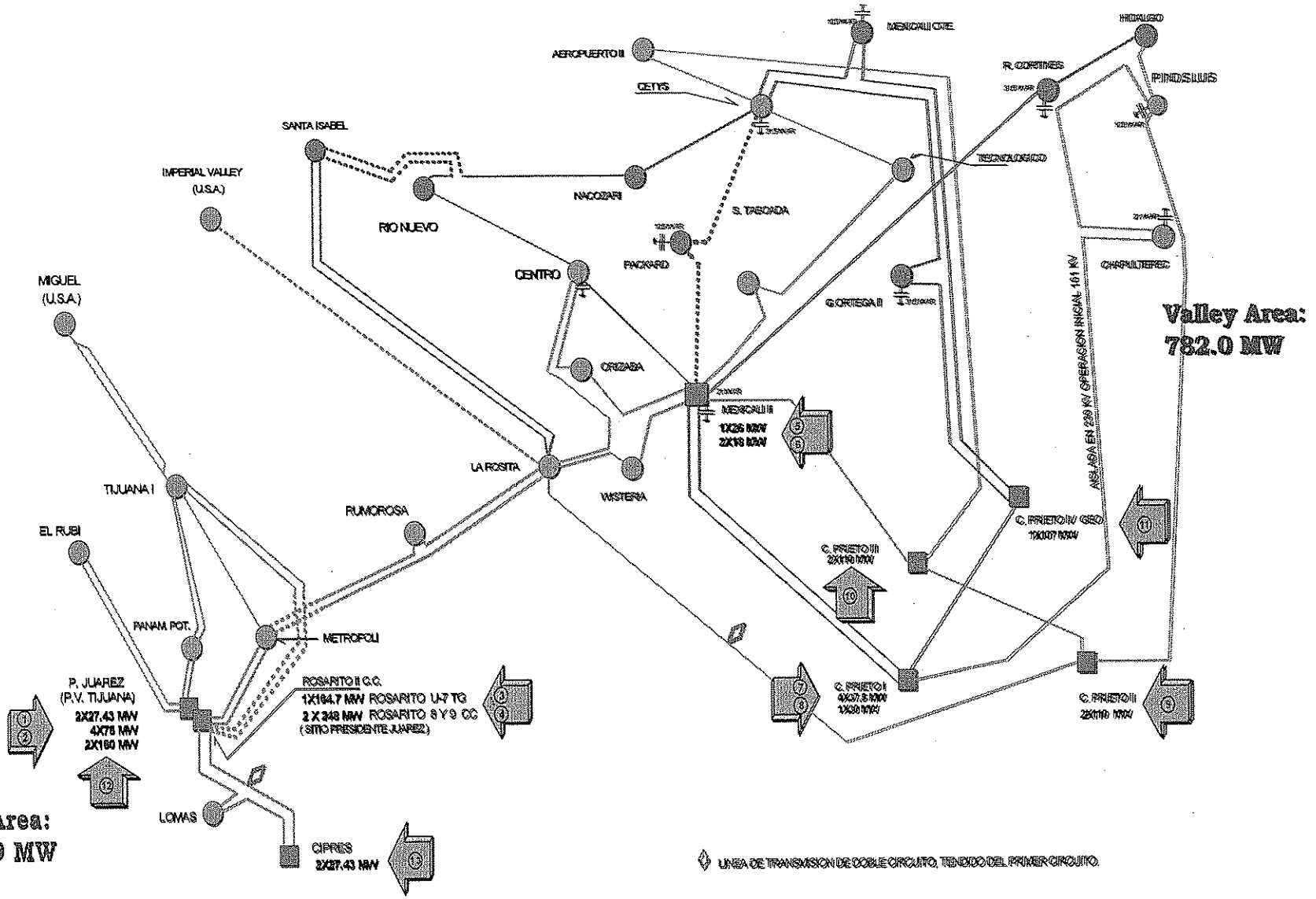
Total Installed Capacity

Baja California System

2002

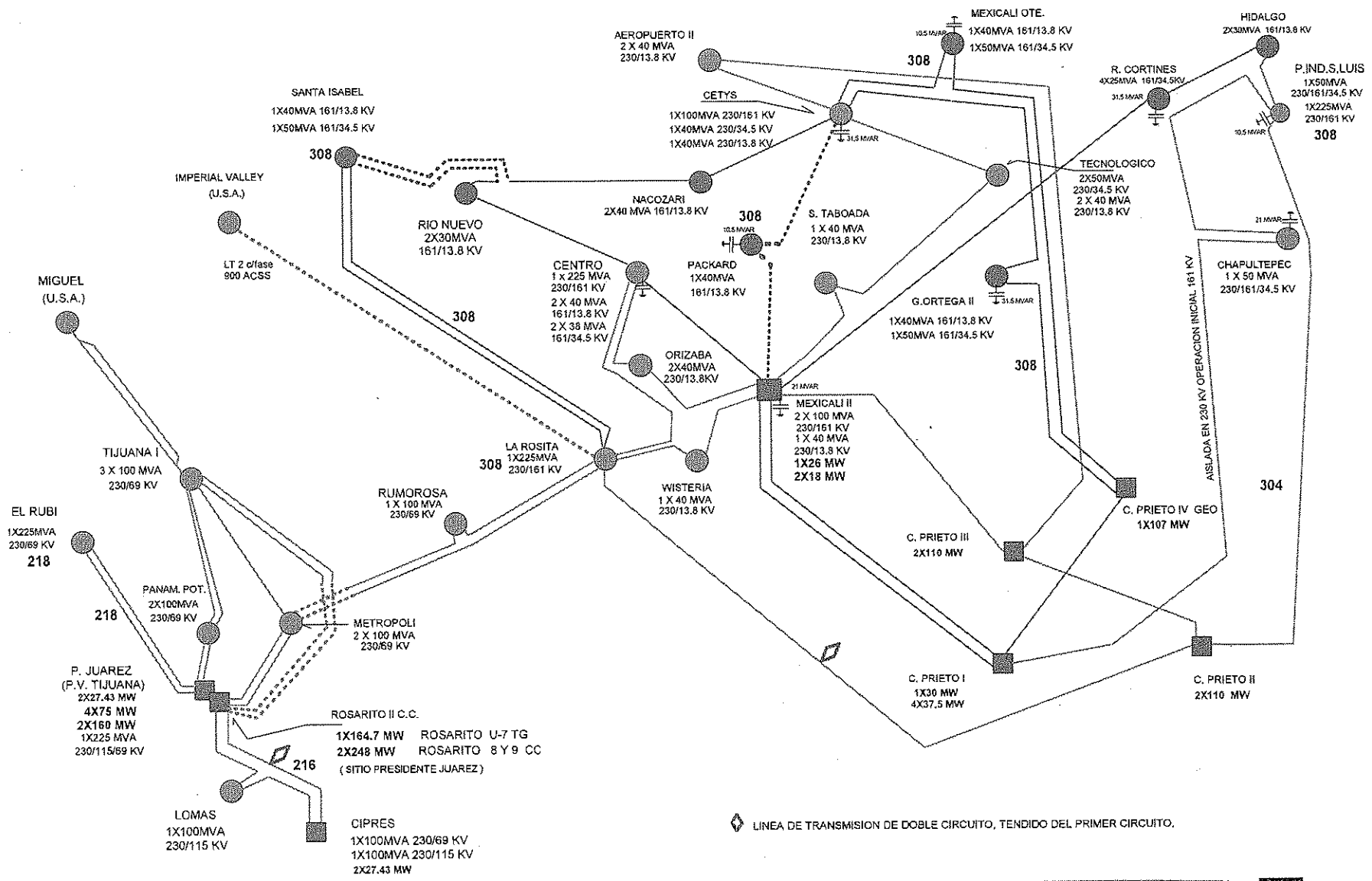
POWER STATION	UNITS	TOTAL CAPACITY (MW)
1.- PRESIDENTE JUAREZ	4 X 75	300
2.- PRESIDENTE JUAREZ	2 X 160	320
3.- PRESIDENTE JUAREZ	1 X 150	150
4.- PRESIDENTE JUAREZ	2 X 248	496
5.- MEXICALI II	1X 26	26
6.- MEXICALI II	2 X 18	36
7.- CERRO PRIETO I	4 X 37.5	150
8.- CERRO PRIETO I	1 X 30	30
9.- CERRO PRIETO II	2 X 110	220
10.- CERRO PRIETO III	2 X 110	220
11.- CERRO PRIETO IV	4 X 25	100
12.- TIJUANA	2 X 30	60
13.- CIPRES	2 X 27.4	55
		2,163

Generation Sites



Existing Transmission Grid

(2002)



Import/Export Transactions

IMPORTS

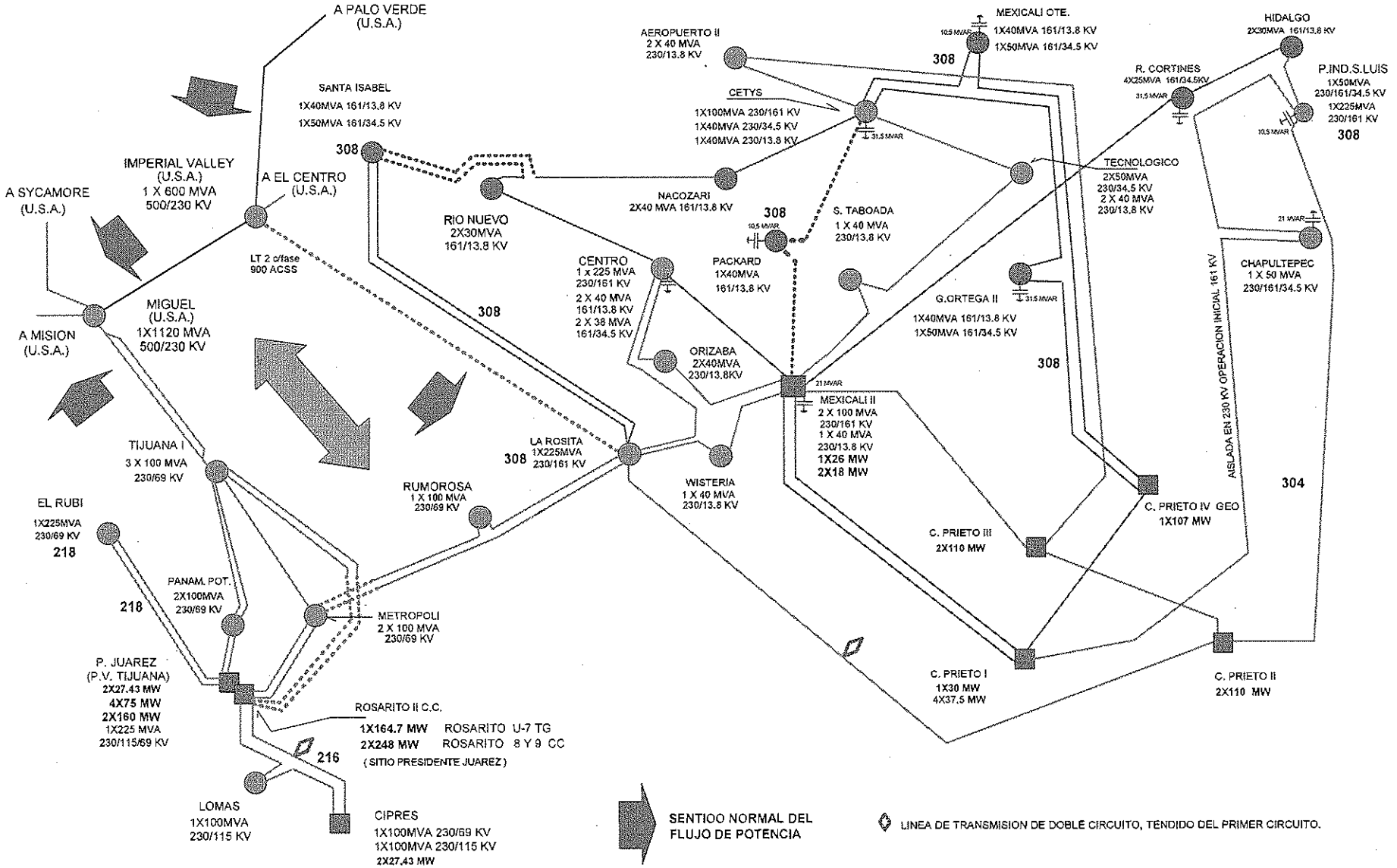
YEAR	SELLER	CAPACITY (MW)	ENERGY (GWh)
1995	SDG&E,SCE,IID	180	229
1996	SDG&E,SCE	270	355
1997	SDG&E,IID,POWEREX,APS	290	406
1998	SDG&E,ENRON,APS,ENOVA,POWEREX	320	480
1999	IID,ENRON,WILLIAMS,CALPX,ISO	408	647
2000	IID,ENRON,PNM,CALPX	390	930
2001	CDWR,CORAL,APS,IID,ISO	120	97
2002	POWEREX ,CDWR,CORAL,ISO	400	316

EXPORTS

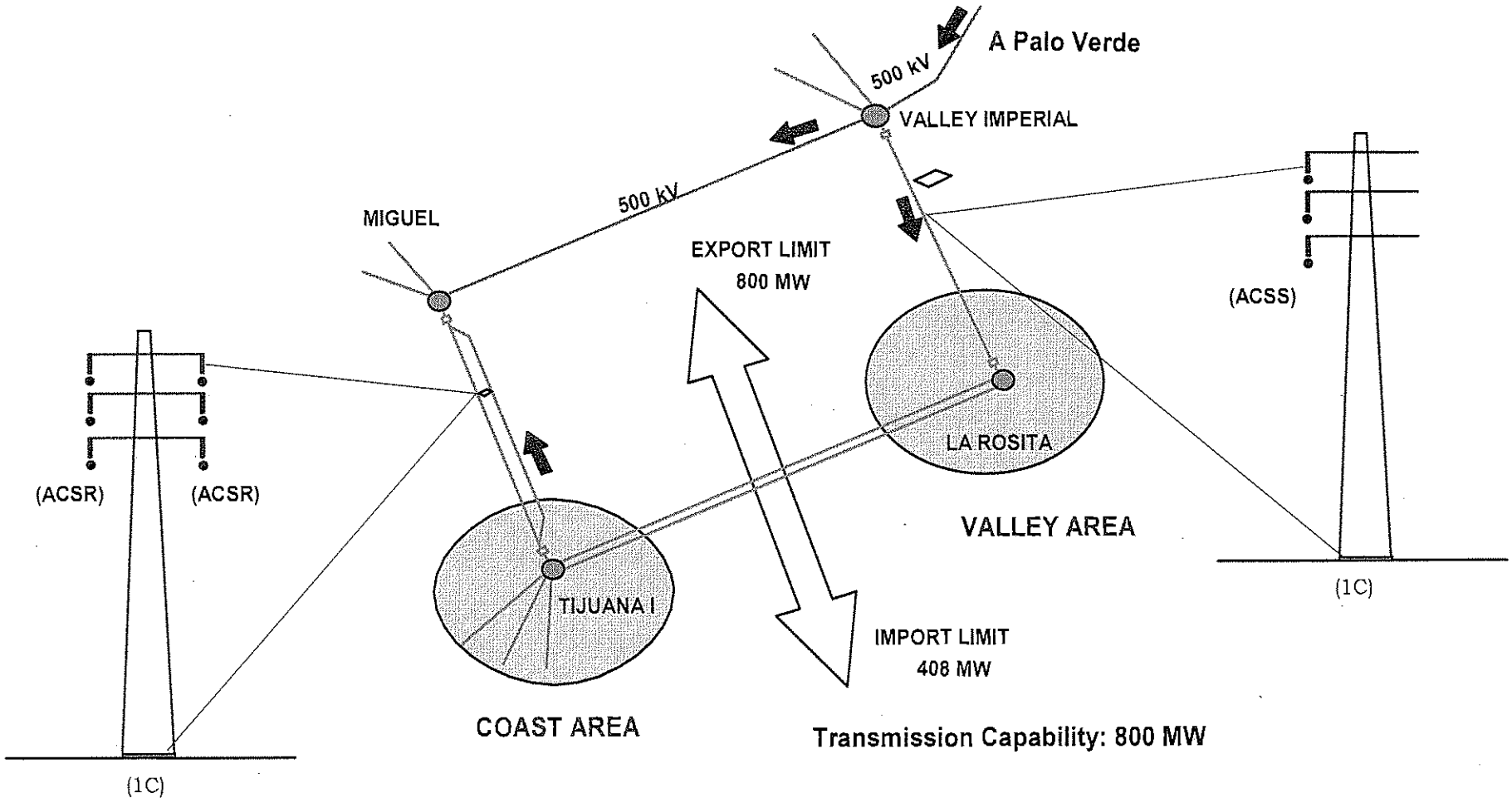
YEAR	BUYER	CAPACITY (MW)	ENERGY (GWh)
1995	SDG&E, SCE	290	1,919
1996	SDG&E, SCE	110	1,258
1997	SDG&E	272	17
1998	ENRON	180	45
1999	ENRON,CALPX	170	31
2000	CALPX	320	75
2001	ISO,CDWR,CORAL	408	127
2002	ISO, CORAL	305	165

Import/Export Transactions

1995–2002

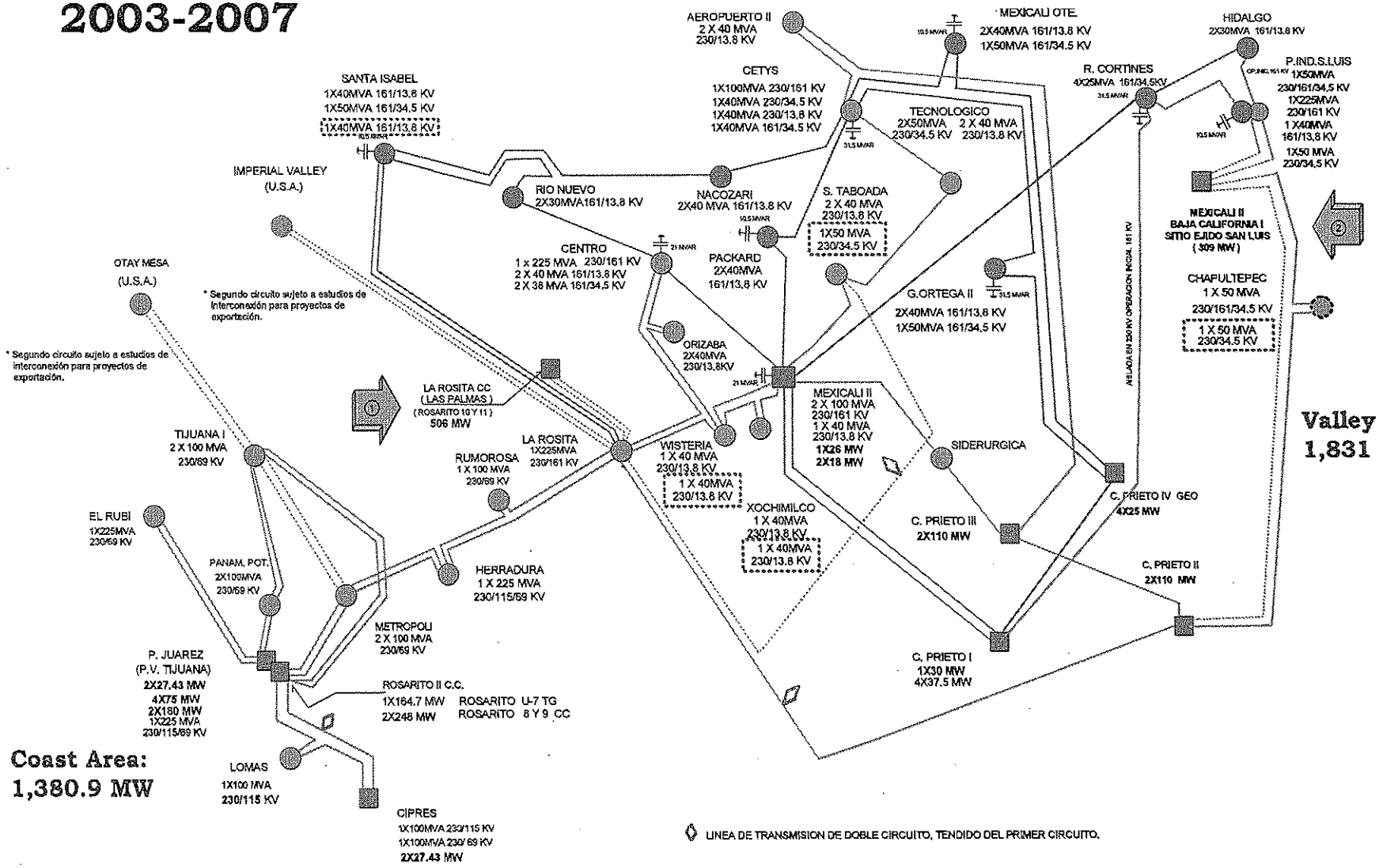


WECC Path 45 Capability



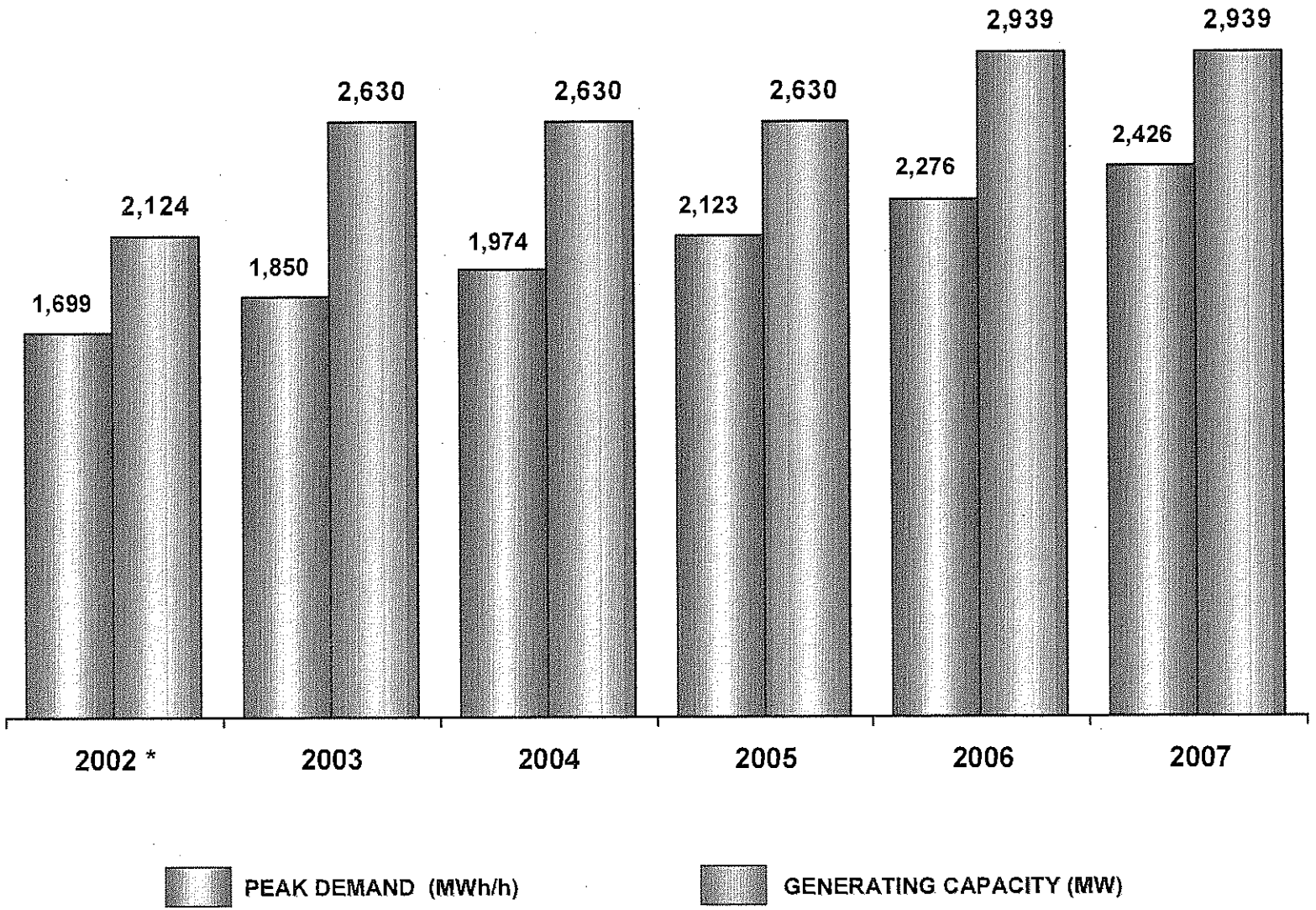
Generation and Transmission Expansion

2003-2007



Generating Capacity and Peak Demand

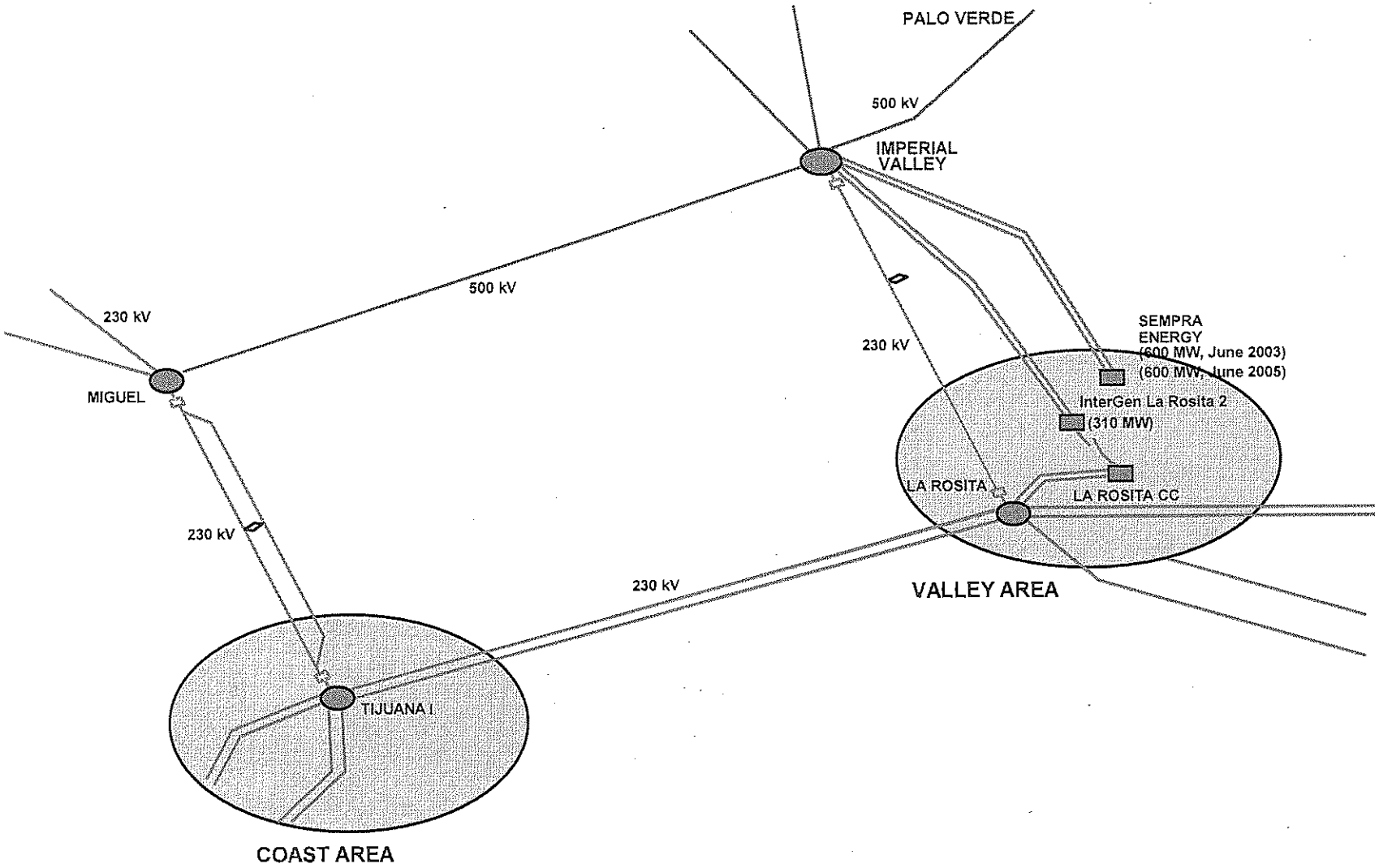
Baja California System



Generating Capacity Additions 2003-2007

Year	Power Station	Capacity (MW)	Site
2003	Rosarito 10 y 11	506	Las Palmas
2004			
2005			
2006	Mexicali II	309	Ejido San Luis

2003-2007


PALO VERDE
500 kV
IMPERIAL VALLEY
500 kV
230 kV
230 kV
MIGUEL
SEMPRA ENERGY
(600 MW, June 2003)
(600 MW, June 2005)
InterGen La Rosita 2
(310 MW)
LA ROSITA
LA ROSITA CC
230 kV
230 kV
VALLEY AREA
TIJUANA I
COAST AREA

CFE

COMISION FEDERAL DE ELECTRICIDAD

Generation and Transmission Expansion Plan
Baja California System

2003-2007

Florencio Aboytes PhD

March 2003

EXHIBIT 3

Bill Powers

From: Don Wood [dwood8@cox.net]
Sent: Wednesday, June 18, 2008 12:05 PM
To: dwood8@cox.net
Subject: The Wind Blows in Mexico

California Energy Markets

Mexico Could Be Wind Hotspot If Wires, Border Issues Are Solved

6/17/08 - FREE TRIAL

Like the Tehachapi region in California, the border area of Mexico's Baja Norte is blessed with abundant wind, but to be successful, developers need to clear transmission hurdles, meet both Mexican and California regulatory requirements and export their electricity at an attractive price.

Moreover, the wind potential of the region needs to be studied in detail, according to a report released June 6 by consulting firms Kema Inc. and Bates White.

"Once the wind resource potential of the Northern Baja region is determined, it could be considered as another renewable-energy-rich region," stated the report, prepared for the California Energy Commission.

A previous report, from California's Renewable Energy Transmission Initiative, rated the Baja Norte region with a wind potential of 1,800 MW, compared to approximately 36,000 MW in British Columbia, 21,000 MW in California, 9,000 MW in Washington and 7,000 MW in Oregon. But according to the Kema-Bates White report, a "more thorough" assessment carried out by a private developer indicates the Baja region could have wind potential up to 10,000 MW with "several thousand" megawatts along the Juarez mountain range.

The report rated the wind potential of the La Rumorosa region in Baja alone as "good to superb," with potential capacity up to 1,800 MW. It also noted the 5,000 MW of applications for Baja projects sitting in the California Independent System Operator interconnection queue.

There is pressure in Mexico "to keep some of their renewable potential for Mexican consumption," said Bates White consultant Nicolas Puga, and some developers might need to "dedicate some of their output to the Mexican market." However, Mexican customers would not need a large chunk of the wind potential, he said.

Mexico has a renewables standard of 8 percent by 2012. Alejandro Peraza,

director general of electricity for Mexico's power regulator, Comisión Reguladora de Energía, told California Energy Markets Thursday that ideal projects for Mexico would "use Baja wind resources on both sides of the border."

"Baja's wind resources are big enough to supply power to U.S. and Mexican consumers," he wrote in an e-mail. But "it is also clear that our transmission capabilities should be upgraded if substantial wind power is to be consumed in Mexico."

Developers have already staked territory in the Mexican wind game, according to the report: Sempra Generation is developing a 250 MW wind project in La Rumorosa-the company's first wind facility-and has signed a power-purchase agreement with Southern California Edison. To bring the wind to load centers, the company applied for a U.S. "presidential permit" to build a 500 kV wire from its Mexico project into California, connecting to the Southwest Powerlink.

Mexico's Fuerza Eólica SA holds the only two permits from CRE for wind power in Baja and claims to have land rights for up to 750 MW of capacity. One 10 MW permit is to supply municipal lighting customers in Mexico; the other 300 MW project is designed for export.

EnXco, the U.S. affiliate of France's EDF Energies Nouvelles, has been studying wind potential in the area. "Evidence" indicates that enXco has rights to about 15,000 acres of land west of La Rumorosa, the Kema-Bates White report stated.

Peraza said that on the whole, developers "seem to be willing to dedicate some capacity to consumers in Mexico."

Sempra Generation CEO and President Mike Allman told CEM Friday that the first phase of the La Rumorosa project would be for export only, but that ultimately the company could develop the site out to 1,000 MW. "I suppose there's some potential in future phases" to supply power in Mexico, he said.

Neither exporting electricity to California from Baja nor exporting some and keeping some for Mexico's use is without precedent. Sempra's Termoeléctrica de Mexicali, a 625 MW natural gas-fired plant, has been moving electrons across the border since 2003. InterGen's 1,065 MW La Rosita natural gas plant also exports and has 500 MW under contract with Mexico's national monopoly utility, Comisión Federal de Electricidad.

The report stressed that cost hurdles exist on both sides of the border. Mexican customers most interested in wind power are municipalities, but they change every two years. Project developers can also sell to CFE, but they would get a price of only 85 to 90 percent of the utility's short-run marginal cost of electricity-"clearly this is not an attractive option," the Kema report stated.

In addition, Mexican renewables are ineligible for U.S. tax credits, which for wind equate to about 3 cents/kWh in levelized value. And in bids received by San Diego Gas & Electric, La Rumorosa developers have quoted

capacity factors of 30 percent compared to the 35 to 40 percent touted by U.S. wind companies.

"There are pluses and minuses," Allman said. "One of the minuses is we don't get the PTC." On the positive end, he noted the wind resources in the region-which extend five miles north of the border and 40 miles south-are "one of the three best areas in California" to develop wind. Mexico also has an accelerated depreciation schedule, which the Kema report noted allows 100 percent depreciation in the first fiscal year of equipment operation. There is also a 30 percent fiscal credit for research and exploration, according to a 2008 report from Milbank, Tweed, Hadley & McCloy LLP.

"We can be as competitive" as California wind, Allman said, adding that La Rumorosa is situated just a few miles from an interconnection with the Cal-ISO system.

The Kema-Bates White report also mentioned it is possible for developers of projects sited in Mexico to earn credits under the Kyoto Protocol's clean-development mechanism. The CDM would offer companies "an additional source of cash without being forced to sell their output in Mexico," the report stated, so long as developers showed their project would displace fossil-fuel generation.

The Milbank report hypothesized wind companies in Mexico could "sell some of the credits expected to be earned" to finance projects.

"Renewable projects in Mexico . . . could benefit from deriving additional income from unbundled RECs, carbon credits or even CDM carbon credits," Puga said.

Developers of wind turbines in Mexico have several transmission options. Mexico's CFE does not invest in wires upgrades designed solely for export, though the Kema-Bates White report indicated the government might justify the investment if the system benefited from a network upgrade.

"Baja is electrically isolated from the rest of the country," Peraza said, adding that the country has plans to build a tie there in 2011.

For exports alone, developers could move power along Path 45, which CFE and Coral Energy use for short-term exports to California. The report estimated that Path 45 has 800 MW in unused capacity, but developers would have to execute long-term wheeling contracts through CFE's system. Wheeling "may result in increasing the overall cost of any renewable resources" and may "not be economical."

Another option is to build a new line, as proposed by Sempra. Project developers would shoulder the cost of the wire until it crossed the border, at which point they could roll expenses into rates.

The question of how to move the cross-border power to load centers, however, would still exist. Sempra's Allman said that the Cal-ISO has said the Southwest Powerlink can accommodate only 80 MW of capacity. Beyond that, the Sunrise Powerlink or some other transmission solution would be required to

move La Rumorosa wind to load centers. The Kema report also mentioned that the Cal-ISO sees Sunrise or GreenPath North as necessities to exploit the potential of Baja Norte wind.

The report also noted that electricity exported to meet the California RPS would have to meet state regulations, in addition to meeting Mexican laws. Environmental groups have protested the La Rumorosa contract, alleging Sempra failed to show appropriate environmental mitigation.

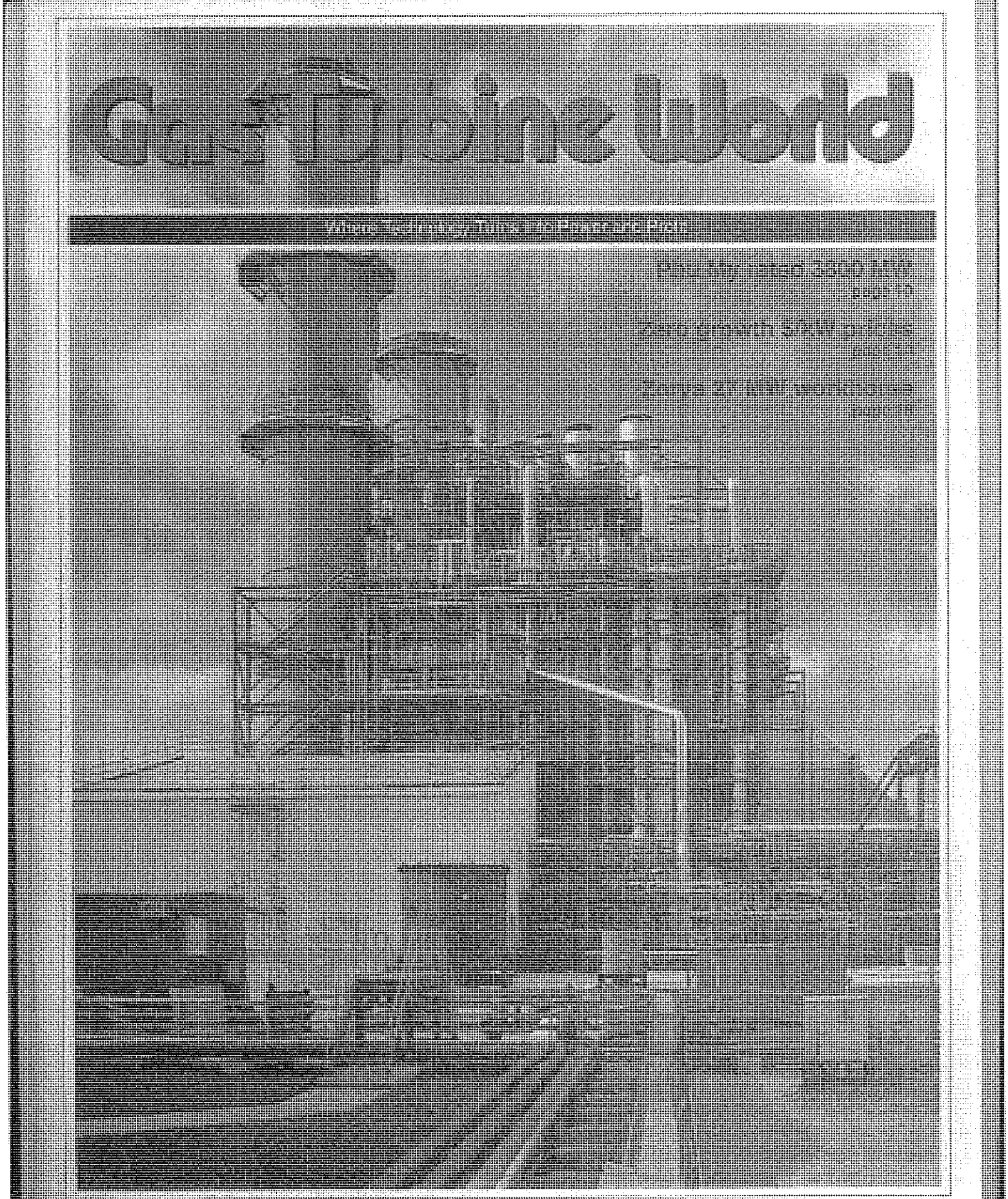
Larson, however, noted that Sempra's TDM plant was "built to meet California air quality standards in terms of equipment."

"You could pick up that plant and operate it on the other side of the border," he said.

Overall, the Kema-Bates White report called on the California Energy Commission to study Baja wind potential and discuss in forums with Mexico the transmission options. The CEC should also work to promote border transmission, including Sunrise and GreenPath North, and Mexico should explore "the possibility of adopting standards identical to the California standards for export projects."

The CEC could undertake a formal collaboration with Mexico's Secretaría de Energía to address energy supply and transmission [MOU 600-07-003].

EXHIBIT 4



provide front-end environmental, permitting and grid connection services.

To date, PB reports, the Barcelona office has provided engineering support services for the existing 800 MW combined cycle plants at San Roque near Cadiz and Besos outside Barcelona.

Projects are part of Spanish electric utility Endesa's alliance with GasNatural (Repsol) to develop large, natural gas fired power stations.

San Roque and Besos are nearly identical. Both are single-shaft KA26-1 combined cycle plants, supplied by Alstom, ISO rated 393 MW each on natural gas fuel.

PB is also working on new projects including the 400 MW Riba Roja d'Ebre and Arrubal power stations.

GE Energy

Qatar expanding LNG production

Qatar Petroleum and ExxonMobil awarded GE Energy a US$200 million contract for the supply of three turbo compressor strings.

To be installed for main refrigerant service in the Qatargas II liquefied natural gas expansion project in Ras Laffan Industrial City.

Qatar II, the world's largest LNG project, will also include the world's largest trains for liquefied gas production.

Each Qatargas II liquefaction train will be rated for an annual capacity of 7.8 million tons.

The project will use the new AP-XO liquefaction process developed by Air Products and Chemicals.

Qatar Petroleum owns 70 percent of the project and ExxonMobil 30 percent.

General Electric

Gas turbines replace diesel power stations

Al Kamil Power Company started operation at its site-rated 285-MW simple cycle power station in the Sharqiya region of Oman.

Plant was purchased to replace installed diesel engine generating capacity in the region. Natural gas is the primary fuel with distillate oil as back-up.

Simple cycle station is powered by three GE MS9001E gas turbines equipped with dry low NOx combustors.

Machines are normally rated 123.4 MW each, derated by high site ambient temperatures (32°C) to 95 MW.

Generated power is sold to Oman's Ministry of Electricity and Water under a fifteen-year power purchase agreement.

Al Kamil Power is a subsidiary of International Power in the UK.

MS9001E

Compression by Fr9E drivers

GE will provide three MS9001E gas turbine driven compression strings with low emissions capability.

GE says this project will be the first application of Fr 9E machines in LNG refrigeration service.

Huge single-shaft machines are rated 169,100 horsepower (126 MW) each.

Company scope of supply includes full-load string testing in addition to gas turbine and compressor spare parts.

Large electric motor/generators with variable frequency drives will be used for start-up helper power on each string. They will also serve for electric power generation.

GE says it will manufacture the gas turbines in Belfort, France. To be tested and packaged at GE Oil & Gas facility in Massa, Italy for shipment to Ras Laffan.

Centrifugal compressors will be built and assembled at GE's Florence and Massa workshops.

Timetable calls for shipment of units to start in November 2005. First LNG train is scheduled for operation in the winter of 2007.

UAE Project

Plans for 1000-MW water and power plant

International 'expression of interest' documents for participation in a planned 1000-MW power generation and water plant in Qidfa, Al Fujairah are under evaluation. Plant to be operational by 2008 at the latest.

This is an independent power and water project in the United Arab Emirates. EOI evaluation and negotiations are to be completed in time for agreements to be signed in the third quarter 2004.

Union Water & Electricity Company (UWEC), which is evaluating the EOIs, has invited international power developers to take an equity stake in this and in future power generation and water desalination projects in the UAE.

Sempra Energy

Mexicali plant spurs surge of capacity

New 600-MW merchant facility in Mexicali Baja, Mexico commissioned by Sempra Energy of San Diego is one of several new plants being built or planned along the U.S.-Mexican border by U.S. and overseas companies.

The location allows utilities to meet the growing power needs of Mexico while also being near U.S. markets.

Other plants are stationed in Mexico and sell power primarily into the U.S. grid, with gas being supplied from indigenous U.S. supplies.

Strong economic advantages for the Mexican programs include availability of low cost labor and avoiding some of the stringent environmental rules for new U.S. facilities.

Another overriding factor is that under Mexican regulations, permitting for a new plant takes only 6-8 months compared with much longer periods—usually twice that—to gain approvals for U.S. projects

Cost for installing Sempra's Termoelectrica de Mexicali (TMD) facility is reported to be around US$350 million.

Power island consists of two GE Frame 7FA gas turbines, two HRSGs, and a 310-MW Alstom steam turbine equipped with a 380 MVA hydrogen-cooled generator installed in combined cycle.

FutureGen

DOE focus on coal hydrogen program

US Dept. of Energy FutureGen program is centered on advancing IGCC technology to develop, build and operate on coal-based feedstock to generate emissions-free electric power and co-produce hydrogen.

R&D scope includes design and construction of a 275-MW demonstration plant that will also serve as a large scale engineering laboratory for testing new clean power, carbon capture, and coal-to-hydrogen technologies.

Also will include design development and testing of advanced sequestration technologies to capture CO_2 from syngas, possibly using novel membranes now under development.

Candidate reservoirs for sequestration include depleted oil and gas reservoirs, non-profitable coal seams, deep saline aquifers, and basalt formations "all common in the U.S."

Pratt & Whitney Marine

"ST" gas turbines for Norwegian patrol boats

Pratt & Whitney Marine ST18 and ST40 gas turbines have been selected to power the Royal Norwegian Navy "Skjold class" surface effect fast patrol boats.

Navy plans on an initial build of six boats, each powered by two ST18 gas turbine engines and two ST40s, combined in pairs to provide cruise and boost propulsion.

Engine buy is worth $40 million to Pratt over the next four years.

Skjold surface effect boats to be built between 2004 and 2007. Will combine very high speed capability with treated exhaust to suppress infrared detection.

Navy gas turbine engines are design rated for 100°F hot day operation on low sulfur distillate or diesel oil, with 4-inch inlet and 6-inch exhaust losses.

At those conditions, the ST18 marine engine is rated at 1869 shaft-hp and the ST40 is rated at 3999 shaft-hp.

EXHIBIT 5

Hour Ending	HE01	HE02	HE03	HE04	HE05	HE06	HE07	HE08	HE09	HE10	HE11
IOU											
PGAE											
Actual System Load	9096	8852	8908	8839	9422	9947	11624	11904	12097	12413	12773
Hour Ahead Forecast	9607	9441	9385	9684	10048	10385	11651	12103	12177	12581	12910
Day Ahead Forecast	9739	9680	9642	9733	10186	11021	12111	12528	12537	12542	12787
2Day Ahead Forecast	9278	9167	9338	9398	9854	10588	11649	12051	12308	12598	12828
SCE											
Actual System Load	9802	9600	9495	9550	10016	10503	11391	11851	12557	13133	13550
Hour Ahead Forecast	9986	9791	9588	9726	10042	10656	11382	11591	12097	12176	13177
Day Ahead Forecast	9645	9373	9208	9262	9667	10285	11034	11435	12066	12674	13172
2Day Ahead Forecast	9706	9414	9279	9329	9739	10273	11028	11539	12163	12756	13222
SDGE											
Actual System Load	1711	1641	1598	1602	1720	1956	2220	2328	2473	2740	2783
Hour Ahead Forecast	1777	1732	1634	1641	1729	1985	2236	2364	2593	2758	2874
Day Ahead Forecast	1773	1702	1669	1677	1775	2033	2296	2434	2601	2780	2930
2Day Ahead Forecast	1786	1717	1687	1698	1800	2064	2329	2467	2618	2769	2893

HE12	HE13	HE14	HE15	HE16	HE17	HE18	HE19	HE20	HE21	HE22	HE23	HE24
Megawatts												
12697	12883	12901	12886	12913	12865	12833	13822	13553	13010	12131	11095	10166
12897	12896	12920	12922	12832	12857	12953	13854	13641	12968	12161	11151	10431
12854	12931	13021	12975	12923	12870	13007	13852	13620	13036	12225	11260	10260
12861	12898	12932	12859	12786	12734	12939	13829	13649	13170	12312	11198	10027
13773	13943	14150	14201	14124	13871	13726	14555	14286	13660	12862	12012	10984
13386	14000	13968	14234	13997	13673	13658	14271	14087	13839	13124	11653	11225
13528	13822	14024	14108	14031	13819	13772	14246	14161	13694	12943	11813	10486
13563	13796	13964	14107	13990	13758	13751	14371	14538	14194	12247	10950	10080
2789	2826	2897	2861	2804	2766	2782	2972	2881	2735	2509	2238	2019
2948	3059	3104	3044	2967	2874	2768	3013	2934	2729	2437	2079	1879
3029	3094	3148	3148	3094	3008	3034	3213	3085	2874	2564	2241	1950
2963	3013	3046	3026	2964	2881	2913	3139	3028	2825	2527	2215	1943

HE25		
	IOU	
		PGAE
	Actual System Load	
	Hour Ahead Forecast	
	Day Ahead Forecast	
	2Day Ahead Forecast	
		SCE
	Actual System Load	
	Hour Ahead Forecast	
	Day Ahead Forecast	
	2Day Ahead Forecast	
		SDGE
	Actual System Load	
	Hour Ahead Forecast	
	Day Ahead Forecast	
	2Day Ahead Forecast	

EXHIBIT 6

California Public Utilities Commission

505 Van Ness Ave., San Francisco

FOR IMMEDIATE RELEASE
Media Contact: Terrie Prosper, 415.703.1366, news@cpuc.ca.gov

PRESS RELEASE
Docket #: A.08-03-015

CPUC APPROVES EDISON SOLAR ROOF PROGRAM

SAN FRANCISCO, June 18, 2009 - The California Public Utilities Commission (CPUC), in its ongoing commitment to innovative programs and policies to advance the delivery of renewable energy, today approved a solar photovoltaic program for Southern California Edison.

The program will result in the deployment of 500 megawatts (MW) of solar photovoltaic (PV) on existing commercial rooftops in Edison's service territory. Edison will own, install, operate, and maintain 250 MW of solar PV projects, which will primarily consist of one to two MW rooftop systems. The remaining 250 MW will be installed, owned, and operated by independent, non-utility solar providers selected through a competitive process.

Prior to today's decision, utility solar programs in the one to two MW range had limited participation in the California Solar Initiative or Renewables Portfolio Standard (RPS) program. Edison's program creates a new avenue for developing such smaller sized solar projects.

"This program represents a valuable complement to the existing renewable procurement efforts we have underway, given the significant permitting challenges large scale renewables face, both in terms of transmission and the generating facilities themselves," said CPUC President Michael R. Peevey. "It represents an important hedging strategy by allowing for the deployment of distributed resources that, while somewhat more expensive than the large scale renewable projects that are the primary focus of the RPS program, offer a much higher level of certainty in terms of when they will come online."

Added Commissioner John A. Bohn, author of the decision, "This decision is a major step forward in diversifying the mix of renewable resources in California and spurring the development of a new

market niche for large scale rooftop solar applications. Unlike other generation resources, these projects can get built quickly and without the need for expensive new transmission lines. And since they are built on existing structures, these projects are extremely benign from an environmental standpoint, with neither land use, water, or air emission impacts. By authorizing both utility-owned and private development of these projects we hope to get the best from both types of ownership structures, promoting competition as well as fostering the rapid development of this nascent market."

"This decision is good for California because it makes good use of all that sun and warehouse roofs in Southern California to produce clean energy right where we need it, both by Edison and independent generators," commented Commissioner Rachelle Chong. "I commend Edison for its foresight in bringing a focus on commercial solar PV projects that are 1-2 megawatts in size."

Commissioner Timothy Alan Simon said, "I support this decision because it strikes a balance between promoting utility-owned generation and competitive procurement for independent energy producers, as well as distributed generation and central station solar systems. Finally, it will bring much needed economic stimulus to the Inland Empire."

Because this is the first significant foray by a utility into ownership of renewable generation, the CPUC will carefully monitor the program's progress, examine ways in which the program can be improved, and fine tune the program when and where appropriate.

The energy generated from the project will be used to serve Edison's retail customers and the output from these facilities will be counted towards Edison's RPS goals. The output and capacity of the projects will not count towards the California Solar Initiative program goals.

The RPS program is one of the most ambitious renewable energy standards in the country. It requires investor-owned utilities to procure 20 percent of their electricity sales from renewable sources by 2010. Governor Schwarzenegger subsequently established an RPS target of 33 percent by 2020 for all retail sellers of electricity. The California Solar Initiative has a goal to install 3,000 MW of new customer solar projects by 2016, moving the state toward a cleaner energy future and helping lower the cost of solar systems for consumers.

###

EXHIBIT 7

Bill Powers

From: Don Wood [dwood8@cox.net]
Sent: Sunday, November 18, 2007 8:04 PM
To: dwood8@cox.net
Subject: Nov. 17 letter to SDUT on need for more local distributed generation

SAN DIEGO UNION TRIBUNE -- LETTERS

Generation of power outside SDG&E grid

11/17/07

Regarding "Power Links in Peril?" (A1, Nov. 13):

As interim vice chancellor for resource management and planning at the University of California San Diego, I would like to comment that the story made clear the importance of distributed generation and development of power separate from the SDG&E grid. Also clear is the need to work pro-actively and cooperatively with our neighbors.

During the wildfires, UC San Diego proved the importance of distributed generation in helping the region avoid rolling blackouts. In support of the San Diego community, the campus was able to reduce its imported power to zero and export up to 4.5 megawatts of power to support the SDG&E grid during the day. This 4.5 megawatts of electricity is enough to power 4,000 homes. When SDG&E was struggling with power challenges, the UCSD-distributed generation system was providing critical support for the region.

The benefits of distributed generation often go unnoticed until times of crisis. But efforts from UCSD and other sources prove the efficacy of this technology and its importance in San Diego's overall energy planning strategy. This technology should be properly incentivized to assure our regional energy "cul-de-sac" can meet the extremes we will undoubtedly face in this era of global climate change.

GARY C. MATTHEWS
San Diego

EXHIBIT 8

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

In the Matter of the Application of San Diego Gas & Electric Company (U 902-E) for a Certificate of Public Convenience and Necessity for the Sunrise Powerlink Transmission Project	Application 06-08-010 (Filed August 4, 2006)

PHASE II REPLY BRIEF OF POWERS ENGINEERING ON BEHALF OF BILL POWERS, P.E.

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Dated: June 13, 2008

SUMMARY

SDG&E's Phase II opening brief is a methodical exercise in mischaracterizing the record to support its pre-determined position that non-wire options are not an alternative to the Sunrise Powerlink. The figurative elephant in the room is the March 27, 2008 SCE commercial PV application and testimony.[1] SDG&E does not mention the SCE commercial PV program once in its opening brief. There is a good reason for this. The technical viability and cost-effectiveness of the proposed SCE PV program contradict virtually every point made by SDG&E in its opening brief in opposition to the large-scale use of PV in San Diego County as a major element of the two non-wire alternatives to the Sunrise Powerlink identified in the DEIR.

A second elephant in the room is the high cost and pre-commercial status of dish Stirling technology, and the imminent failure of SDG&E's dish Stirling contract. Without the dish Stirling project, there is no renewable energy justification for the Sunrise Powerlink.

This reply brief is organized in "statement and response" format. A specific statement from the SDG&E Phase II opening brief is provided followed by the Powers Engineering response. Powers Engineering provides responses to thirty-four statements in this reply brief.

[1] Ex. SD-115, Ex. SD-116.

1. **Mr. Powers wrote his Smart Energy Report on behalf of the "No Sunrise Team," not as an impartial analysis of how best to meet San Diego's energy needs. Moreover, Mr. Powers has never designed or constructed a PV system other than the 2 kW system on his home, he is not an electrical engineer. (p. 238)**

The DEIR prepared by the Commission lists two non-wire alternatives as superior to the Sunrise Powerlink. Using SDG&E's logic, the Commission is also a member of the "No Sunrise Team." Mr. Powers clarified the significance of this term at TR at 3918 ln 8-16:

> "THE WITNESS: So the No Sunrise Team are people who are working against Sunrise? The point I want to make there is that the San Diego Smart Energy Report is based on the California Energy Action Plan and the loading order. The fact that the Energy Action Plan and the loading order are -- are consistent with a No Transmission Alternative in San Diego should in no way take away from the validity of that approach."

SDG&E mischaracterizes Mr. Powers experience with power systems by focusing exclusively on PV systems. Mr. Powers has extensive experience in power system design, as described at TR at 3914 ln 4-11:

> "My statement is that I have experience designing a large number of power systems. I was on the design team for three 50 megawatt peaking turbines in San Diego, the 3.5 megawatt CHP Project at Children's Hospital in San Diego, and am the coauthor of two Electric Power Research Institute documents on emission-control systems and cooling systems for gas-turbine power plants."

2. **"Because Mr. Powers is proposing 920 MW of PV, *id.* at 7, the "renewable energy park" proposal apparently envisions up to 92 "parks" (if each "park" was 10 MW) to 920 "parks" (if each "park" was 1 MW)." (p. 240)**

SDG&E misunderstands the renewable energy park alternative. Mr. Powers does not suggest transmitting 920 MW generated in renewable energy parks on the rural 69 kV grid. The proposal is to substitute the 290 MW solar trough plant in Borrego Springs described in the DEIR with 290 MW of renewable energy parks at or near rural SDG&E substations.[2] SDG&E acknowledges that the existing rural 69 kV can move up to 324 MW without upgrades.[3] Therefore the existing rural 69 kV grid has the capability move 290 MW of power from renewable energy parks without upgrades.

---

[2] Ex Powers-1, p. 6.
[3] SDG&E Phase II rebuttal testimony, p. 5-21.

3. **Mr. Powers, however, admitted that he could not identify any "renewable energy parks" under development in San Diego County. (p. 241)**

SDG&E mischaracterizes Mr. Powers' position. Mr. Powers stated that SDG&E was almost certainly receiving bids to install a large amount of renewable energy park capacity (TR at 3916 ln 9-28):

> "Next question: So when you said in your testimony that renewable-energy parks were a concept, you meant just exactly that, that they are a hypothetical concept but they are not currently under development?
>
> Powers: The point I would like to make there is that SDG&E currently has a renewables solicitation open. They are to receive renewable proposals I think on April 28th of this year. I am -- it is highly likely that they will receive numerous proposals for the energy park-type system, a number of megawatts at substations, and that they will also receive proposals to put in a tremendous amount of PV into San Diego.
>
> The -- PG&E already has done two – contracted for two solar renewable parks at two substations. So my point here is that the fact that I do not have an explicit list does not mean that within a couple of weeks SDG&E may have a whole suite of specific proposals for exactly that."

4. **Third, Mr. Powers fails to show that such PV systems are cost-effective. (p. 241)**

Commercial PV is more cost-effective than dish Stirling, SDG&E's renewable energy justification for the Sunrise Powerlink. The CEC identifies an installed capital cost of approximately $6,000/kW for dish Stirling.[4] The gross installed cost of 900 MW of dish Stirling would be $5.4 billion.[5] In contrast, the gross installed cost of flat-plate PV stated in the SCE PV application to the Commission is less than $4,000/kW.[6] The gross cost of 900 MW of PV using the SCE cost would be less than $3.6 billion.

The economics overwhelmingly favor developing the estimated 4,600 MW of commercial building and commercial parking area PV potential in San Diego County before paying for a 500 kV transmission line to access higher cost dish Stirling solar power in Imperial County.[7]

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[4] RT at 3921 ln 3
[5] RT at 3921 ln 4
[6] Ex. SD-115. Average installed cost of PV is $3.5/watt DC (p. 13). DC to AC conversion factor is 0.9 (p. 1). Estimated AC output is $3.5/watt ÷ 0.9 = $3.85/watt ($3,850/kW).
[7] Ex. Powers-1, Attachment B, p. 48.

by the CEC) seeks to achieve 400 MW of solar electric capacity statewide. In the DEIR, Aspen estimates that the CEC will allocate 15% of the funding and goal to SDG&E's service territory, and thus, if achieved, would add 60 MW to SDG&E's target." Population growth in SDG&E service territory averaged 0.2 percent in the 2004-2006 timeframe.[21] Extrapolating from the 2004-2006 population growth trend, and assuming load growth is proportional to population growth, load could be expected to grow by 2 to 3 percent by 2020. Even if none of this load growth is equipped with PV, it will have little overall impact on Mr. Powers comparison due to the small amount of load growth.

14. **Mr. Powers testified: "Non-renewable distributed generation (DG) should substitute for the 620 MW combined-cycle plant in the In-Area All-Source alternative, as explained in detail in [the Smart Energy Report]." Mr. Powers, however, admitted that: "I cannot identify any specific CHP plants," and he is not aware of any CHP plants under development. (p. 246)**

SDG&E mischaracterizes Mr. Powers' position. Mr. Powers states (TR at 3917 at ln 19-26):

> "My response to that is that the combined-heat-and-power projects are being proposed on a continuous basis in the San Diego area. The -- I want to clarify that the fact that I did not put together a specific list of 80 or 100 CHP projects for -- as a substitute for a combined-cycle project somehow implies that there isn't a continuous stream of such proposals."

SDG&E cites in its Phase II rebuttal testimony (p. 5-38) an EPRI marketing study of additional CHP potential in SDG&E service territory of nearly 400 MW. EPRI found that "*A little over half would reject a project with a payback of 2 years.*" Two years is a very aggressive payback period. The CEC metric for cost-effective is a simple payback in ten years. A ten-year payback would greatly expand the cost-effective CHP potential in SDG&E service territory relative to the nearly 400 MW of additional CHP potential already identified in the EPRI CHP marketing study.[22]

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[21] Ex. Powers-1, Attachment B, p. D2.
[22] Powers Phase II opening brief, p. 24.

EXHIBIT 3

Hearing Research 268 (2010) 12–21

Hearing Research

Review Article

Responses of the ear to low frequency sounds, infrasound and wind turbines

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ABSTRACT

Infrasonic sounds are generated internally in the body (by respiration, heartbeat, coughing, etc) and by external sources, such as air conditioning systems, inside vehicles, some industrial processes and, now becoming increasingly prevalent, wind turbines. It is widely assumed that infrasound presented at an amplitude below what is audible has no influence on the ear. In this review, we consider possible ways that low frequency sounds, at levels that may or may not be heard, could influence the function of the ear. The inner ear has elaborate mechanisms to attenuate low frequency sound components before they are transmitted to the brain. The auditory portion of the ear, the cochlea, has two types of sensory cells, inner hair cells (IHC) and outer hair cells (OHC), of which the IHC are coupled to the afferent fibers that transmit "hearing" to the brain. The sensory stereocilia ("hairs") on the IHC are "fluid coupled" to mechanical stimuli, so their responses depend on stimulus velocity and their sensitivity decreases as sound frequency is lowered. In contrast, the OHC are directly coupled to mechanical stimuli, so their input remains greater than for IHC at low frequencies. At very low frequencies the OHC are stimulated by sounds at levels below those that are heard. Although the hair cells in other sensory structures such as the saccule may be tuned to infrasonic frequencies, auditory stimulus coupling to these structures is inefficient so that they are unlikely to be influenced by airborne infrasound. Structures that are involved in endolymph volume regulation are also known to be influenced by infrasound, but their sensitivity is also thought to be low. There are, however, abnormal states in which the ear becomes hypersensitive to infrasound. In most cases, the inner ear's responses to infrasound can be considered normal, but they could be associated with unfamiliar sensations or subtle changes in physiology. This raises the possibility that exposure to the infrasound component of wind turbine noise could influence the physiology of the ear.

1. Introduction

The increasing use of wind turbines as a "green" form of energy generation is an impressive technological achievement. Over time, there have been rapid increases in the size of the towers, blades, and generator capacity of wind turbines, as well as a dramatic increase in their numbers. Associated with the deployment of wind turbines, however, has been a rather unexpected development. Some people are very upset by the noise that some wind turbines produce. Wind turbine noise becomes annoying at substantially lower levels than other forms of transportation noise, with the exception of railroad shunting yards (Pedersen and Waye, 2004; Pedersen and Persson Waye, 2007; Pedersen et al., 2009). Some people with wind turbines located close to their homes have reported a variety of clinical symptoms that in rare cases are severe enough to force them to move away. These symptoms include sleep disturbance, headaches, difficulty concentrating, irritability and fatigue, but also include a number of otologic symptoms including dizziness or vertigo, tinnitus and the sensation of aural pain or pressure (Harry, 2007; Pierpont, 2009). The symptom group has been colloquially termed "wind turbine syndrome" and speculated to result from the low frequency sounds that wind turbines generate (Pierpont, 2009). Similar symptoms resulting from low frequency sound emissions from non-wind turbine sources have also been reported (Feldmann and Pitten, 2004).

On the other hand, engineers associated with the wind industry maintain that infrasound from wind turbines is of no consequence if it is below the audible threshold. The British Wind Energy Association (2010), states that sound from wind turbines are in the 30–50 dBA range, a level they correctly describe as difficult to discern above the rustling of trees [i.e. leaves].

This begs the question of why there is such an enormous discrepancy between subjective reactions to wind turbines and the measured sound levels. Many people live without problems near

Abbreviations: CA, cochlear aqueduct; CM, cochlear microphonic; CSF, cerebrospinal fluid; cVEMP, cervical vestibular evoked myogenic potential; EP, endocochlear potential; IHC, inner hair cell(s); oVEMP, ocular vestibular evoked myogenic potential; OHC, outer hair cell(s); RW, round window; ST, scala tympani; SV, scala vestibuli.

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noisy intersections, airports and factories where sound levels are higher. The answer may lie in the high infrasound component of the sound generated by wind turbines. A detailed review of the effects of low frequency noise on the body was provided by Leventhall (2009). Although it is widely believed that infrasound from wind turbines cannot affect the ear, this view fails to recognize the complex physiology that underlies the ear's response to low frequency sounds. This review considers the factors that influence how different components of the ear respond to low frequency stimulation and specifically whether different sensory cell types of the inner ear could be stimulated by infrasound at the levels typically experienced in the vicinity of wind turbines.

2. The physics of infrasound

Sounds represent fluctuating pressure changes superimposed on the normal ambient pressure, and can be defined by their spectral frequency components. Sounds with frequencies ranging from 20 Hz to 20 kHz represent those typically heard by humans and are designated as falling within the audible range. Sounds with frequencies below the audible range are termed infrasound. The boundary between the two is arbitrary and there is no physical distinction between infrasound and sounds in the audible range other than their frequency. Indeed, infrasound becomes perceptible if presented at high enough level.

The level of a sound is normally defined in terms of the magnitude of the pressure changes it represents, which can be measured and which does not depend on the frequency of the sound. In contrast, for sounds of constant pressure, the displacement of the medium is inversely proportional to frequency, with displacements increasing as frequency is reduced. This phenomenon can be observed as the difference in vibration amplitude between a subwoofer generating a low frequency tone and a tweeter generating a high frequency tone at the same pressure level. The speaker cone of the subwoofer is visibly displaced while the displacement of the tweeter cone is imperceptible. As a result of this phenomenon, vibration amplitudes to infrasound are larger than those to sounds in the auditory range at the same level, with displacements at 1 Hz being 1000 times those at 1 kHz when presented at the same pressure level. This corresponds to an increase in displacement at a rate of 6 dB/octave as frequency is lowered.

3. Overview of the anatomy of the ear

The auditory part of the inner ear, the cochlea, consists of a series of fluid-filled tubes, spiraling around the auditory nerve. A section through the middle of a human cochlea is shown in Fig. 1A. The anatomy of each turn is characterized by three fluid-filled spaces (Fig. 1B): scala tympani (ST) and scala vestibuli (SV) containing perilymph (yellow), separated by the endolymphatic space (ELS)(blue). The two perilymphatic compartments are connected together at the apex of the cochlea through an opening called the helicotrema. Perilymph is similar in ionic composition to most other extracellular fluids (high Na^+, low K^+) while endolymph has a unique composition for an extracellular fluid in the body, being

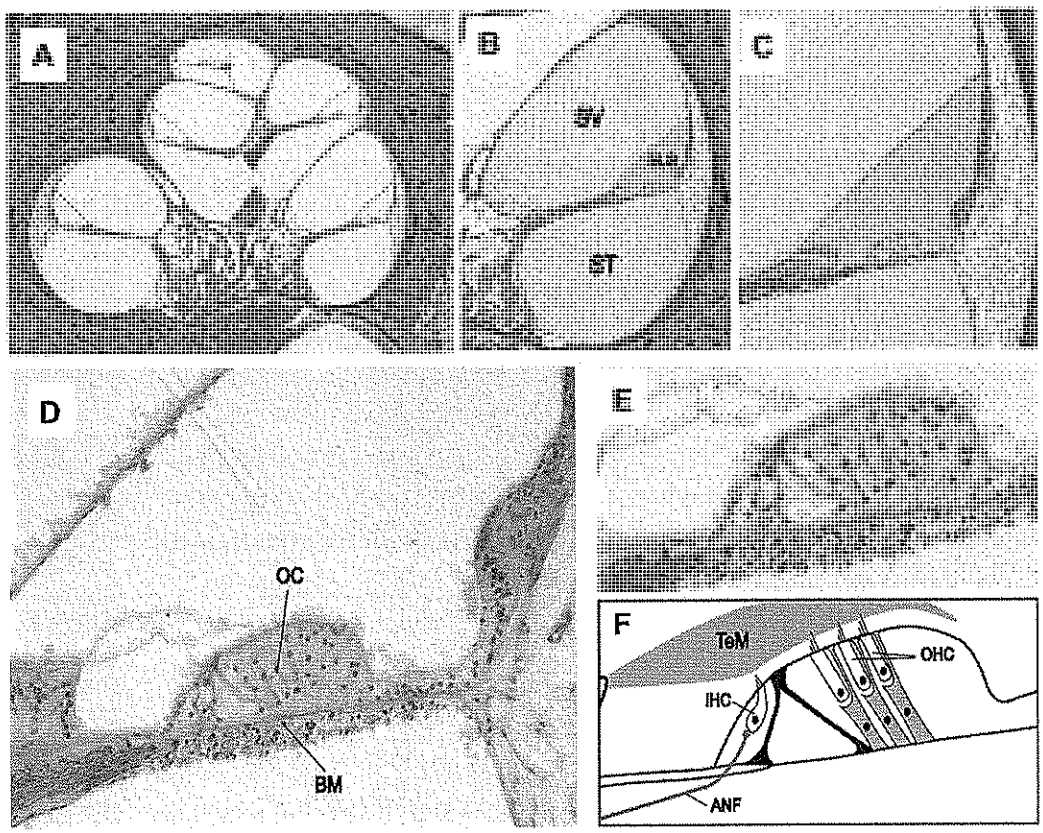

Fig. 1. Panels A–E Cross-section through the human cochlea shown with progressively increasing magnification. Panels B and C The fluid spaces containing perilymph have been colored yellow and endolymph blue. Panel D The sensory structure of the cochlea, the organ of Corti, is colored green. Panel F Schematic showing the anatomy of the main components of the organ of Corti. Abbreviations are: SV: scala vestibuli; ST: scala tympani; ELS: endolymphatic space; OC: organ of Corti; BM: basilar membrane; TeM: tectorial membrane; IHC: inner hair cell; OHC: outer hair cell; ANF: afferent nerve fiber. Original histological images courtesy of Saumil Merchant, MD, Otopathology Laboratory, Massachusetts Eye and Ear Infirmary and Harvard Medical School, Boston.

high in K^+ and low in both Na^+ and Ca^{2+}. It is also electrically polarized by about + 80 mV with respect to perilymph, which is called the endocochlear potential (EP). The main sensory organ of the cochlea (Fig. 1C–E, and shown colored green in Fig. 1D) lies on the basilar membrane between the ELS and the perilymph of ST and is called the organ of Corti. The organ of Corti, seen here in cross section, contains one row of inner hair cells (IHC) and three rows of outer hair cells (OHC) along the spiral length of the cochlea. As shown schematically in Fig. 1F, the sensory hairs (stereocilia) of the OHC have a gradation in length, with the tallest stereocilia embedded in the gelatinous tectorial membrane (TeM) which overlies the organ of Corti in the endolymphatic space (Kimura, 1975). This arrangement allows sound-evoked displacements of the organ of Corti to be converted to a lateral displacement of OHC stereocilia. In contrast, the stereocilia of the IHC do not contact the tectorial membrane, but remain within the fluid of the subtectorial space (Kimura, 1975; Lim, 1986). Because of this difference in how the hair cell stereocilia interact with the TeM, the two types of hair cell respond differently to mechanical stimuli. At low frequencies, the IHC respond according to the velocity of basilar membrane displacement, while OHC respond to the displacement itself (Russell and Sellick, 1983; Dallos, 1984).

The two types of hair cells also contact different types of afferent nerve fibers, sending information to the brain (Spoendlin, 1972; Santi and Tsuprun, 2001). Each IHC is innervated by multiple Type I afferent fibers, with each fiber innervating only a single IHC. The Type I afferents represent the vast majority (95%) of the fibers transmitting information to the brain and as a result it is generally believed that mammals hear with their IHC (Dallos, 2008). In contrast, the OHC contact Type II afferent fibers, which are unmyelinated and make synaptic contacts with a number of OHC. Type II afferents fibers are believed to be unresponsive to sounds and may signal the static position of the organ of Corti (Brown, 1994; Robertson et al., 1999). The OHC also receive substantial efferent innervation (from the brain) while the IHC receive no direct efferent innervation (Spoendlin, 1972).

4. Mechanics of low frequency stimulation

Infrasound entering the ear through the ossicular chain is likely to have a greater effect on the structures of the inner ear than is sound generated internally. The basic principles underlying stimulation of the inner ear by low frequency sounds are illustrated in Fig. 2. Panel A shows the compartments of a simplified, uncoiled cochlea bounded by solid walls with two parallel fluid spaces representing SV and ST respectively that are separated by a distensible membrane representing the basilar membrane and organ of Corti. It is generally agreed that the differential pressure between SV and ST across the basilar membrane is the important factor driving the motion of the basilar membrane (Von Békésy, 1960; Dancer and Franke, 1980; Nakajima et al., 2008; Merchant and Rosowski, 2008). In example A, all the boundaries of the inner ear are solid and noncompliant with the exception of the stapes. In this non-physiologic situation, the stapes applies pressures to SV (indicated by the red arrows) but as the fluid can be considered incompressible, pressures are instantaneously distributed throughout both fluid spaces and pressure gradients across the basilar membrane will be small. In panel B, the round window (RW) and the cochlear aqueduct (CA) have been added to the base of ST. For frequencies below 300 Hz the RW provides compliance between perilymph and the middle ear (Nakajima et al., 2008) and the CA provides fluid communication between perilymph and the cerebrospinal fluid (CSF). Under this condition, pressures applied by the stapes induce small volume flows between the stapes and

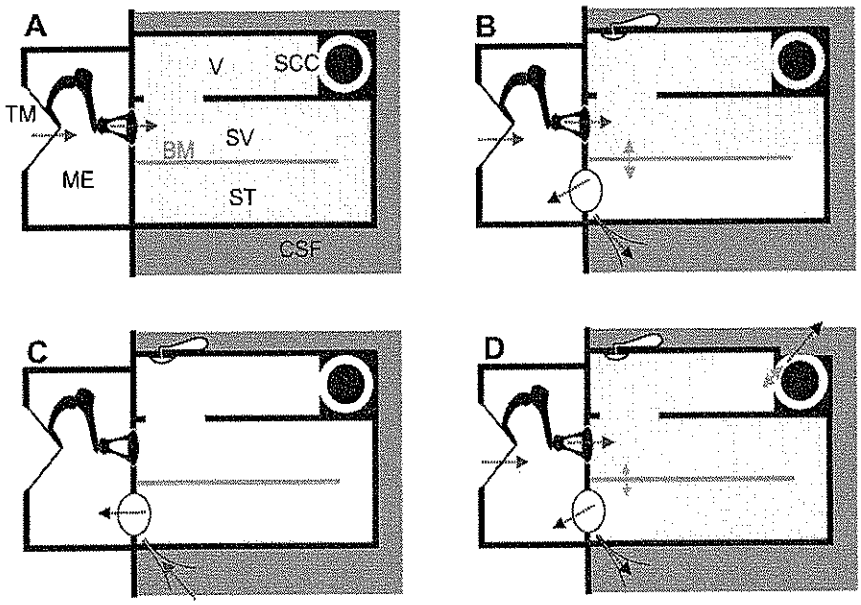

Fig. 2. Schematic representation of the uncoiled inner ear for four different mechanical conditions with low frequency stimulation. Red arrows indicate applied pressure and blue arrows indicate loss to compliant structures. A: indicates a hypothetical condition where the fluid space is rigidly bounded with no "windows" providing compliance. Sound pressure applied by the stapes causes uniform pressures (indicated by color shading) throughout the fluid space, so pressure difference across the basilar membrane and therefore stimulation is minimal. B: The normal situation with compliances provided by the round window and cochlear aqueduct at the base of scala tympani. Pressure differentials cause movement of fluid towards the compliant regions, including a pressure differential across the basilar membrane causing stimulation. C: Situation where low frequency enters scala tympani through the cochlear aqueduct. The main compliant structure is located nearby so pressure gradients across the basilar membrane are small, limiting the amount of stimulation. Infrasound entering through the cochlear aqueduct (such as from respiration and body movements) therefore does not provide the same degree of stimulation as that entering via the stapes. D: Situation with compromised otic capsule, such as superior canal dehiscence. As pressure gradients occur both along the cochlea and through the vestibule and semi-circular canal, the sensory structures in the semi-circular canal will be stimulated. Abbreviations: BM: basilar membrane; CA: cochlear aqueduct; CSF: cerebrospinal fluid; ES: endolymphatic duct and sac; ME: middle ear; RW: round window; SCC: semi-circular canal; ST: scala tympani, SV: scala vestibuli, TM: tympanic membrane; V: vestibule. The endolymphatic duct and sac is not an open pathway but is closed by the tissues of the sac, so it is not considered a significant compliance.

the site(s) of compliance (blue arrows) which requires a pressure gradient to exist along the system, as indicated by the shading. The pressure differential across the basilar membrane will displace it, causing stimulation of the IHC and OHC. This is the situation for external sounds entering the normal cochlea via the ossicular chain. In panel C the situation is compared for sounds originating in the CSF and entering the system through the CA. In this case, the compliant RW is situated close to the location of aqueduct entry, so the major fluid flows and pressure gradients occur locally between these structures. As the stapes and other boundaries in scala vestibuli and the vestibule are relatively noncompliant, pressure gradients across the basilar membrane will be lower than with an equivalent pressure applied by the stapes. For infrasonic frequencies, it was shown that responses to 1 Hz pressure oscillation applied to the fluid in the basal turn of ST were substantially increased when the wall of SV was perforated thereby providing greater compliance in that scala (Salt and DeMott, 1999).

The final condition in Fig. 2D shows the consequences of a "third window" on the SV/vestibule side of the cochlear partition. This causes an increased "air-bone gap" (i.e. an increase in sensitivity to bone conducted vibration and a decreased sensitivity to air conducted sounds, primarily at low frequencies; Merchant and Rosowski, 2008). It may also produce an abnormal sound-induced stimulation of other receptors in the inner ear, such as the hair cells in the ampulla of the semi-circular canal. This is the basis of the Tullio phenomenon, in which externally or internally generated sounds, such as voice, induce dizziness.

Receptors in other organs of the inner ear, specifically both the saccule and the utricle also respond to airborne sounds delivered by the stapes, as discussed in more detail below. The mechanism of hair cell stimulation of these organs is less certain, but is believed to be related to pressure gradients through the sensory epithelium (Sohmer, 2006).

5. Physiologic responses of the ear to low frequency stimuli

5.1. Cochlear hair cells

When airborne sounds enter the ear, to be transduced into an electrical signal by the cochlear hair cells, they are subjected to a number of mechanical and physiologic transformations, some of which vary systematically with frequency. The main processes involved were established in many studies and were summarized by Cheatham and Dallos (2001). A summary of the components is shown in Fig. 3. There are three major processes influencing the sensitivity of the ear to low frequencies. The first arises from the transmission characteristics of sounds through the ossicular structures of the middle ear, which have been shown to attenuate signals at a rate of 6 dB/octave for frequencies below 1000 Hz (Dallos, 1973). As the vibration amplitude in air increases at 6 dB/octave as frequency is lowered, this attenuation characteristic of middle ear transmission results in the displacement of middle ear structures remaining almost constant across frequency for sounds of constant pressure level. A second process attenuating low frequency sounds is the fluid shunting between ST and SV through the helicotrema. The helicotrema has been shown to attenuate frequencies below 100 Hz by 6 dB/octave (Dallos, 1970). The third filter arises from the demonstrated dependence of the IHC on stimulus velocity, rather than displacement (Dallos, 1984). This results in an attenuation of 6 dB/octave for frequencies below approximately 470 Hz for the IHC, and causes a 90° phase difference between IHC and OHC responses (Dallos, 1984). The combined results of these processes are compared with the measured sensitivity of human hearing (ISO226, 2003) in Fig. 3B. The three processes combine to produce the steep decline of sensitivity (up to

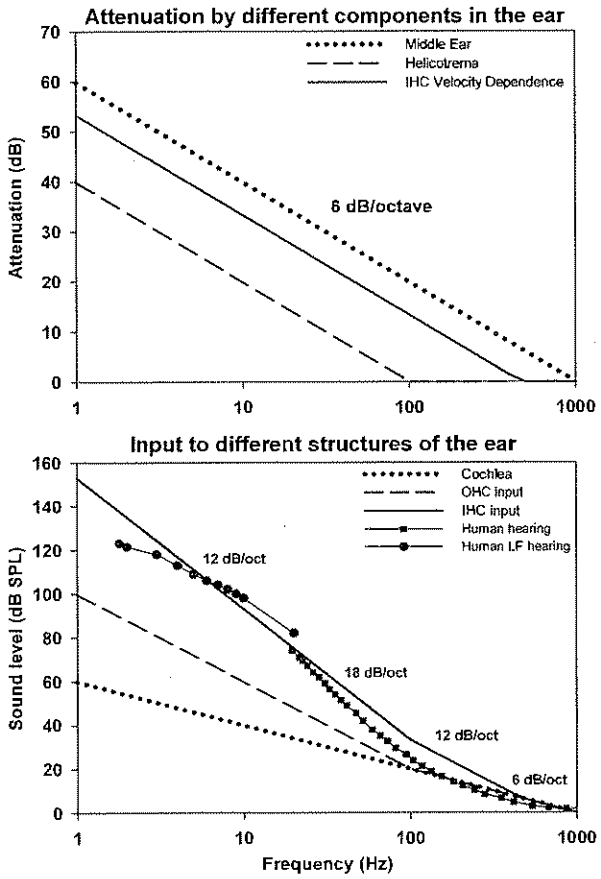

Fig. 3. Upper panel: Estimated properties of high-pass filter functions associated with cochlear signal processing (based on Cheatham and Dallos, 2001). The curves show the low frequency attenuation provided by the middle ear (6 dB/octave below 1000 Hz), by the helicotrema (6 dB/octave below 100 Hz) and by the fluid coupling of the inner hair cells (IHC) resulting in the IHC dependence on stimulus velocity (6 dB/Octave below 470 Hz). Lower panel: Combination of the three processes above into threshold curves demonstrating: input to the cochlea (dotted) as a result of middle ear attenuation; input to the outer hair cells (OHC) as a result of additional filtering by the helicotrema; and input to the IHC as a result of their velocity dependence. Shown for comparison is the sensitivity of human hearing in the audible range (ISO226, 2003) and the sensitivity of humans to infrasounds (Møller and Pederson, 2004). The summed filter functions account for the steep (18 dB/octave) decrease in sensitivity below 100 Hz.

18 dB/octave) in human hearing for frequencies between 100 and 20 Hz. This steep cutoff means that to hear a stimulus at 5 Hz it must be presented at 105 dB higher level than one at 500 Hz. This reflects the fact that the predominant, type I afferent fibers are stimulated by the IHC and that mammals hear with their IHC (Dallos, 2008). However, an important consequence of this underlying mechanism is that the OHC and IHC differ markedly in their responses to low frequency stimuli. As the OHC respond to displacement, rather than velocity, they are not subject to the 6 dB/octave attenuation seen by IHC, so at low frequencies they are stimulated by lower sound levels than the IHC. In theory, the difference between IHC and OHC responses will increase as frequency decreases (becoming over 50 dB at 1 Hz), but in practice, there is interaction between the two types of hair cells which limits the difference as discussed below.

The measured response phase of OHC, IHC and auditory nerve fibers is consistent with the above processes. The cochlear microphonics (CM) recorded in the organ of Corti with low frequency stimuli are in phase with the intracellular potentials of the OHC. This supports the view that the low frequency CM is dominated by

OHC-generated potentials, which follow the displacement of the basilar membrane (Dallos et al., 1972). In contrast, intracellular responses from the IHC lead the organ of Corti CM response by an amount which approaches 90° as frequency is reduced to 100 Hz (Dallos, 1984) corresponding to maximal basilar membrane velocity towards SV (Nuttall et al., 1981). As frequency is lowered, the intracellular potentials of IHC and afferent fiber responses show phase changes consistent with the IHC no longer responding to the increasingly attenuated velocity stimulus, but instead responding to the extracellular potentials generated by the OHC (Sellick et al., 1982; Cheatham and Dallos, 1997). A similar change of phase as frequency is lowered was reported in human psychophysical measurements (Zwicker, 1977) with masking patterns differing by approximately 90° for frequencies above and below 40 Hz. This transition from a response originating from mechanical stimulation of the IHC, to one originating from electrical stimulation of the IHC by large extracellular responses from the OHC may account for the transition of low frequency sensitivity in humans from 18 dB/octave above 20 Hz to 12 dB/octave below 10 Hz (Møller and Pederson, 2004) (Fig. 3B). Near 10 Hz the IHC transition to become primarily stimulated by the more sensitive OHC responses. It can be inferred that if extracellular voltages generated by the OHC are large enough to electrically stimulate the IHC at a specific frequency and level, then the lowest level that the OHC respond to at that frequency must be substantially lower. Based on this understanding of how the sensitivity of the ear arises, one conclusion is that at low frequencies the OHC are responding to infrasound at levels well below those that are heard. On the basis of the calculated input to OHC in Fig. 3B, it is possible that for frequencies around 5 Hz, the OHC could be stimulated at levels up to 40 dB *below* those that stimulate the IHC. Although the OHC at 1 kHz are approximately 12 dB less sensitive than IHC (Dallos, 1984), this difference declines as frequency is lowered and differences in hair cell sensitivity at very low frequencies (below 200 Hz) have not been measured.

Much of the work understanding how the ear responds to low frequency sounds is based on measurements performed in animals. Although low frequency hearing sensitivity depends on many factors including the mechanical properties of the middle ear, low frequency hearing sensitivity has been shown to be correlated with cochlear length for many species with non-specialized cochleas, including humans and guinea pigs (West, 1985; Echteler et al., 1994). The thresholds of guinea pig hearing have been measured with stimulus frequencies as low as 50 Hz, as shown in Fig. 4A. The average sensitivity at 125 Hz for five groups in four studies (Heffner et al., 1971; Miller and Murray, 1966; Walloch and Taylor-Spikes, 1976; Prosen et al., 1978; Fay, 1988) was 37.9 dB SPL, which is 17.6 dB less sensitive than the human at the same frequency and is consistent with the shorter cochlea of guinea pigs. In the absence of data to the contrary, it is therefore reasonable to assume that if low frequency responses are present in the guinea pig at a specific level, then they will be present in the human at a similar or lower stimulus level.

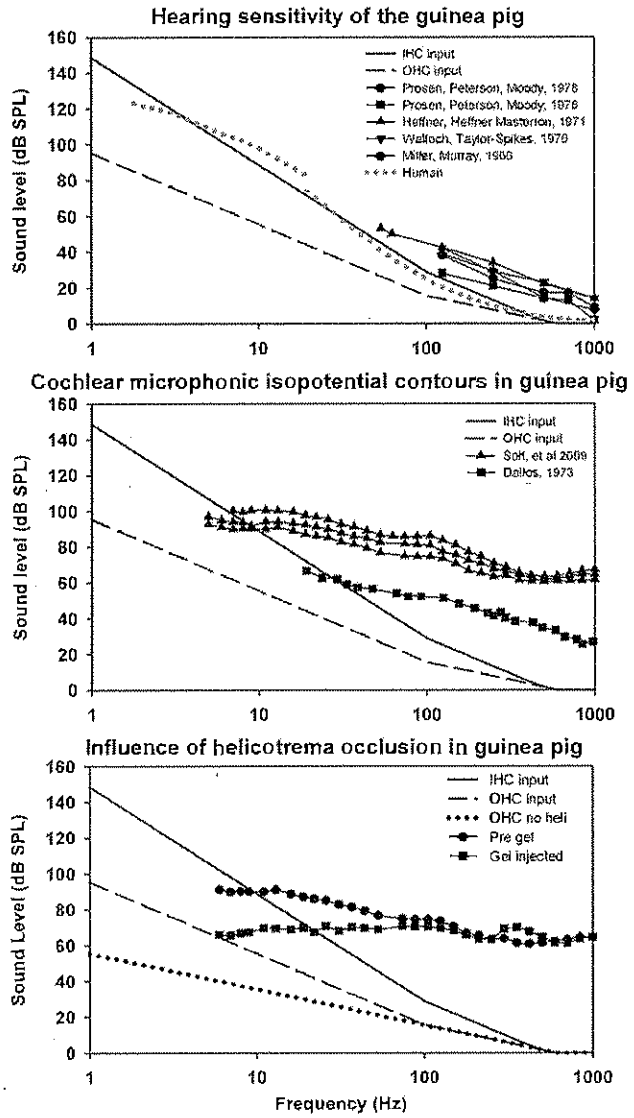

Fig. 4. Upper panel: Similar filter functions as Fig. 3, with parameters appropriate for the guinea pig, and compared with measures of guinea pig hearing. At 125 Hz the guinea pig is approximately 18 dB less sensitive than the human (shown dotted for comparison). Middle panel: Cochlear microphonic isopotential contours in the guinea pig show no steep cutoff below 100 Hz, consistent with input to the OHC being maintained at lower levels than the IHC for low frequencies. Lower panel: Influence of helicotrema occlusion in the guinea pig, produced by injecting 2 μL of hyaluronate gel into the cochlear apex, on the CM isopotential function. Also shown for comparison is the estimated input sensitivity for the OHC with the attenuation by the helicotrema excluded. CM sensitivity curves both have lower slopes than their predicted functions, but the change caused by helicotrema occlusion is comparable.

5.2. Cochlear microphonic measurements

Cochlear microphonics (CM) to low frequency tones originate primarily from the OHC (Dallos et al., 1972; Dallos and Cheatham, 1976). The sensitivity of CM as frequency is varied is typically shown by CM isopotential contours, made by tracking a specified CM amplitude as frequency is varied. Fig. 4B shows low frequency CM sensitivity with two different criteria (Dallos, 1973: 3 μV; Salt et al., 2009: 500 μV). The decrease in CM sensitivity as frequency is lowered notably follows a far lower slope than that of human hearing over the comparable frequency range. In the data from Salt et al. (2009), the stimulus level differences between 5 Hz and 500 Hz average only 34 dB (5.2 dB/octave), compared to the 105 dB difference (15.8 dB/octave) for human hearing over the same range. Although these are suprathreshold, extracellular responses, based on an arbitrary amplitude criterion, these findings are consistent with the OHC having a lower rate of cutoff with frequency than the IHC, and therefore responding to lower level stimuli at very low frequencies.

The measured change in CM sensitivity with frequency may include other components, such as a contribution from transducer adaptation at the level of the OHC stereocilia (Kros, 1996). Kennedy et al. (2003) have suggested that adaptation of the mechano-electrical transducer channels is common to all hair cells and contributes to driving active motion of the hair cell bundle. Based

on their measurements in cells isolated from the apical turns of neonatal rats, they estimated that the adaptation caused high-pass filtering with a low frequency cutoff frequency of 2/3 of the best frequency for the cochlear location. This type of adaptation, however, does not appear to provide additional attenuation at very low frequencies, as inferred from CM sensitivity curves measured down to 5 Hz. On the contrary, the CM sensitivity curve appears to flatten below 10 Hz, a phenomenon which is currently under investigation in our laboratory.

Fig. 4C shows the influence of plugging the helicotrema with gel on CM sensitivity with frequency, recorded from the basal turn of a guinea pig with a 500 μV criterion (Salt et al., 2009). These relative sensitivity changes, combined with a 90° phase shift in responses, replicate those of Franke and Dancer (1982) and demonstrate the contribution to attenuation provided by the helicotrema for frequencies below approximately 100 Hz. This contrasts with a prior suggestion that the helicotrema of the guinea pig was less effective than that of other species (Dallos, 1970). While the above CM measurements were made with the bulla open, measurements made in both the bulla open/closed conditions with closed sound-field stimulation suggest there is no pronounced frequency dependence of the difference between these conditions below 300 Hz although there may be a level difference of 5–15 dB (Dallos, 1973; Wilson and Johnstone, 1975).

5.3. Low frequency biasing, operating point, and distortion generation

As a result of the saturating, nonlinear transducer characteristic of cochlear hair cells (Russell and Sellick, 1983; Kros, 1996), the fidelity of cochlear transduction depends highly on the so-called operating point of the cochlear transducer, which can be derived by Boltzmann analysis of the CM waveform (Patuzzi and Moleirinho, 1998; Patuzzi and O'Beirne, 1999). The operating point can be regarded as the resting position of the organ of Corti or its position during zero crossings of an applied stimulus (which may not be identical, as stimulation can itself influence operating point). Small displacements of operating point have a dramatic influence on even-order distortions generated by the cochlea ($2f$, f_2-f_1) while having little influence on odd-order distortions ($3f$, $2f_1-f_2$) until displacements are large (Frank and Kössl, 1996; Sirjani et al., 2004). Low frequency sounds (so-called bias tones) have been shown to modulate distortion generated by the ear by their displacement of the operating point of the organ of Corti (Brown et al., 2009). In normal guinea pigs, 4.8 Hz bias tones at levels of 85 dB SPL have been shown to modulate measures of operating point derived from an analysis of CM waveforms (Brown et al., 2009; Salt et al., 2009). This is a level that is substantially below the expected hearing threshold of the guinea pig at 4.8 Hz. In animals where the helicotremea was occluded by injection of gel into the perilymphatic space at the cochlear apex, even lower bias levels (down to 60 dB SPL) modulate operating point measures (Salt et al., 2009). These findings are again consistent with the OHC being the origin of the signals measured and the OHC being more responsive to low frequency sounds than the IHC. A similar hypersensitivity to 4.8 Hz bias tones was also found in animals with surgically-induced endolymphatic hydrops (Salt et al., 2009). This was thought to be related to the occlusion of the helicotrema by the displaced membranous structures bounding the hydropic endolymphatic space in the apical turn. In some cases of severe hydrops, Reissner's membrane was seen to herniate into ST. As endolymphatic hydrops is present both in patients with Meniere's disease and in a significant number of asymptomatic patients (Merchant et al., 2005), the possibility exists that some individuals may be more sensitive to infrasound due the presence of endolymphatic hydrops.

In the human ear, most studies have focused on the $2f_1-f_2$ distortion product, as even-order distortions are difficult to record in humans. The $2f_1-f_2$ component has been demonstrated to be less sensitive to operating point change (Sirjani et al., 2004; Brown et al., 2009). Using different criteria of bias-induced distortion modulation, the dependence on bias frequency was systematically studied in humans for frequencies down to 25 Hz, 6 Hz and 15 Hz respectively (Bian and Scherrer, 2007; Hensel et al., 2007; Marquardt et al., 2007). In each of these studies, the bias levels required were above those that are heard by humans, but in all of them the change of sensitivity with frequency followed a substantially lower slope than the hearing sensitivity change as shown in Fig. 5. Again this may reflect the OHC origins of acoustic emissions, possibly combined with the processes responsible for the flattening of equal loudness contours for higher level stimuli, since the acoustic emissions methods are using probe stimuli considerably above threshold. Although in some regions, slopes of 9–12 dB/octave were found, all showed slopes of 6 dB/octave around the 20 Hz region where human hearing falls most steeply at 18 dB/octave. It should also be emphasized that each of these studies selected a robust modulation criterion and was not specifically directed at establishing a threshold for the modulation response at each frequency. Indeed, in the data of Bian and Scherrer (2007) (their Fig. 3), significant modulation can be seen at levels down to 80 dB SPL at some of the test frequencies. In one of the studies (Marquardt et al., 2007) equivalent measurements were performed in guinea pigs. Although somewhat lower slopes were observed in guinea pigs it is remarkable that stimulus levels required for modulation of distortion were within 5–10 dB of each other for guinea pigs and humans across most of the frequency range. In this case the guinea pig required lower levels than the human. Although the threshold of sensitivity cannot be established from these studies, it is worth noting that for distortion product measurements in the audible range, "thresholds" typically require stimulus levels in the 35–45 dB SPL range (Lonsbury-Martin et al., 1990). In the Marquardt study, the bias tone level required at 500 Hz is over 60 dB above hearing threshold at that frequency.

5.4. Feedback mechanisms stabilizing operating point

The OHC not only transduce mechanical stimuli to electrical responses, but also respond mechanically to electrical stimulation

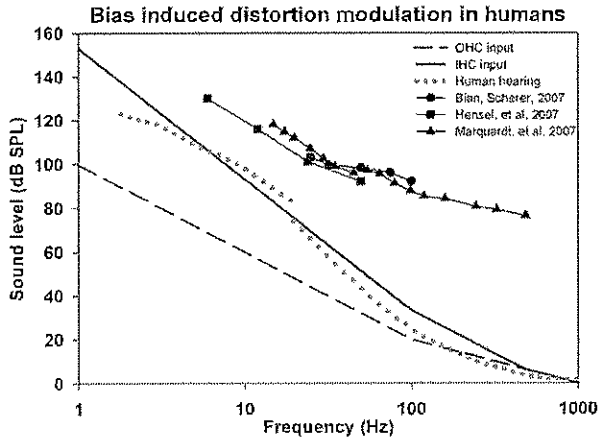

Fig. 5. Frequency dependence of low frequency bias-induced modulation of the $2f_1-f_2$ distortion product measured in the external ear canal of humans in three studies, compared with estimated input functions and human hearing sensitivity. Below 100 Hz the sensitivity to bias falls off at a much lower slope than human hearing, consistent with the response originating from OHC with a lower cutoff slope.

(reviewed by Dallos, 2008) in a manner that provides mechanical amplification. This "active tuning" primarily enhances responses to high stimulus frequencies and is thought to provide little or no active gain with stimuli below approximately 1 kHz (Sellick et al., 2006). For low frequency stimulation, however, basilar membrane modulation by the low frequency tone does have a major influence on the mechanics at the best frequency of high frequency tones i.e. on the active tuning process (Patuzzi et al., 1984). It has been suggested that slow mechanical movements of the OHC may play a part in stabilizing the operating point of the transducer (LePage, 1987, 1989) so the OHC may participate in an active cancellation of low frequency sounds. In models of the cochlear transducer, it was proposed that negative feedback occurred at low frequencies (in which the OHC opposed movements of the basilar membrane), which becomes a positive feedback at the best frequency for the region (Mountain et al., 1983). Chan and Hudspeth (2005) have also suggested OHC motility may be exploited to maintain the operating point of a fast amplifier in the hair cell bundle. However, this possibility has recently been questioned by Dallos (Ashmore et al., 2010) for a number of reasons, one of which is the somatic motor protein, prestin, has an extremely fast response capability. So the interrelationships between hair cell motility and transduction, and between OHC and IHC remain an intense focus of current research. For low frequencies, it has been shown that an out-of phase motion exists between the IHC reticular lamina and the overlying TM so that electromechanical action of the OHC may stimulate the IHC directly, without involvement of the basilar membrane (Nowotny and Gummer, 2006). The possible roles of the OHC and efferent systems are made more complex by recent findings of reciprocal synapses between OHC and their efferent terminals, seen as afferent and efferent synapses on the same fiber (Thiers et al., 2008). One explanation for this system is that the synapses may locally (without involvement of the central nervous system) coordinate the responses of the OHC population so that optimum operating point is maintained for high frequency transduction.

There is some evidence for active regulation of operating point based on the biasing of acoustic emission amplitudes by low frequency tones in which a "hysteresis" was observed (Bian et al., 2004). The hysteresis was thought to result from active motor elements, either in the stereocilia or the lateral wall of the OHC, shifting the transducer function in the direction of the bias. A similar hysteresis was also reported by Lukashkin and Russell (2005) who proposed that a feedback loop was present during the bias that keeps the operating point at its most sensitive region, shifting it in opposite directions during compression and rarefaction phase of the bias tone thereby partially counteracting its effects.

If there are systems in the cochlea to control operating point as an integral component of the amplification process, they would undoubtedly be stimulated in the presence of external infrasound.

5.5. Vestibular function

The otolith organs, comprising of the saccule and utricle, respond to linear accelerations of the head (Uzun-Coruhlu et al., 2007) and the semi-circular canals respond to angular acceleration. These receptors contribute to the maintenance of balance and equilibrium. In contrast to the hair cells of the cochlea, the hair cells of the vestibular organs are tuned to very low frequencies, typically below 30 Hz (Grossman et al., 1988). Frequency tuning in vestibular hair cells results from the electrochemical properties of the cell membranes (Manley, 2000; Art and Fettiplace, 1987) and may also involve active mechanical amplification of their stereociliary input (Hudspeth, 2008; Rabbitt et al., 2010). Although vestibular hair cells are maximally sensitive to low frequencies they typically do not respond to airborne infrasound. Rather, they normally respond to mechanical inputs resulting from head movements and positional changes with their output controlling muscle reflexes to maintain posture and eye position. At the level of the hair cell stereocilia, although vibrations originating from head movements and low frequency sound would be indistinguishable, the difference in sensitivity lies in the coupling between the source stimulus and the hair cell bundle. Head movements are efficiently coupled to the hair cell bundle, while acoustic stimuli are inefficiently coupled due to middle ear characteristics and the limited pressure gradients induced within the structure with sound stimuli (Sohmer, 2006).

In a similar manner to cochlear hair cells, which respond passively (i.e. without active amplification) to stimuli outside their best frequency range, vestibular hair cells respond passively to stimuli outside their best frequency range. The otolith organs have been shown to respond to higher, acoustic frequencies delivered in the form of airborne sounds or vibration. This has been demonstrated in afferent nerve fiber recordings from vestibular nerves (Young et al., 1977; McCue and Guinan, 1994; Curthoys et al., 2006) and has recently gained popularity as a clinical test of otolith function in the form of vestibular evoked myogenic potential (VEMP) testing (Todd et al., 2003; Zhou and Cox, 2004; Curthoys, 2010).These responses arise because higher frequency stimuli are more effectively coupled to the otolithic hair cells. But as sound or vibration frequency is reduced, its ability to stimulate the vestibular organs diminishes (Murofushi et al., 1999; Hullar et al., 2005; Todd et al., 2008). So for very low frequencies, even though the hair cell sensitivity is increasing as active tuning is invoked, mechanical input is being attenuated. While there have been many studies of vestibular responses to physiologic stimuli (i.e. head accelerations, rotations, etc) comprising of infrasonic frequency components, we are unaware of any studies that have directly investigated vestibular responses to airborne infrasound of similar frequency composition. As people do not become unsteady and the visual field does not blur when exposed to high-level infrasound, it can be concluded that sensitivity is extremely low.

In some pathologic conditions, coupling of external infrasound may be greater. It is known that "third window" defects, such as superior canal dehiscence increase the sensitivity of labyrinthine receptors to sounds (Wit et al., 1985; Watson et al., 2000; Carey et al., 2004), and are exhibited as the Tullio phenomenon (see earlier section). To our knowledge, the sensitivity of such patients to controlled levels of infrasound has never been evaluated. In this respect, it needs to be considered that vestibular responses to stimulation could occur at levels below those that are perceptible to the patient (Todd et al., 2008).

5.6. Inner ear fluids changes

Some aspects of cochlear fluids homeostasis have been shown to be sensitive to low frequency pressure fluctuations in the ear. The endolymphatic sinus is a small structure between the saccule and the endolymphatic duct which has been implicated as playing a pivotal role in endolymph volume regulation (Salt, 2005). The sinus has been shown to act as a valve, limiting the volume of endolymph driven into the endolymphatic sac by pressure differences across the endolymphatic duct (Salt and Rask-Andersen, 2004). The entrance of saccular endolymph into the endolymphatic sac can be detected either by measuring the K^+ concentration in the sac (as saccular endolymph has substantially higher K^+ concentration) or by measuring hydrostatic pressure. The application of a sustained pressure to the vestibule did not cause K^+ elevation or pressure increase in the sac, confirming that under this condition, flow was prevented by the membrane of the sinus acting as a valve. In contrast, the application of 5 cycles at 0.3 Hz to the

external ear canal, caused a K^+ increase in the sac, confirming that oscillation of pressure applied to the sinus allowed pulses of endolymph to be driven from the sinus into the endolymphatic sac. The pressure changes driving these pulses was large, comparable to those produced by contractions of the tensor tympani muscle, as occurs during swallowing. Tensor tympani contractions produce displacements of the stapes towards the vestibule for a duration of approximately 0.5 s (~2 Hz), which induce large EP changes and longitudinal movements of endolymph within the cochlea (Salt and DeMott, 1999). The lowest sound level that drives endolymph movements is currently unknown.

A therapeutic device (the Meniett: www.meniett.com; Odkvist et al., 2000) that delivers infrasound to the inner ear is widely used to treat Meniere's disease in humans (a disease characterized by endolymphatic hydrops). The infrasonic stimulus (6 Hz or 9 Hz) is delivered by the device in conjunction with sustained positive pressure in the external canal. An important aspect of this therapy, however, is that a tympanostomy tube is placed in the tympanic membrane before the device is used. The tympanostomy tube provides an open perforation of the tympanic membrane which shunts pressure across the structure, so that ossicular movements (and cochlear stimulation) are minimized, and the pressures are applied directly to the round window membrane. Nevertheless, the therapeutic value of this device is based on infrasound stimulation influencing endolymph volume regulation in the ear.

As presented above, endolymphatic hydrops, by occluding the perilymph communication pathway through the helicotrema, makes the ear more sensitive to infrasound (Salt et al., 2009). It has also been shown that non-damaging low frequency sounds in the acoustic range may themselves cause a transient endolymphatic hydrops (Flock and Flock, 2000; Salt, 2004). The mechanism underlying this volume change has not been established and it has never been tested whether stimuli in the infrasound range cause endolymphatic hydrops.

Although infrasound at high levels apparently does not cause direct mechanical damage to the ear (Westin, 1975; Jauchem and Cook, 2007) in animal studies it has been found to exacerbate functional and hair cell losses resulting from high level exposures of sounds in the audible range (Harding et al., 2007). This was explained as possibly resulting from increased mixture of endolymph and perilymph around noise induced lesion sites in the presence of infrasound.

6. Wind turbine noise

Demonstrating an accurate frequency spectrum of the sound generated by wind turbines creates a number of technical problems. One major factor that makes understanding the effects of wind turbine noise on the ear more difficult is the widespread use of A-weighting to document sound levels. A-weighting shapes the measured spectrum according to the sensitivity of human hearing, corresponding to the IHC responses. As we know the sensitivity for many other elements of inner ear related to the OHC do not decline at the steep slope seen for human hearing, then A-weighting considerably underestimates the likely influence of wind turbine noise on the ear. In this respect, it is notable that in none of the physiological studies in the extensive literature reporting cochlear function at low frequencies were the sound stimuli A-weighted. This is because scientists in these fields realize that shaping sound levels according to what the brain perceives is not relevant to understanding peripheral processes in the ear. A-weighting is also performed for technical reasons, because measuring unweighted spectra of wind turbine noise is technically challenging and suitable instrumentation is not widely available. Most common approaches to document noise levels (conventional sound level meters, video cameras, devices using moving coil microphones, etc) are typically insensitive to the infrasound component. Using appropriate instrumentation, Van den Berg showed that wind turbine noise was dominated by infrasound components, with energy increasing between 1000 Hz and 1 Hz (the lowest frequency that was measured) at a rate of approximately 5.5 dB/octave, reaching levels of approximately 90 dB SPL near 1 Hz Sugimoto et al. (2008) reported a dominant spectral peak at 2 Hz with levels monitored over time reaching up to 100 dB SPL. Jung and Cheung (2008) reported a major peak near 1 Hz at a level of approximately 97 dB SPL. In most studies of wind turbine noise, this high level, low frequency noise is dismissed on the basis that the sound is not perceptible. This fails to take into account the fact that the OHC are stimulated at levels that are not heard.

7. Conclusions

The fact that some inner ear components (such as the OHC) may respond to infrasound at the frequencies and levels generated by wind turbines does not necessarily mean that they will be perceived or disturb function in any way. On the contrary though, if infrasound is affecting cells and structures at levels that cannot be heard this leads to the possibility that wind turbine noise could be influencing function or causing unfamiliar sensations. Long-term stimulation of position-stabilizing or fluid homeostasis systems could result in changes that disturb the individual in some way that remains to be established. We realize that some individuals (such as fighter pilots) can be exposed to far higher levels of infrasound without undue adverse effects. In this review, we have confined our discussion to the possible direct influence of infrasound on the body mediated by receptors or homeostatic processes in the inner ear. This does not exclude the possibility that other receptor systems, elsewhere in the body could contribute to the symptoms of some individuals.

The main points of our analysis can be summarized as follows:

1) Hearing perception, mediated by the inner hair cells of the cochlea, is remarkably insensitive to infrasound.
2) Other sensory cells or structures in the inner ear, such as the outer hair cells, are more sensitive to infrasound than the inner hair cells and can be stimulated by low frequency sounds at levels below those that are heard. The concept that an infrasonic sound that cannot be heard can have no influence on inner ear physiology is incorrect.
3) Under some clinical conditions, such as Meniere's disease, superior canal dehiscence, or even asymptomatic cases of endolymphatic hydrops, individuals may be hypersensitive to infrasound.
4) A-weighting wind turbine sounds underestimates the likely influence of the sound on the ear. A greater effort should be made to document the infrasound component of wind turbine sounds under different conditions.
5) Based on our understanding of how low frequency sound is processed in the ear, and on reports indicating that wind turbine noise causes greater annoyance than other sounds of similar level and affects the quality of life in sensitive individuals, there is an urgent need for more research directly addressing the physiologic consequences of long-term, low level infrasound exposures on humans.

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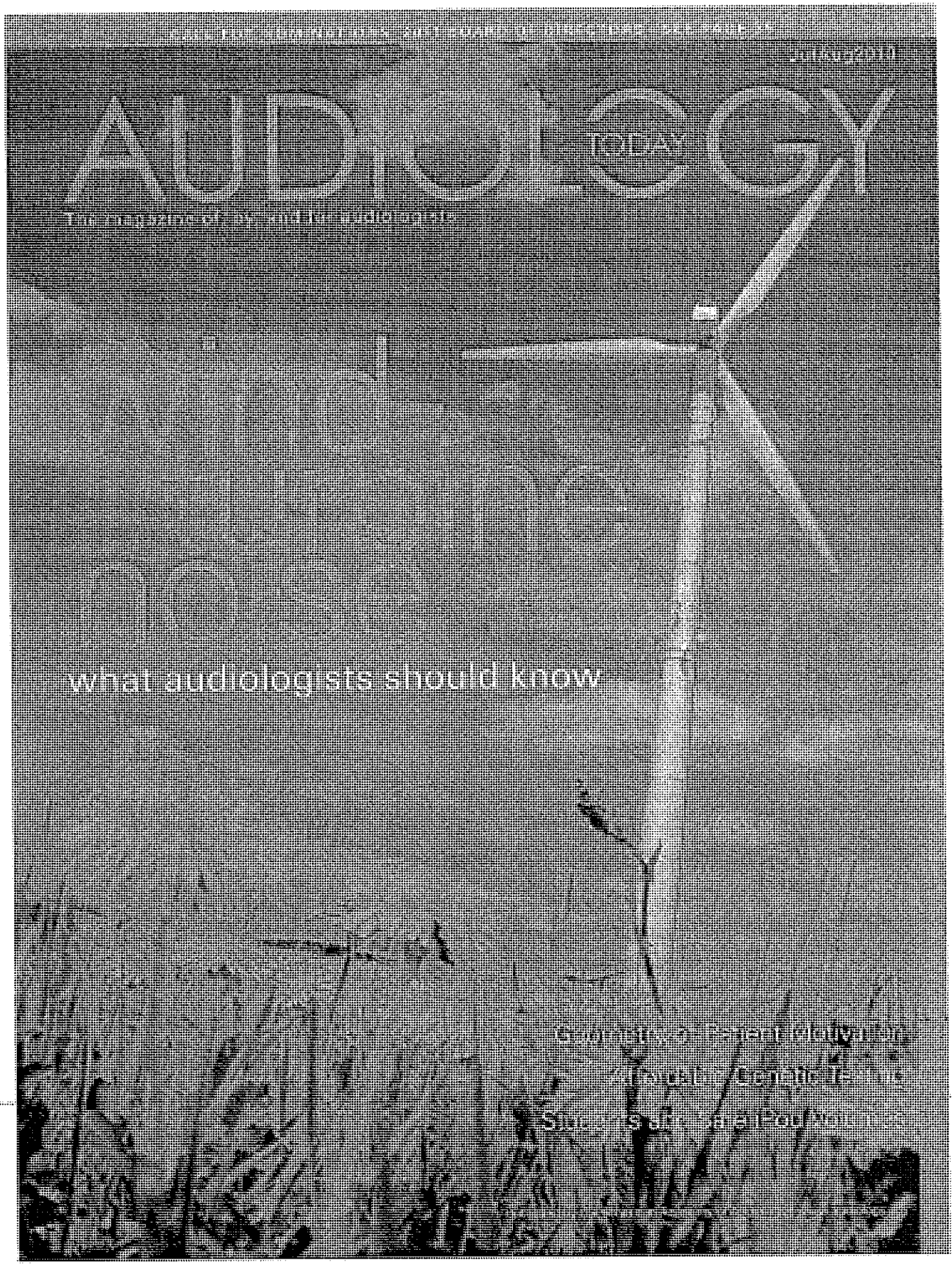
EXHIBIT 4


TODAY
what audiologists should know

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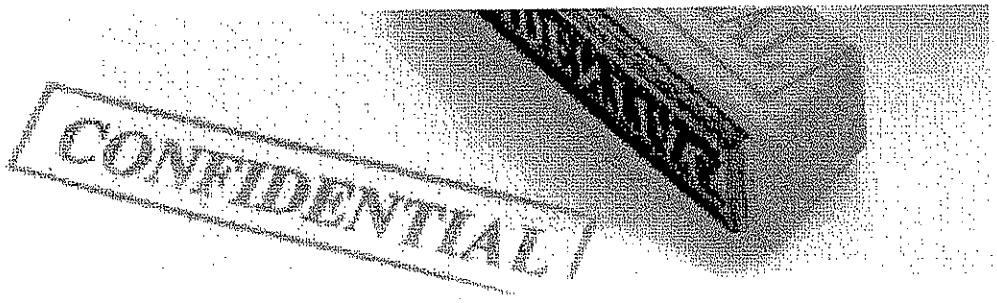
DEPARTMENTS



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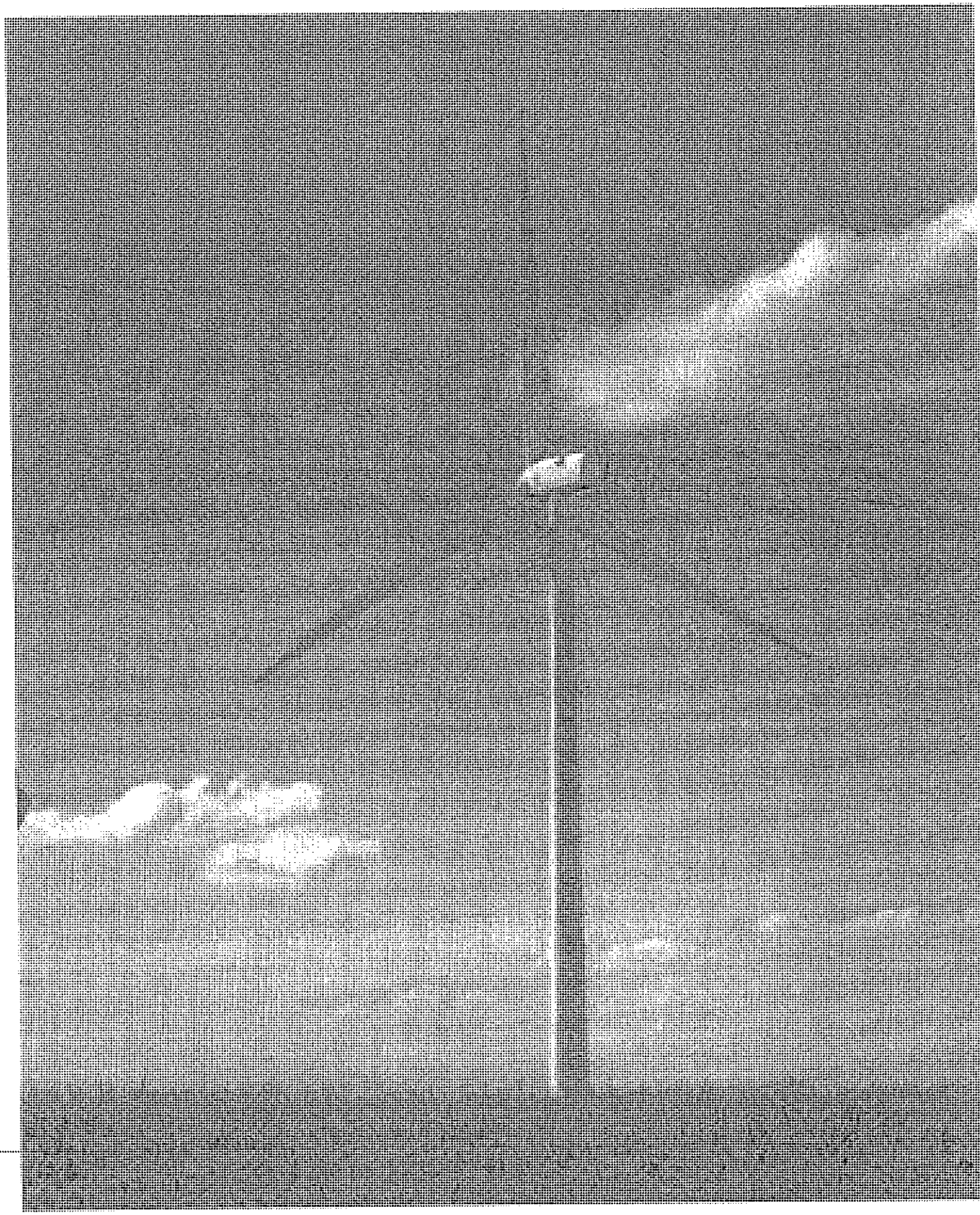
Wind-Turbine NOISE

What Audiologists Should Know

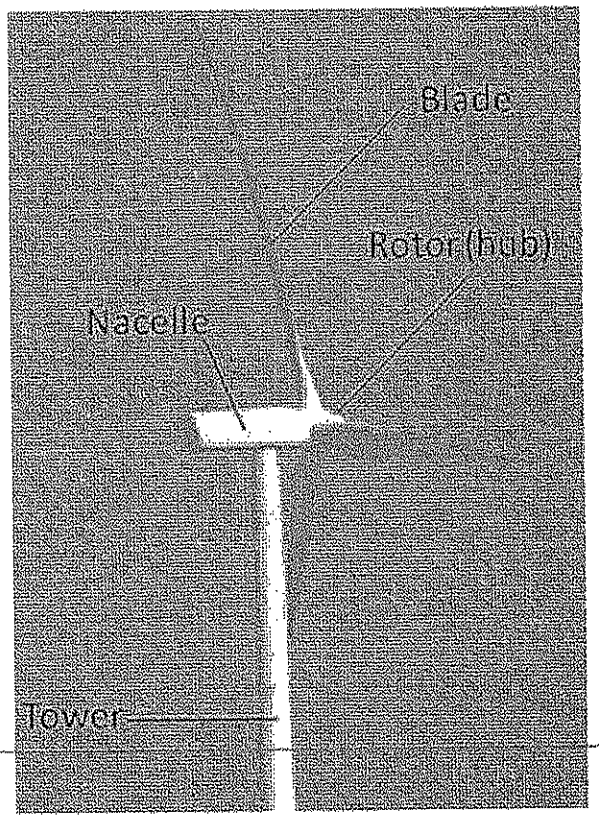
BY JERRY PUNCH, RICHARD JAMES, AND DAN PABST

Noise from modern wind turbines is not known to cause hearing loss, but the low-frequency noise and vibration emitted by wind turbines may have adverse health effects on humans and may become an important community noise concern.



Most of us would agree that the modern wind turbine is a desirable alternative for producing electrical energy. One of the most highly touted ways to meet a federal mandate that 20 percent of all energy must come from renewable sources by 2020 is to install large numbers of utility-scale wind turbines. Evidence has been mounting over the past decade, however, that these utility-scale wind turbines produce significant levels of low-frequency noise and vibration that can be highly disturbing to nearby residents.

None of these unwanted emissions, whether audible or inaudible, are believed to cause hearing loss, but they are widely known to cause sleep disturbances. Inaudible components can induce resonant vibration in solids, liquids, and gases—including the ground, houses, and other building structures, spaces within those structures, and bodily tissues and cavities—that is potentially harmful to humans. The most extreme of these low-frequency (infrasonic) emissions, at frequencies under about 16 Hz, can easily penetrate homes. Some residents perceive the energy as sound, others experience it as vibration, and others are not aware of it at all. Research is beginning to show that, in addition to sleep disturbances, these emissions may have other deleterious consequences on health. It is for these reasons that wind turbines are becoming an important community health issue, especially when hosted in quiet rural communities that have no prior experience with industrial noise or urban hum.



Major components of a modern wind turbine.

The people most susceptible to disturbances caused by wind turbines may be a small percentage of the total exposed population, but for them the introduction of wind turbines in their communities is not something to which they can easily become acclimated. Instead, they become annoyed, uncomfortable, distressed, or ill. This problem is increasing as newer utility-scale wind turbines capable of generating 1.5-5 MWatts of electricity or more replace the older turbines used over the past 30 years, which produced less than 1 MWatt of power. These large wind turbines can have hub heights that span the length of a football field and blade lengths that span half that distance. The increased size of these multi-MWatt turbines, especially the blades, has been associated with complaints of adverse health effects (AHEs) that cannot be explained by auditory responses alone.

For this article, we reviewed the English-language, peer-reviewed literature from around the world on the topic of wind-turbine noise and vibration and their effects on humans. In addition, we used popular search engines to locate relevant online trade journals, books, reference sources, government regulations, and acoustic and vibration standards. We also consulted professional engineers and psychoacousticians regarding their unpublished ideas and research.

Sources of Wind-Turbine Noise and Vibration

Physically, a modern wind turbine consists of a tower; a rotor (or hub); a set of rotating blades—usually three, located upwind to the tower; and a nacelle, which is an enclosure containing a gearbox, a generator, and

computerized controls that monitor and regulate operations (FIGURE 1). Wind speed can be much greater at hub level than at ground level, so taller wind towers are used to take advantage of these higher wind speeds. Calculators are available for predicting wind speed at hub height, based on wind speeds at 10 meter weather towers, which can easily be measured directly.

Mechanical equipment inside the nacelle generates some noise, but at quieter levels than older turbines. This mechanical sound is usually considered of secondary importance in discussions of annoyance from today's turbines. The main cause of annoyance is an aerodynamic source created by interaction of the turning blades with the wind. With optimal wind conditions, this aerodynamic noise is steady and commonly described as an airplane overhead that never leaves.

When wind conditions are not optimal, such as during turbulence caused by a storm, the steady sounds are augmented by fluctuating aerodynamic sounds. Under steady wind conditions, this interaction generates a broadband whooshing sound that repeats itself about once a second and is clearly audible. Many people who live near the wind turbine find this condition to be very disturbing.

The whooshing sound comes from variations of air turbulence from hub to blade tip and the inability of the turbine to keep the blades adjusted at an optimal angle as wind direction varies. The audible portion of the whoosh is around 300 Hz, which can easily penetrate walls of homes and other buildings. In addition, the rotating blades create energy at frequencies as low as 1–2 Hz (the blade-passage frequency), with overtones of up to about 20 Hz. Although some of this low-frequency energy is audible to some people with sensitive hearing, the energy is mostly vibratory to people who react negatively to it.

Adverse Health Effects of Wind-Turbine Noise

Hubbard and Shepherd (1990), in a technical paper written for the National Aeronautics and Space Administration (NASA), were the first to report in depth on the noise and vibration from wind turbines. Most of the relevant research since that time has been conducted by European investigators, as commercial-grade (utility-scale) wind turbines have existed in Europe for many decades. Unfortunately, the research and development done by wind-turbine manufacturers is proprietary and typically has not been shared with the public, but reports of the distressing effects on people living near utility-scale wind turbines in various parts of the world are becoming more common.

Studies carried out in Denmark, The Netherlands, and Germany (Wolsink and Sprengers, 1993; Wolsink et al, 1993), a Danish study (Pedersen and Nielsen, 1994), and two Swedish studies (Pedersen and Persson Waye, 2004, 2007) collectively indicate that wind turbines differ from other sources of community noise in several respects. These investigators confirm the findings of earlier research that amplitude-modulated sound is more easily perceived and more annoying than constant-level sounds (Bradley, 1994; Bengtsson et al, 2004) and that sounds that are unpredictable and uncontrollable are more annoying than other sounds (Geen and McCown, 1984; Hatfield et al, 2002).

Annoyance from wind-turbine noise has been difficult to characterize by the use of such psychoacoustic parameters as sharpness, loudness, roughness, or modulation (Persson Waye and Öhrström, 2002). The extremely low-frequency nature of wind-turbine noise, in combination with the fluctuating blade sounds, also means that the noise is not easily masked by other environmental sounds.

Pedersen et al (2009), in a survey conducted in The Netherlands on 725 respondents, found that noise from

wind turbines is more annoying than transportation or industrial noises at comparable levels, measured in dBA. They noted that annoyance from turbine sounds at 35 dBA corresponds to the annoyance reported for other common community-noise sources at 45 dBA. Higher visibility of the turbines was associated with higher levels of annoyance, and annoyance was greater when attitudes toward the visual impact of the turbines on the landscape were negative. However, the height of wind turbines means that they are also most clearly visible to the people closest to them and those who also receive the highest sound levels. Thus, proximity of the receiver to wind turbines makes it difficult to determine whether annoyance to the noise is independent of annoyance to the visual impact. Pedersen et al (2009) also found that annoyance was substantially lower in people who benefitted economically from having wind turbines located on their property.

Among audiologists and acousticians, it has been understood for many decades that sufficiently intense and prolonged exposure to environmental noise can cause hearing impairment, annoyance, or both. In essence, the view has been *what* you can hear can hurt you. In the case of wind turbines, it seems that *what* you can't hear can also hurt you. Again, there is no evidence that noise generated by wind turbines, even the largest utility-scale turbines, causes hearing loss. But there is increasingly clear evidence that audible and low-frequency acoustic energy from these turbines is sufficiently intense to cause extreme annoyance and inability to sleep, or disturbed sleep, in individuals living near them.

Jung and colleagues (2008), in a Korean study, concluded that low-frequency noise in the frequency range above 30 Hz can lead to psychological complaints and that infrasound in the frequency range of 5–8 Hz can cause complaints due to rattling doors and windows in homes.

The energy generated by large wind turbines can be especially disturbing to the vestibular systems of some people, as well as cause other troubling sensations of the head, chest, or other parts of the body. Dr. Nina Pierpont (2009), in her definitive natural experiment on the subject, refers to these effects as Wind-Turbine Syndrome (WTS). TABLE 1 lists the symptoms that, in various combinations, characterize WTS. Although hearing impairment is not one of the symptoms of WTS, audiologists whose patients report these symptoms should ask them if they live near a wind turbine.

It is well known that sleep deprivation has serious consequences, and we know that noncontinuous sounds and nighttime sounds are less tolerable than continuous and daytime sounds. Somewhat related effects, such as cardiac arrhythmias, stress, hypertension, and headaches have also been attributed to noise or vibration from wind turbines, and some researchers are referring to these effects as Vibroacoustic Disease, or VAD (Castelo Branco, 1999; Castelo Branco and Alves-Pereira, 2004). VAD is described as occurring in persons who are exposed to high-level (>90 dB SPL) infra- and low-frequency noise (ILFN), under 500 Hz, for periods of 10 years or more. It is believed to be a systemic pathology characterized by direct tissue damage to a variety of bodily organs and may involve abnormal proliferation of extracellular matrices.

Alves-Pereira and Castelo Branco (2007) reported on a family who lived near wind turbines and showed signs of VAD. The sound levels in the home were less than 60 dB SPL in each 1/3-octave band below 100 Hz. We have measured unweighted sound levels ranging from 60 to 70 dB Leq (averaged over 1 minute) in these low-frequency bands in Ontario homes of people reporting AHEs from wind turbines. A spectral analysis of sounds emitted at a Michigan site revealed that unweighted peak levels at frequencies under 5 Hz exceeded 90 dB SPL (Wade Bray, pers. comm., 2009).

Table 1. Core Symptoms of Wind-Turbine Syndrome

1	Sleep disturbance
2	Headache
3	Visceral Vibratory Vestibular Disturbance (VVVD)
4	Dizziness, vertigo, unsteadiness
5	Tinnitus
6	Ear pressure or pain
7	External auditory-canal sensation
8	Memory and concentration deficits
9	Irritability, anger
10	Fatigue, loss of motivation

Source: Pierpont, 2009

Similar observations have been made in studies of people who live near busy highways and airports, which also expose people to low-frequency sounds, both outdoors and in their homes. Evidence is insufficient to substantiate that typical exposures to wind-turbine noise, even in residents who live nearby, can lead to VAD, but early indications are that there are some more-vulnerable people who may be susceptible. Because ILFN is not yet recognized as a disease agent, it is not covered by legislation, permissible exposure levels have not yet been established, and dose-response relationships are unknown (Alves-Pereira, 2007).

As distinguished from VAD, Pierpont's (2009) use of the term Wind-Turbine Syndrome appears to emphasize a constellation of symptoms due to stimulation, or overstimulation, of the vestibular organs of balance due to ILFN from wind turbines (see TABLE 1). One of the most distinctive symptoms she lists in the constellation of symptoms comprising WTS is Visceral Vibratory Vestibular Disturbance (VVVD), which she defines as "a sensation of internal quivering, vibration, or pulsation accompanied by agitation, anxiety, alarm, irritability, rapid heartbeat, nausea, and sleep disturbance" (p. 270).

Drawing on the recent work of Balaban and colleagues (i.e., Balaban and Yates, 2004), Pierpont describes the close association between the vestibular system and its neural connections to brain nuclei involved with balance processing, autonomic and somatic sensory inflow and outflow, the fear and anxiety associated with vertigo or a sudden feeling of postural instability, and aversive learning. These neurological relationships give credence to Pierpont's linkage of the symptoms of VVVD to the vestibular system.

Todd et al (2008) demonstrated that the resonant frequency of the human vestibular system is 100 Hz, concluding that the mechano-receptive hair cells of the vestibular structures of the inner ear are remarkably sensitive to low-frequency vibration and that this sensitivity to vibration exceeds that of the cochlea. Not only is 100 Hz the frequency of the peak response of the vestibular system to vibration, but it is also a frequency at which a substantial amount of acoustic energy is produced by wind turbines. Symptoms of both VAD and VVVD can presumably occur in the presence of ILFN as a result of disruptions of normal paths or structures that mediate the fine coordination between living tissue deformation and activation of signal transducers; these disruptions can lead to aberrant mechano-electrical coupling that can, in turn, lead to conditions such as heart arrhythmias (Ingber, 2008). Ultimately, further research will be needed to sort out the commonalities and differences among the symptoms variously described in the literature as VAD, VVVD, and WTS.

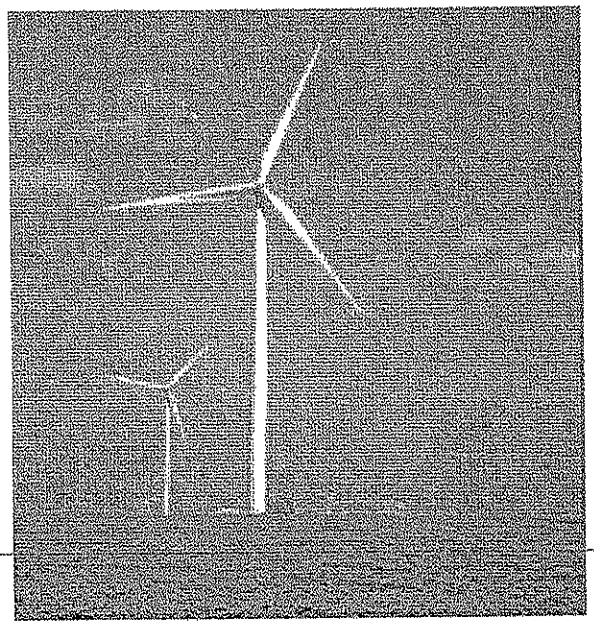
Dr. Geoff Leventhall, a British scientist, and his colleagues (Waye et al, 1997; Leventhall, 2003, 2004) have documented the detrimental effects of low-frequency noise exposure. They consider it to be a special environmental noise, particularly to sensitive people in their homes. Waye et al (1997) found that exposure to dynamically modulated low-frequency ventilation noise (20–200 Hz)—as opposed to midfrequency noise exposure—was more bothersome, less pleasant, impacted work performance more negatively, and led to lower social orientation.

Leventhall (2003), in reviewing the literature on the effects of exposure to low-frequency noise, found no evidence of hearing loss but substantial evidence of vibration of bodily structures (chest vibration), annoyance (especially in homes), perceptions of unpleasantness (pressure on the eardrum, unpleasant perception within the chest area, and a general feeling of vibration), sleep disturbance (reduced wakefulness), stress, reduced performance on demanding

verbal tasks, and negative biological effects that included quantitative measurements of EEG activity, blood pressure, respiration, hormone production, and heart rate.

Regarding work performance, reviewed studies indicated that dynamically modulated low-frequency noise, even when inaudible to most individuals, is more difficult to ignore than mid- or high-frequency noise and that its imperviousness to habituation leads to reduced available information-processing resources. Leventhall hypothesized that low-frequency noise, therefore, may impair work performance. More recently, as a consultant on behalf of the British Wind Energy Association (BWEA), the American Wind Energy Association (AWEA), and the Canadian Wind Energy Association (CANWEA), Leventhall (2006) changed his position, stating that although wind turbines do produce significant levels of low-frequency sound, they do not pose a threat to humans—in effect reverting to the notion that *what* you can't hear can't hurt you.

According to the World Health Organization guidelines (WHO, 2007), observable effects of nighttime, outdoor wind-turbine noise do not occur at levels of 30 dBA or lower. Many rural communities have ambient, nighttime sound levels that do not exceed 25 dBA. As outdoor sound levels increase, the risk of AHEs also increases, with the most vulnerable being the first to show its effects. Vulnerable populations include elderly persons; children, especially those younger than age six; and people with pre-existing medical conditions, especially if sleep is affected. For outdoor sound levels of 40 dBA or higher, the WHO states that there is sufficient evidence to link prolonged exposure to AHEs. While the WHO identifies long-term, nighttime audible sounds over 40 dBA outside one's home as a cause of AHEs, the wind industry commonly promotes 50 dBA as a safe limit for nearby homes and properties. Recently, a limit of 45 dBA has been proposed for new wind projects in Canada (Keith et al, 2008).



Utility-scale wind turbines located in Huron County, Michigan.

Much of the answer as to why the wind industry denies that noise is a serious problem with its wind turbines is because holding the noise to 30 dBA at night has serious economic consequences. The following quotation by Upton Sinclair seems relevant here: "It is difficult to get a man to understand something when his salary depends upon his not understanding it" (Sinclair, 1935, reprinted 1994, p. 109).

In recent years, the wind industry has denied the validity of any noise complaints by people who live near its utility-scale wind turbines. Residents who are leasing their properties for the siting of turbines are generally so pleased to receive the lease payments that they seldom complain. In fact, they normally are required to sign a leasing agreement, or gag clause, stating they will not speak or write anything unfavorable about the turbines. Consequently, complaints, and sometimes lawsuits, tend to be initiated by individuals who live near property on which wind turbines are sited, and not by those who are leasing their own property. This situation pits neighbor against neighbor, which leads to antagonistic divisions within communities.

Measurement of Wind-Turbine Noise

It is important to point out that the continued use of the A-weighting scale in sound-level meters is the basis for misunderstandings that have led to acrimony between advocates and opponents of locating wind turbines in residential areas. The dBA scale grew out of the desire to incorporate a function into the measurement of sound pressure levels of environmental and industrial noise that is the inverse of the minimum audibility curve (Fletcher and Munson, 1933) at the 40-phon level. It is typically used, though, to specify the levels of noises that are more intense, where the audibility curve becomes considerably flattened, obviating the need for A-weighting. It is mandated in various national and international standards for measurements that are compared to damage-risk criteria for hearing loss and other health effects. The A-weighted scale in sound-level meters drastically reduces

sound-level readings in the lower frequencies, beginning at 1000 Hz, and reduces sounds at 20 Hz by 50 dB.

For wind-turbine noise, the A-weighting scale is especially ill-suited because of its devaluation of the effects of low-frequency noise. This is why it is important to make C-weighted measurements, as well as A-weighted measurements, when considering the impact of sound from wind turbines. Theoretically, linear-scale measurements would seem superior to C-scale measurements in wind-turbine applications, but linear-scale measurements lack standardization due to failure on the part of manufacturers of sound-level meters to agree on such factors as low-frequency cutoff and response tolerance limits. The Z-scale, or zero-frequency weighting, was introduced in 2003 by the International Electro-technical Commission (IEC) in its Standard 61672 to replace the flat, or linear, weighting used by manufacturers in the past.

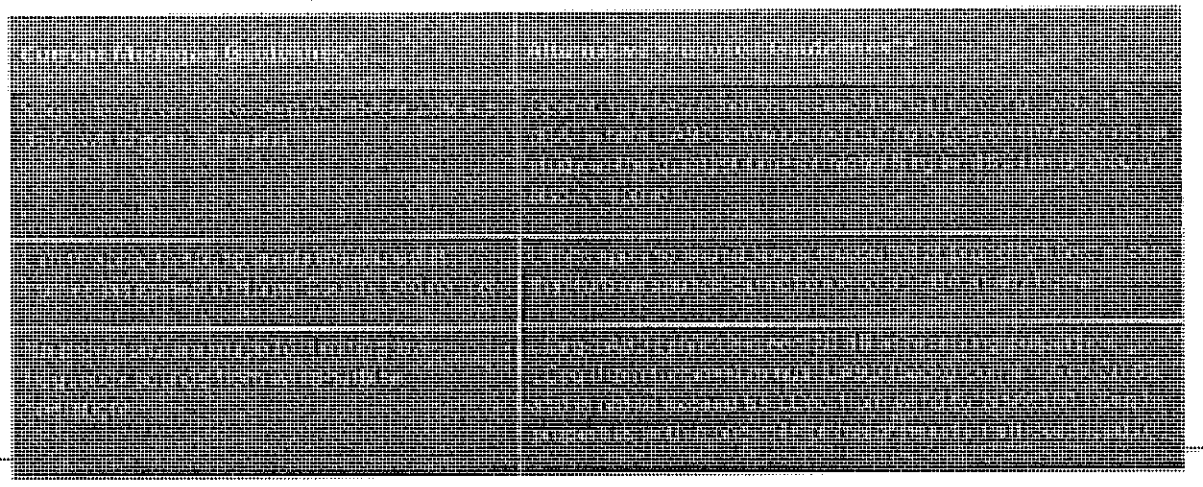
State of Michigan Siting Guidelines

Michigan's siting guidelines (State of Michigan, 2008) will be used as an example of guidelines that deal only in a limited way with sound. These guidelines refer to earlier, now outdated, WHO and Environmental Protection Agency (EPA) guidelines to support a noise criterion that SPLs cannot exceed 55 dBA at the adjacent property line. This level is allowed to be exceeded during severe weather or power outages, and when the ambient sound level is greater than 55 dBA, the turbine noise can exceed that higher background sound level by 5 dB. These levels are about 30 dB above the nighttime levels of most rural communities. When utility-scale turbines were installed in Huron County, Michigan, in May 2008, the WHO's 2007 guidelines that call for nighttime, outside levels not to exceed 30 dBA were already in place. Based on measurements made by the authors, these turbines produce 40–45 dBA sound levels at the perimeter of a 1,000 ft radius under typical weather conditions, and the additive effects of multiple turbines produce higher levels. Many of the turbines have been located close enough to homes to produce very noticeable noise and vibration.

Kamperman and James (2009) have offered recommendations for change in the State of Michigan guidelines (2008) for wind turbines. Some of the more pertinent details of the Michigan siting guidelines are shown in the left-hand column of TABLE 2. The state of Michigan permits sound levels that do not exceed 55 dBA or L90 + 5 dBA, whichever is greater, measured at the property line closest to the wind-energy system. These guidelines make no provisions to limit low-frequency sounds from wind-turbine operations.

In consideration of the current WHO guidelines (2007), measurements made by the authors in Huron County, Michigan, indicate that the current Michigan guidelines do not appear adequate to protect the public from the nuisances and known health risks of wind-turbine noise. In fact, these guidelines appear to be especially lenient

Table 2. Current and Proposed Wind-Turbine Siting Guidelines



*Source: State of Michigan, 2008

**Source: Kamperman and James, 2009

in terms of tolerable sound levels. Sound levels that approach 20 dBA higher than natural ambient levels are considered unacceptable in most countries; Michigan permits 30 dBA increases.

In considering the health and well-being of people living near wind-turbine projects, the changes recommended by Kamperman and James (2009) would abandon the 55 dBA limit in favor of the commonly accepted criteria of L90 + 5 dBA, for both A- and C-scale readings, where L90 is the preconstruction ambient level. These recommendations also include a prohibition against any wind-turbine-related sound levels exceeding 35 dBA on receiving properties that include homes or other structures in which people sleep. Additional protections against low-frequency sound are given in the right-hand column of TABLE 2. These recommended provisions would protect residents by limiting the difference between C-weighted Leq during turbine operation and the quietest A-weighted pre-operation background sound levels, plus 5 dB, to no more than 20 dB at the property line. This level should not exceed 55 dB Leq on the C scale, or 60 dB Leq for properties within one mile of major heavily trafficked roads, which sets a higher tolerance for communities that tend to experience slightly noisier conditions.

Implementation of the recommendations of Kamperman and James would result in siting wind turbines differently than what is currently planned for future wind-turbine projects in Michigan. This change would result in sound levels at nearby properties that are much less noticeable, and much less likely to cause sleep deprivation, annoyance, and related health risks. These sound-level measurements should be made by independent acoustical engineers or knowledgeable audiologists who follow ANSI guidelines (1993, 1994) to ensure fair and accurate readings, and not by representatives of the wind industry.

People living within a mile of one or more wind turbines, and especially those living within a half mile, have frequent sleep disturbance leading to sleep deprivation, and sleep disturbances are common in people who live up to about 1.25 miles away. This is the setback distance at which a group of turbines would need to be in order not to be a nighttime noise disturbance (Kamperman and James, 2009). It is also the setback distance used in several other countries that have substantial experience with wind turbines, and is the distance at which Pierpont (2009) found very few people reporting AHEs.

A study conducted by van den Berg (2003) in The Netherlands demonstrated that daytime levels cannot be used to predict nighttime levels and that residents within 1900 mile (1.18 mile) of a wind-turbine project expressed annoyance from the noise. Pierpont (2009) recommends baseline minimum setbacks of 2 kilometers (1.24 mile) from residences and other buildings such as hospitals, schools, and nursing homes, and longer setbacks in mountainous terrain and when necessary to meet the noise criteria developed by Kamperman and James (2009).

In a panel review report, the American Wind Energy Association (AWEA) and Canadian Wind Energy Association (CANWEA) have objected to setbacks that exceed 1 mile (Colby et al, 2009). A coalition of independent medical and acoustical experts, the Society for Wind Vigilance (2010), has provided a recent rebuttal to that report. The society has described the panel review as a typical product of industry-funded white papers, being neither authoritative nor convincing. The society accepts as a medical fact that sleep disturbance, physiological stress, and psychological distress can result from exposure to wind-turbine noise.

Wind turbines have different effects on different people. Some of these effects are somewhat predictable based on financial compensation, legal restrictions on free speech included in the lease contracts with hosting landowners, and distance of the residence from wind projects, but they are sometimes totally unpredictable. Planning for wind projects needs to be directed not only toward benefitting society at large but also toward protecting the individuals living near them. We believe that the state of Michigan, and other states that have adopted similar siting guidelines for wind turbines, are not acting in the best interest of all their citizens and need to revise their siting guidelines to protect the public from possible health risks and loss of property values, as well as reduce complaints about noise annoyance.

Wind-utility developers proposing new projects to a potential host community are often asked if their projects will cause the same negative community responses that are heard from people living in the footprint of operating projects. They often respond that they will use a different

People living near wind turbines may experience sleep disturbance.

type of wind turbine or that reports of complaints refer to older-style turbines that they do not use. In our opinion, these statements should usually be viewed as diversionary.

Finally, it is important to note that there is little difference in noise generated across makes and models of modern utility-scale, upwind wind turbines once their power outputs are normalized. Kamperman (pers. comm., 2009), after analyzing data from a project funded by the Danish Energy Authority (Søndergaard and Madsen, 2008), has indicated that when the A-weighted sound levels are converted to unweighted levels, the low-frequency energy from industrial wind turbines increases inversely with frequency at a rate of approximately 3 dB per octave to below 10 Hz (the lowest reported frequency). Kamperman has concluded that the amount of noise generated at low frequencies increases by 3–5 dB for every MW of electrical power generated. Because turbines are getting larger, this means that future noise problems are likely to get worse if siting guidelines are not changed.

Conclusion

Our purpose in this article has been to provide audiologists with a better understanding of the types of noise generated by wind turbines, some basic considerations underlying sound-level measurements of wind-turbine noise, and the adverse health effects on people who live near these turbines. In future years, we expect that audiologists will be called upon to make noise measurements in communities that have acquired wind turbines, or are considering them. Some of us, along with members of the medical profession, will be asked to provide legal testimony regarding our opinions on the effects of such noise on people. Many of us will likely see clinical patients who are experiencing some of the adverse health effects described in this article.

As a professional community, audiologists should become involved not only in making these measurements to corroborate the complaints of residents living near wind-turbine projects but also in developing and shaping siting guidelines that minimize the potentially adverse health effects of the noise and vibration they generate. In these ways, we can promote public health interests without opposing the use of wind turbines as a desirable and viable alternative energy source.

Jerry Punch, PhD, Richard James, BME, and Dan Pabst, BS, are with the Department of Communicative Sciences and Disorders, Michigan State University, East Lansing, MI.

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EXHIBIT 5

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

In the Matter of the Application of SAN DIEGO GAS & ELECTRIC COMPANY (U902 E) for a Permit to Construct Electrical Facilities with Voltages between 50 kV and 200 kV and New Substations with High Side Voltages Exceeding 50 kV: The East County Substation Project	)	Application 09-08-003 (Filed August 10, 2009)

DECLARATION OF DAVID COLLING IN SUPPORT OF BACKCOUNTRY AGAINST DUMPS' COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT REPORT/ENVIRONMENTAL IMPACT STATEMENT FOR THE EAST COUNTY SUBSTATION, TULE WIND AND ENERGIA SIERRA JUAREZ GEN-TIE PROJECTS

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Attorneys for Party and Protestant
Backcountry Against Dumps

March 3, 2011

I, David Colling, declare as follows:

Qualifications

1. I am an electrical pollution assessor for Bio-Ag Consultants and Distributors, Inc. ("Bio-Ag"). After a long career as a dairy farmer in the Ripley area of Ontario, Canada, I began working for Bio-Ag as a sales representative in 1991. I subsequently received two years of training in electrical engineering at Ryerson Polytechnical Institute, and obtained specialized training in electrical pollution from recognized electrical pollution experts Dave Stetzer and Dr. Andrew Michrowski. I have worked as an electrical pollution assessor for Bio-Ag since 2005. In that time, I have performed electrical pollution testing on over 300 homes, offices and farms, which includes the measuring of ground current. I have tested for electrical pollution in residences adjacent to the Ripley, Underwood, Melancthon/Amaranth and Kingsbridge wind farms in Ontario. I have also tested for electrical pollution in a residence adjacent to the Amaranth Substation, which receives and transmits electricity produced by the Melanchton/Amaranth Wind Farm.

My Testing Shows that Wind Turbines Can Produce Harmful Electrical Pollution

2. Dirty electricity refers to electromagnetic energy that flows along a conductor and deviates from a pure 60-Hz sine wave. These deviations occur in the KHz and MHz range, the intermediate frequency portion of the nonionizing part of the electromagnetic spectrum.

3. Dirty electricity is produced by both electricity-consuming equipment, such as computers and televisions, and electricity-generating equipment. Wind turbines are one of the latter sources of dirty electricity. To enable variable speed operation of

wind turbines, the alternating current they generate is first converted to direct current and then converted back into alternating current with the correct voltage and frequency. These conversions create higher frequency electrical currents that "ride" the 60-Hz sine wave and radiate from the collector lines that transmit the wind-generated electricity to substations. If not adequately filtered, the dirty electricity can be propagated through the substations and onto transmission and distribution lines.

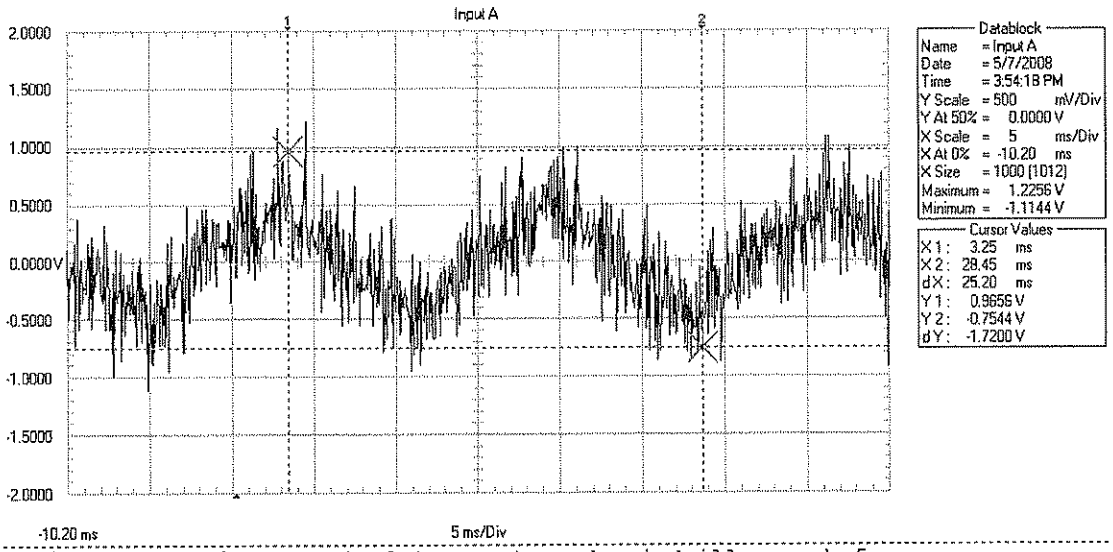
4. The dirty electrical currents reach and impact people and the environment in two ways. The currents are propagated from the electrical transmission facilities through both the atmosphere and the ground. Ground current is typically propagated through grounding rods extending from neutral conductor wires.

5. At the behest of residents experiencing health problems after wind farms began operating nearby, I have tested for dirty electricity emanating from the Ripley, Underwood, Melancthon/Amaranth and Kingsbridge wind farms in Ontario. Not only did my tests confirm that all four of these wind farms were emitting dirty electricity, they confirmed that the dirty electrical currents were – and in some cases still are – propagated in the form of ground currents to numerous nearby residences. As an example, the Ripley Wind Farm and its electrical pollution are discussed in more detail below. Electrical pollution measurements for the Underwood Wind Farm are reproduced in Exhibit 1, along with measurements from additional Ripley Wind Farm sites.

6. The Ripley Wind Farm is located in Ripley, Ontario, off the southeastern shores of Lake Huron. The farm consists of 38 Enercon E82 2 MW turbines, with a total maximum production of 76 MW. The waveforms shown below were measured at one of the many nearby residences I tested for electrical pollution, Residence 1. Residence 1 is

located 900-plus meters from 10 wind turbines. Measurements were taken between the primary ground wire at the transformer pole and a remote rod, and in the residence's home between the kitchen sink and an ECG electrode on the floor, as indicated in the caption for the figures. As figure 1 shows, the wind turbines were creating significant electrical pollution. The frequency profile of the primary neutral to earth voltage ("PNEV") shown in figure 1 is littered with higher frequency distortions of the 60-Hz sine wave.

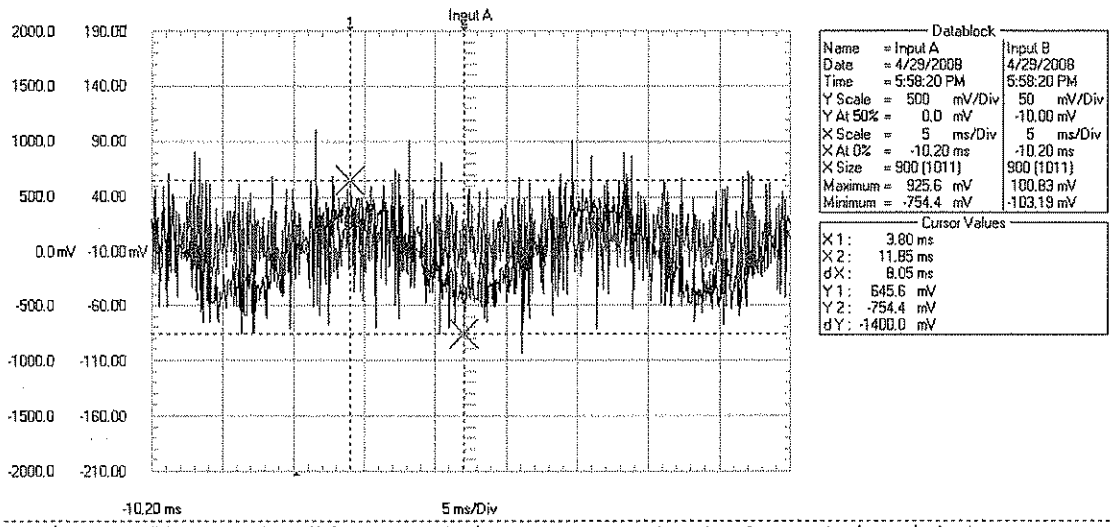
Figure 1.



Residence 1, Primary neutral to remote rod, windmills on, before collection lines buried.

7. Figure 2, on the following page, shows that the dirty electrical current produced by the Ripley wind turbines was propagated as a ground current that reached Residence 1, as measured by sink-to-floor readings in the kitchen with the power to the home turned off. A frequency comparison of the PNEV and sink-to-floor readings confirmed that the source of the ground current was the Ripley Wind Farm.

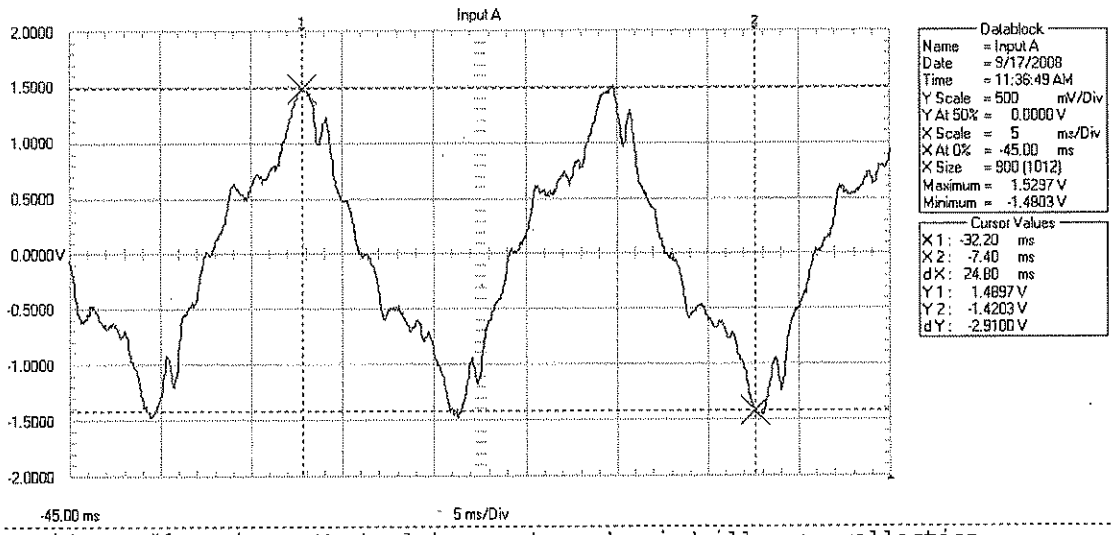
Figure 2.



Residence #1, Input A(blue wave) is PNEV. Input B(red wave) is sink to floor. The power was shut off to the house. Windmills running.

8. A few months after I took the measurements shown in figures 1 and 2, the Ripley Wind Farm developers – Suncor Energy and Acciona Energy – buried the collector lines leading from the wind turbines to the substation. The undergrounding substantially reduced the PNEV frequency distortions, though it did not eliminate them. This change is shown in figure 3, on the following page.

Figure 3.



Residence #3, Primary Neutral to remote rod, windmills on, collection line now buried.

9. The electrical pollution testing I did at other locations on the Ripley Wind Farm and nearby residences yielded similar results, as exemplified by the measurements for Residence 3 shown in Exhibit 1. The testing I did at the Underwood, Melancthon/Amaranth and Kingsbridge wind farms also yielded comparable results, with the wind turbines producing significant PNEV frequency distortions. Examples of the measurements I took at the Underwood Wind Farm is also included in Exhibit 1.

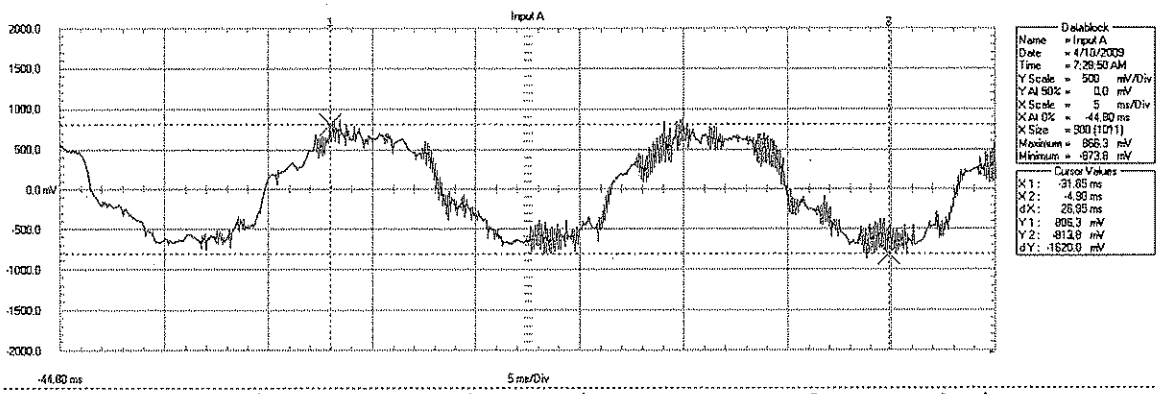
My Testing Shows that Electrical Substations Can Propagate Harmful Electrical Pollution

10. As discussed, if not adequately filtered, dirty electricity can be propagated through electrical substations and onto transmission and distribution lines. I observed and measured this precise phenomenon at a residence approximately 300 meters from the Amaranth Substation. This substation is connected to the same distribution lines that power the residence as the substation requires power for the wind turbine control network. The power from the wind turbines comes into the substation on a separate set

electrical lines called collection lines that are of higher voltage than the distribution lines. The substation requires power from the distribution lines as the only power coming in on the collection lines is from wind turbines. Therefore when the wind turbines are off power is needed from the distribution lines to keep control systems on. Measurements were taken at the ground wire on a distribution pole at the road entrance to the substation. The measurements were taken in the same manner as described above for the Ripley Wind Farm measurements. As figure 4 on the following page shows, the substation was creating significant electrical pollution that propagated along the distribution lines leading to the residence. The frequency profile of the primary neutral to earth voltage ("PNEV") measured at the entrance to the Amaranth substation shown in figure 4 is littered with higher frequency distortions of the 60-Hz sine wave.

11. Figures 5 and 6 show that the dirty electrical current flowing through the Amaranth Substation was propagated as a ground current that reached the residence, as measured by sink-to-floor readings in the kitchen with the power to the home turned off and no body contact (shown as the red waveforms in both figures; the blue waveform in figure 6 is the PNEV frequency profile). The PNEV was measured at the residence transformer pole. A frequency comparison of the PNEV and sink-to-floor readings confirmed that the source of the ground current was the Amaranth Substation.

Figure 4.



Amaranth Substation, PNEV at the service entrance pole ground wire

Figure 5.

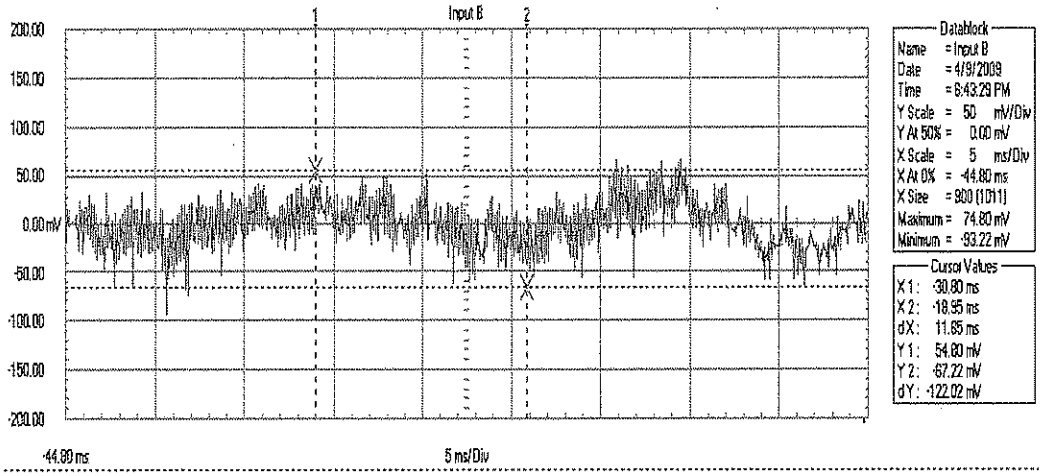
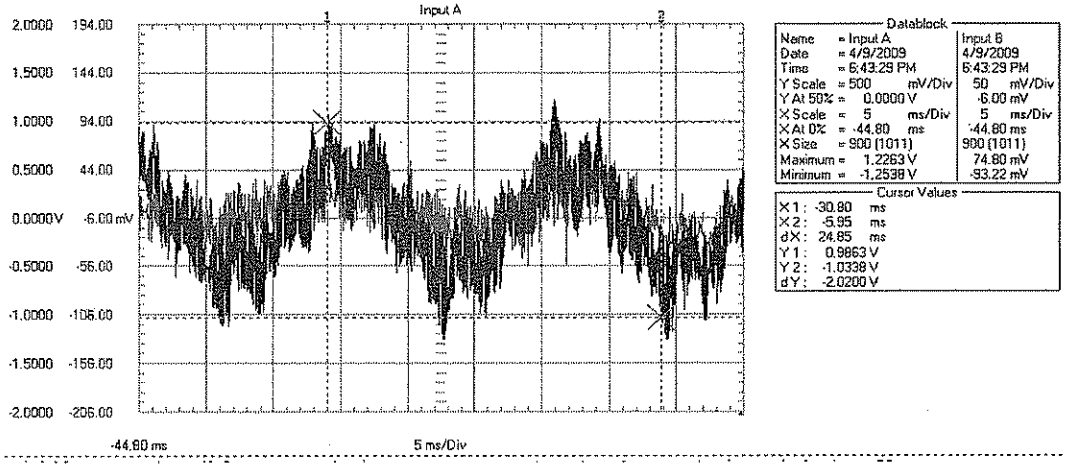


Figure 6.



Conclusions

12. Wind turbines can produce significant electrical pollution in the form of dirty electricity. Additionally, if not adequately filtered, dirty electricity can be propagated through the substations and onto transmission and distribution lines. I have tested for dirty electricity emanating from the Ripley, Underwood, Melancthon/Amaranth and Kingsbridge wind farms, as well as the Amaranth Substation, all in southern Ontario. Not only did my tests confirm that all four wind farms and the substation were emitting dirty electricity, they confirmed that the dirty electrical currents were – and in some cases still are – propagated in the form of ground currents to numerous nearby residences.

I declare, under penalty of perjury, that the foregoing is true and correct based on my personal knowledge and best professional judgment, and that this declaration was executed on March 3, 2011 in Ripley, Ontario, Canada.

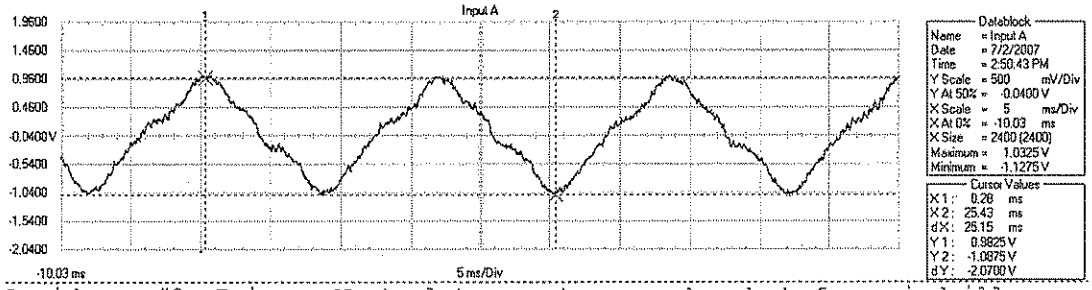
DAVID COLLING

EXHIBIT 1

Ripley Wind Farm, Electrical Pollution Testing Near Residence 3

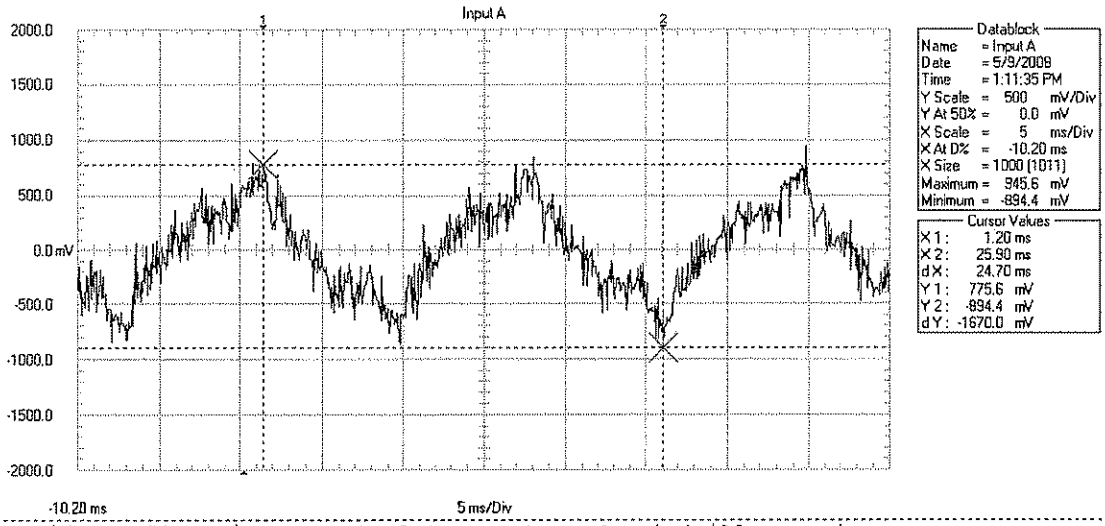
I took the measurements shown below in figures 1 through 3 in the same manner as described for the Ripley Wind Farm measurements discussed in the main body of my declaration.

Figure 1.



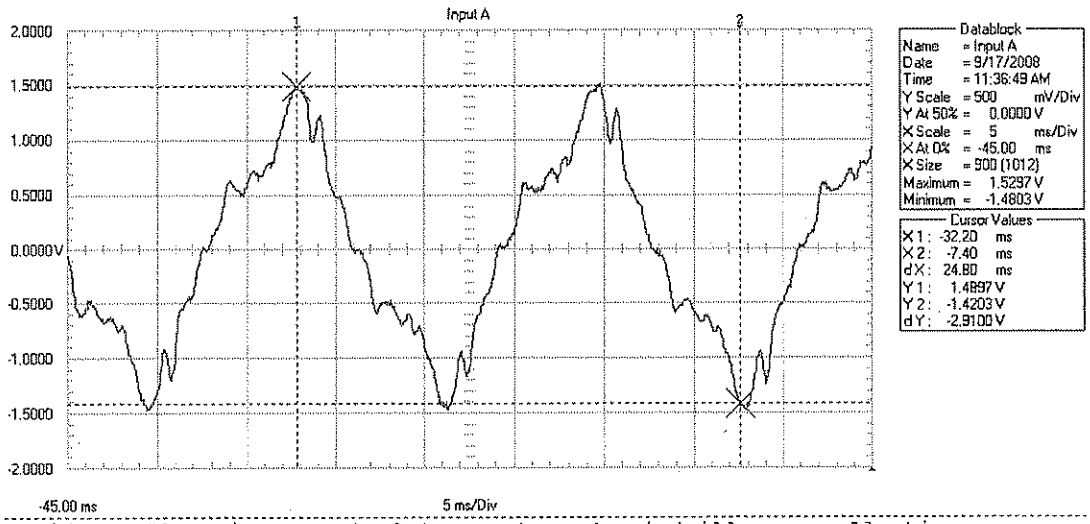
Residence #3, Primary Neutral to remote ground rod, before windmills were installed and running.

Figure 2.



Residence #3, Primary Neutral to remote rod, windmills running before the collection line was buried.

Figure 3.

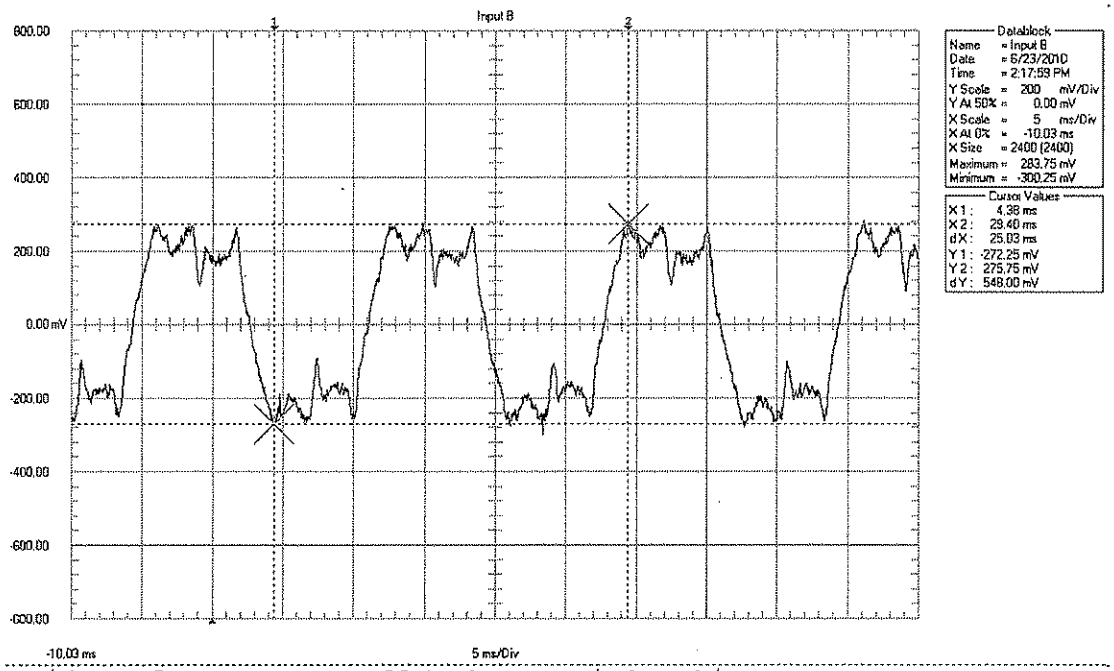


Residence #3, Primary Neutral to remote rod, windmills on, collection line now buried.

Underwood Wind Farm

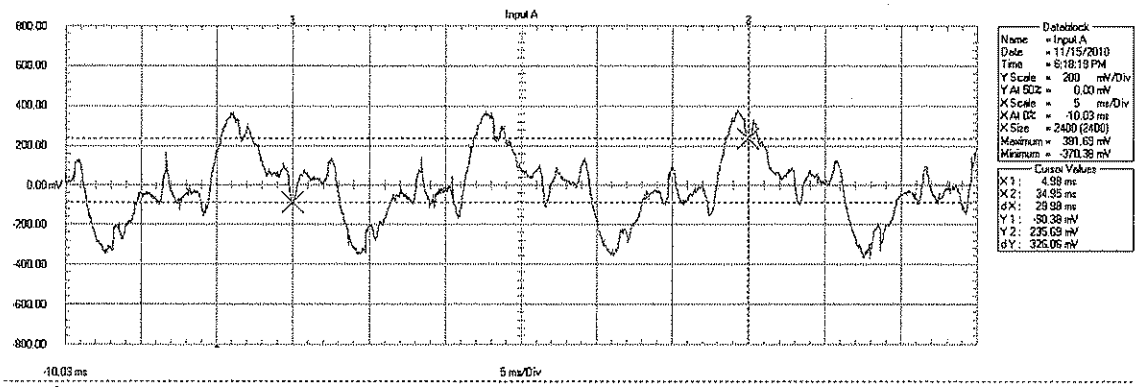
The Underwood Wind Farm, developed and operated by Enbridge, Inc., is located just north of Kincardine, Ontario. It consists of 110 Vestas V82 1.65 MW wind turbines, with a maximum generation capacity of 181.5 MW. I took the measurements shown below in figures 4 through 6 in the same manner as described for the Ripley Wind Farm measurements.

Figure 4.



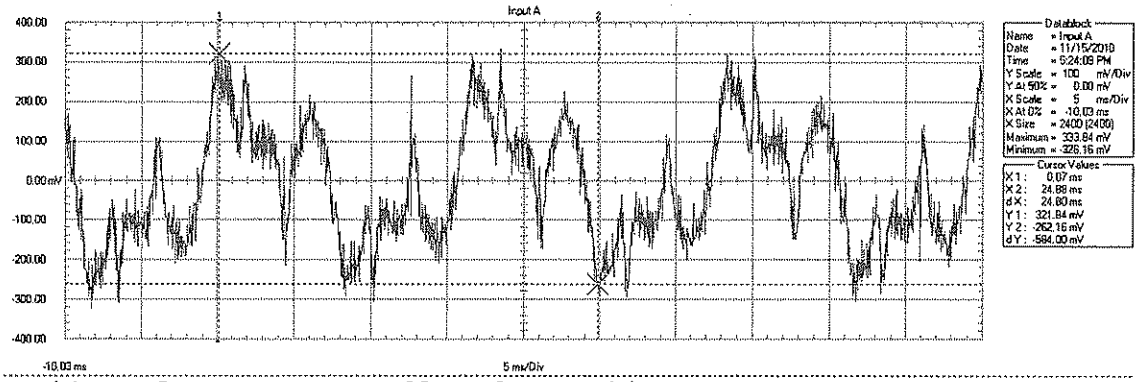
Residence 5, PNEV power off to house. Wind Turbines on.

Figure 5.



Residence 5, PNEV, power off to farm, wind turbines off.

Figure 6.



Residence 5, PNEV, power off to farm,turbines on.

EXHIBIT 6

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

In the Matter of the Application of San Diego Gas & Electric Company (U 902-E) for a Certificate of Public Convenience and Necessity for the Sunrise Powerlink Transmission Project	Application 06-08-010 (Filed August 4, 2006)

PHASE II DIRECT TESTIMONY OF TRAVIS LONGCORE ON BEHALF OF THE CENTER FOR BIOLOGICAL DIVERSITY AND THE SIERRA CLUB

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Dated: March 12, 2008

TESTIMONY OF TRAVIS LONGCORE, PH.D.

My name is Travis Longcore. I have been retained to provide written and oral testimony on the biological impacts of the proposed Sunrise Powerlink Transmission Project with special emphasis on avian collision and electrocution and other impacts to birds. I am currently Research Assistant Professor of Geography at the University of Southern California Center for Sustainable Cities where I am Director of Urban Ecological Research. I am also Science Director of The Urban Wildlands Group, a Los Angeles-based conservation nonprofit. I have taught for seven years at UCLA for the Department of Geography, Institute of the Environment, and Department of Ecology and Evolutionary Biology. Courses taught include Environmental Impact Assessment, Bioresource Management, Ecology, and Field Ecology.

For the past ten years I have consulted on land use issues, providing expert opinion on the compliance of proposed projects with various laws, including the California Environmental Quality Act, National Environmental Policy Act, California Coastal Act, Endangered Species Act, and Migratory Bird Treaty Act. In this capacity I have reviewed dozens of environmental reports and evaluated the quality of their biological resources analysis. I have expertise in the scientific literature describing avian collisions with structures, particularly with lighted communication towers, but also with wind turbines and other structures. Further information about my background can be found in the attached curriculum vitae.

This testimony is based on the Draft Environmental Impact Report/Environmental Impact Statement and Proposed Land Use Plan Amendment ("DEIR/EIS"), peer-reviewed scientific articles that are cited herein, assumptions predicated on these sources, and expert opinion supported by these facts and assumptions.

Collision Impacts

The DEIR/EIS does not provide adequate data to describe and mitigate the impacts resulting from avian collisions with the proposed power transmission lines. Guidance for identifying and mitigating impacts from collisions is available (APLIC 1994) and the DEIR/EIS claims that the project will follow these guidelines in designing and siting towers. "The applicant shall install the transmission lines utilizing Avian Power Line Interaction Committee standards for collision-

reducing techniques as outlined in 'Mitigating Bird Collisions with Power Lines: The State of the Art in 1994'" (p. D.2-147). APLIC is a well-respected utility-supported organization that is run by the Edison Electric Institute, which is the research arm of the utilities. The authors of the APLIC guidelines include a U.S. Fish and Wildlife Service biologist, a respected ornithologist from Clemson University, and a retired electrical engineer from a utility company (APLIC 1994). They received input from a broad range of electric utility companies and the resulting guidelines are widely accepted by the industry. A comparison of these guidelines and the DEIR/EIS reveals, however, that these techniques have not been utilized in the siting and design of towers for this project.

It deserves mention that avian collisions with power lines can be reduced through tower design and siting decisions, but collisions cannot be eliminated (Alonso et al. 1994; Brown and Drewien 1995; Janss and Ferrer 1998). Even a single tower can kill many birds in a single night under adverse conditions, as was shown by a 100-foot unlighted communication tower on a ridge in West Virgina that killed 75 birds in a single night (Wylie 1977). This type of blind collision can occur during the day as well (Emerson 1904; Bevanger 1998; Janss 2000). Even after following all possible mitigation measures currently available, avian collisions will continue to occur with power lines. For this reason, site planning is critically important to minimize impacts of new routes. As summarized by Janss (2000), "Because mitigation measures only reduce collision mortality, but do not solve it, adequate route planning of power lines is especially important."

APLIC (1994) provides the following guidance on route planning:

- Keep lines distant from areas where birds are taking off or landing (e.g., wetlands).
- Keep lines below the height of vegetation (in forests).
- Avoid topographic features that concentrate migratory birds (e.g., mountain passes, river valleys).
- Orient lines parallel to primary flight patterns.
- Minimize the horizontal distribution of lines by placing them all at the same height rather than stacked at different heights. This is especially important because the majority of collisions occur with the overhead ground wire, which is typically smaller than other wires and virtually invisible to birds in flight.

Obviously a certain amount of field reconnaissance is necessary to gather the information needed to follow these guidelines. APLIC (1994) provides an entire chapter describing methods to observe birds in power line corridors and to evaluate the presence of birds for potential new corridors. They conclude:

> "All items that could affect the success of the project must be considered and evaluated before the line is built. In general, the purpose of preconstruction studies is to obtain information on bird flight altitudes, directions of flight, intensity of movement, species composition, and temporal variations in flight activity in and about the corridor. Day-time and night-time observations should be made by individuals who can identify birds correctly and gather quantitative data in a systematic fashion" (APLIC 1994).

The DEIR/EIS, despite claiming to follow the APLIC guidelines as part of mitigation measure B-10a, does not show any evidence that project applicants have done so in planning the route and designing the towers.

Some effort is made in the DEIR/EIS to identify migratory pathways for birds. These pathways are shown on several figures (D.2-1, D.2-2, D.2-3). The source given for these pathways is two email communications between a staff member at the San Diego Natural History Museum and consultants for the proposed project (p. D.2-540). The applicant has an obligation under the APLIC guidelines to collect data regarding the distribution, behavior, species composition, and collision susceptibility of the birds that will encounter all portions of the proposed project. Unfortunately, the DEIR/EIS incorrectly claims that it is not possible to know how many birds or what species might be impacted by the proposed projects (D.2-146 and repeated several times thereafter). To the contrary, the APLIC guidelines identify many techniques to evaluate the bird use of areas in route planning. These include: daytime and nighttime visual observation using tools to measure distance and altitude of birds (clinometers and theodolites), closed circuit television recordings, night vision tools such as image intensifiers, forward looking infra-red devices, and radar. In fact, radar techniques were developed to detect birds specifically to evaluate the risk of new transmission lines in 1978 (Korschgen et al. 1984). These tools can be used to develop a reasonable assessment of the quantity and general species composition of birds that might be at risk of collision. Examples of such efforts are available in the published literature. Williams et

al. (2001) used radar, visual observations, and a ceilometer to describe birds migrating through a mountain pass. Mabee and colleagues have described bird numbers and altitude of flight using radar at proposed wind power sites (Mabee and Cooper 2004; Mabee et al. 2006). Others have used nocturnal flight calls to identify passing migrants (Farnsworth et al. 2004; Farnsworth and Russell 2007).

It is common for energy projects that may impact migratory birds to include detailed studies of bird migration using a combination of visual observation and radar investigation as part of the environmental review process. The APLIC guidelines cite three such examples (James 1980; McKernan et al. 1982; Gauthreaux 1991). A cursory Internet search reveals many other examples of pre-construction monitoring of birds for potential impacts, including reference to a study of "bird migration in relationship to a proposed powerline and proposed mitigation" by the Golden Valley Electric Association in Alaska, and numerous studies of risk to birds from wind power projects (Mabee and Cooper 2004; Mabee et al. 2006). There are consulting firms that specialize in such studies, offering services such as "monitor rates of nocturnal and diurnal bird migration/movements" and "identify migration and movement corridors for birds" (www.abrinc.com). For projects with potential impacts from avian collision, fieldwork using radar and other techniques is common (Korschgen et al. 1984; Cooper et al. 1991; Harmata et al. 1999; Deng and Frederick 2001; Gauthreaux and Belser 2003; Mabee and Cooper 2004; Mabee et al. 2006).

Although the DEIR/EIS should rely on data gathered in the field at proposed transmission line sites to assess the collision risk of potential structures, it is remarkable that the DEIR/EIS contains no data from San Diego Gas & Electric regarding collisions (or electrocutions) of birds at existing high voltage transmission lines. Given the environmentally oriented operating procedures described in the DEIR/EIS, it would seem that SDG&E personnel would have collected data regarding collision events (incidental observations made by maintenance staff) or electrocution events resulting in power outages. Other utilities collect such data, especially on electrocutions, because they result in service interruptions (APLIC 1994, 2006). Although such data are rarely collected by systematic surveys, they would at least give an indication of the patterns of species vulnerability to collision and electrocution in the project area at existing transmission lines.

Absent data from original studies or incidental observations from SDG&E at existing lines, potential mortality and vulnerable species must be discerned from the scientific literature. Although most migrants travel at altitudes greater than the tops of the proposed towers (Able 1970; Bellrose 1971), a certain proportion of migrants is found nearer the ground, especially during inclement weather or daytime migration (APLIC 1994). Mabee and Cooper (2004) found that at two locations in Oregon, 12–14% of spring migrants were flying below 100 m (328 feet). For a fall migration in West Virginia, 12.7% of birds flew below 100 m (Mabee et al. 2006). These studies show that at given times birds are migrating at an altitude where they could collide with powerlines (e.g., below 100 m).

Ornithologists have identified characteristics that make certain bird species especially vulnerable to collisions (Bevanger 1994; Savereno et al. 1996; Bevanger 1998; Janss 2000). Rails, coots, and cranes (Gruiformes) are most frequently recorded birds killed at powerlines (Bevanger 1998). Other groups at risk include waterbirds and diving birds such as ducks (Anseriformes) and loons (Gaviformes), which also have high "wing loading," which means that their wings are small relative to their weight (Bevanger 1998). These species are unable to maneuver to avoid powerlines, especially in low visibility conditions. Many shorebirds (Scolopacidae) are collision victims, partially because they encounter many lines in their long migratory routes (Bevanger 1998). Aerial predators, such as swifts, many raptors, and even gulls, are at risk because they spend so much time in flight that they have an increased probability of colliding with wires than other species that fly less (Bevanger 1998; Janss 2000).

Collision mortality is of particular concern for species that are in decline (Bevanger 1998; Janss 2000). Usually such species are identified as "sensitive" or are formally listed as threatened or endangered species. For those bird species identified as sensitive in the DEIR/EIS, many fall into groups that are susceptible to collision with power lines. These include the raptors (Cooper's hawk, golden eagle, long-eared owl, ferruginous hawk, Swainson's hawk, northern harrier, white-tailed kite, prairie falcon, bald eagle), common loon, greater sandhill crane, least bittern, and long-billed curlew. Also at risk are all smaller migratory species, which are killed in collisions but are much more difficult to locate under wires than larger species.

The DEIR/EIS fails to recognize the hazard posed to resident and migratory birds of the Salton

Sea and the agricultural fields to the south of it. The proposed northern route would pass along and through the western edge of the agricultural zone and within two miles of the Salton Sea itself. The agricultural fields are even more important than the Salton Sea itself to many wading birds (cattle egret, white-faced ibis, sandhill crane) and shorebirds (mountain plover, whimbrel, long-billed curlew) (Shuford et al. 2002), yet the DEIR/EIS does not recognize the increased risk of mortality posed by a new transmission line through this essential habitat. Furthermore, the DEIR/EIS does not identify the risk of constructing a power line across San Felipe Creek, less than 1.5 miles from wetland habitats on the southwestern edge of the Salton Sea. This area is identified as supporting particular concentrations of colonial waterbirds (Shuford et al. 2002). Because of the proximity to wetland habitats associated with the Salton Sea and the rather extensive marsh and stream habitats along San Felipe Creek and San Sebastian Marsh, birds can be expected to move between the Salton Sea and the San Sebastian Marsh. These will include members of the very groups of birds that are at high risk of collision with power lines. Indeed, the earliest records of power line mortalities are derived from exactly this situation, where power lines are located between and adjacent to wetland habitats (Emerson 1904).

The DEIR/EIS should consider impacts to sensitive bird species at the Salton Sea from collision with the Imperial Valley Link (Table 1). These species have morphological characteristics that predispose them to collisions with power lines (Bevanger 1998; Janss 2000) and the DEIR/EIS fails to identify many of them as being impacted by the proposed power line.

Table 1. Sensitive species associated with Salton Sea and agricultural lands (Shuford et al. 2002) that are vulnerable to collision with power lines (Emerson 1904; McNeil et al. 1985; Bevanger 1998; Janss 2000). Status is indicated as California Bird Species of Special Concern (BSSC), federal Birds of Conservation Concern (BCC), and listing status under state and federal endangered species acts.

Species	Status
brown pelican	Federally endangered
American white pelican	California BSSC, Federal BCC
American bittern	Federal BCC
least bittern	California BSSC, Federal BCC

greater sandhill crane	California threatened, Fully Protected Species
lesser sandhill crane	California BSSC
white-faced ibis	Federal BCC
wood stork	California BSSC
fulvous whistling-duck	California BSSC
black rail	California Threatened, Federal BCC
Yuma clapper rail	Federal Endangered
greater sandhill crane	State Threatened, Fully Protected Species
long-billed curlew	Federal BCC

Collision with power lines is the principal cause of death for sandhill cranes (California Department of Fish and Game 1994), which are threatened and fully protected species in California. Collisions occur during migration and when power lines are found in feeding areas (Krapu et al. 1984; Windingstad 1988). The construction of major power lines within known feeding areas south of the Salton Sea would constitute a significant impact to sandhill cranes, which the DEIR/EIS overlooks entirely.

Part of the risk to waterfowl from power lines is that waterfowl rarely fly under power lines but rather attempt to gain altitude and fly over them (Morkill and Anderson 1991). This makes them vulnerable, especially when they see transmission lines and gain altitude, only to collide with the nearly invisible ground wire above the energized lines (Morkill and Anderson 1991). Marking ground wires is consequently a common mitigation technique (APLIC 1994; Brown and Drewien 1995; Janss and Ferrer 1998).

The proposed aboveground transmission line routes would be a permanent hazard to resident and migratory birds. Far greater field data must be conducted to describe this risk, but it is probably significant in most of the undeveloped regions of the project area. The proposed project design, as far as it is revealed in the DEIR/EIS, does not minimize those impacts, nor does it follow the APLIC recommendations to do so.

1. *Keep lines distant from areas where birds take off or land.* The Imperial Valley Link

cuts through habitat highly utilized by wintering birds (agricultural lands) and between wetland habitats. The Anza-Borrego Link, Central Link, and Inland Valley Link traverse habitats where dense populations of birds live and through which many species migrate. No mitigation for the Imperial Valley Link is even proposed.

2. *Keep lines below the height of vegetation.* This minimization measure is not available for the proposed project because the vegetation types through which the lines would pass are not forested.

3. *Avoid topographic features that concentrate migratory birds.* Although the proposed routes do not follow ridgelines, they do follow valley floors, which can also concentrate migrants. Furthermore, no data were collected to describe the movement of birds across the various project areas so no conclusions can be reached whether migratory pathways have been avoided.

4. *Orient lines parallel to primary flight patterns.* No studies were conducted to determine these flight patterns, but the extent of the project guarantees that this recommendation cannot be followed throughout.

5. *Minimize horizontal distribution of lines.* The proposed project fails to follow this recommendation. The 500 kV tower design includes two ground wires at the top of the tower with the main circuits hanging below. In areas with the 69/92 kV underbuild the towers include three heights of wires spread over 60–70 feet (Figure B-19). All of the steel pole towers show circuits at several heights (B-16 to B-18) rather than at the same height. None of these designs are consistent with the APLIC (1994) recommendations because they spread the wires over a vertical area of 60–80 feet. If all cables were to be at one level, one change in altitude would allow birds to avoid them (Janss 2000). The current designs therefore do not minimize collision risk to birds.

Mitigation Measure B-10a further suggests the use of diversion devices for a portion of the project in the Imperial Valley and Anza-Borrego links. Diversion devices can reduce mortality of birds by 50% and sometimes 75% (Morkill and Anderson 1991; Alonso et al. 1994; Brown and Drewien 1995; Janss and Ferrer 1998). Such a reduction is an improvement, but certainly does

not represent reduction of the significant impact to a less than significant level given the miles of lines to be installed and the vulnerable species known to live and migrate near these lines. Appropriate studies of these transmission corridors following the APLIC (1994) guidelines would allow for an adequate description of additional risk to birds from collisions with the proposed lines but these studies have not been conducted. Sufficient data are not presented in the DEIR/EIS to support the claim that impacts to birds from collision with the proposed transmission lines would be mitigated to a less than significant level and indeed, collisions could result in take of federal and state protected species.

Electrocution Impacts

Electrocution by power lines is a significant source of mortality for some bird species to the extent that population density and distribution is altered (Sergio et al. 2004). The DEIR/EIS describes a project that will consist of large transmission lines, while most mortality from electrocution derives from smaller distribution lines where the separation between wires is smaller (Lehman 2001; APLIC 2006). The proposed project also involves relocation of a 69 kV distribution line along the Central Link of the project (p. D.2-144). Although the DEIR/EIS argues that the electrocution risk will be the same as before, this relocation makes the relocated distribution line part of the project and therefore impacts must be identified, minimized, and mitigated. The project also does not fully account for the collision risk posed by the 69 or 92 kV underbuilds along several project links. The depictions of such structures (Figure B-19) do not provide measurements of the distances between the energized conductors and between the innermost conductor and the steel structure. The renderings are apparently not to scale, but it seems possible that the underbuild lines might be close enough to allow for electrocution of birds.

The DEIR/EIS does not discuss the potential of "streamers" to cause flashovers on power lines. "Streamers" are long streams of bird excrement that can span energized conductors and other line structures. A flashover is a fault that originates on the energized conductor and travels through the streamer to the structure (APLIC 2006). These may cause power outages and occasionally bird mortalities (APLIC 2006). The DEIR/EIS should discuss this potential problem relative to the tower designs proposed for the project.

Transmission Towers as Perches

The construction of transmission towers across areas that have few natural perches can dramatically alter the distribution of raptors and ravens (Knight and Kawashima 1993; Knight et al. 1993). For example, a study of raptor habitat use and density following construction of a 230 kV transmission line with 75-foot towers across open prairie in Colorado showed a significant increase in raptor density within 1,300 feet (0.4 km) of the towers (Stahlecker 1978), essentially changing the distribution of raptors across the landscape. Although towers were 1.5% of the available perches, they accounted for 81% of raptor perch sites (Stahlecker 1978). Such artificial concentration of predaceous species by power lines has been confirmed in other studies (Knight and Kawashima 1993) can have adverse impacts on prey species (Lammers and Collopy 2007).

The DEIR/EIS acknowledges that transmission towers would provide additional nest sites for red-tailed hawks but asserts that the number of red-tailed hawks would be controlled by prey availability (p. D.2-148). This argument does not, however, account for the altered distribution of raptors within the landscape that results from transmission tower construction (Stahlecker 1978). This impact is in fact significant because of the concentration of predator activity in certain areas and its effects on sensitive species. The DEIR/EIS offers no mitigation for this impact.

The mitigation proposed for increased density of ravens associated with transmission towers is to develop a raven control plan for Anza-Borrego State Park and in habitat for desert tortoise and flat-tailed horned lizard (MM B-11a, b). Ongoing lethal control of ravens, as implied by the text of the mitigation measure, is far less desirable than avoiding such impacts. Undergrounding lines along existing roads would avoid this impact entirely.

Noise

The analysis in the DEIR/EIS of the impacts of increased noise from construction and operations on sensitive bird species relies on the faulty assumption that they are not affected by noise levels less than 60 dB(A). The DEIR/EIS applies this standard to least Bell's vireo, southwestern willow flycatcher, California gnatcatcher, and other species. Least Bell's vireo was located along the proposed route in the Anza Borrego Link (Yaqui Well) and Central Link (assumed present at MP 101), while southwestern willow flycatcher is assumed present along the Central Link (MP

101). These species were located or assumed present along several of the alternative routes as well.

The 60 dB(A) threshold for impacts on avian species was established in 1991 by a study conducted for the San Diego Association of Governments in which "it was theoretically estimated that noise levels in excess of 60 dB(A) Leq in [Least Bell's] vireo habitat would mask the bird's song, subsequently reducing the reproductive success of this species during their breeding season...." (County of San Diego 2000). This study, on which the U.S. Fish and Wildlife Service apparently based its acceptance of the 60 dB(A) threshold as well, to our knowledge has never been published or peer reviewed. The DEIR/EIS refers to Bowles and Wisdom (2005) as a source for the standard but this published abstract of a conference paper questions, and does not support, the use of the 60 dB(A) standard.

Since 1991, scientific understanding of the effects of noise on birds has improved greatly, with studies published that present heuristic and mathematical models that quantify the pattern of impacts caused by noise (Hill 1990; Reijnen and Foppen 1994; Reijnen et al. 1996; Reijnen et al. 1997; Forman et al. 2002; Peris and Pescador 2004; Slabbekoorn and Ripmeester 2008). Rather than relying on undocumented research nearly two decades old, it is incumbent upon the applicant to incorporate the best and most up-to-date scientific evidence of the impacts of noise on breeding birds in the environmental analysis of the proposed project.

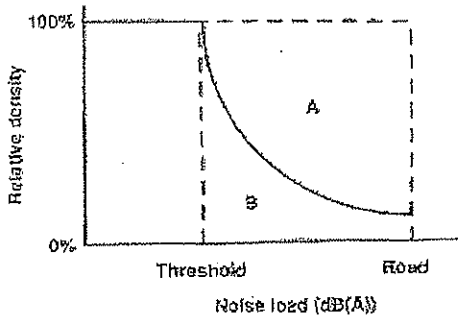


Figure 1. Threshold model for relative breeding density of birds plotted against traffic noise, where T is the threshold value and R the value at the roadside [or other noise source]. The decrease factor of the density = area of A/(area of A + B). Caption and figure reproduced from Reijnen et al. (1995).

In the late 1990s, a group of Dutch ecologists investigated the effects of traffic noise on breeding bird density. Of 45 bird species investigated in woodlands in The Netherlands, 33 showed significantly depressed breeding density near roads. All species in the small passerine families Sylviidae, Fringillidae, and Emberizidae were affected by noise (Reijnen et al. 1997). This research also showed that noise effects followed a threshold model (Reijnen et al. 1995). This means that up to a certain noise level, no decrease in density is observed. When noise increases beyond that threshold level, bird density decreases dramatically in the area between the location at which that threshold is met and the road (Figure 1). The decreased density over the area with noise greater than the threshold level ranges from 30% to 100% and is known as the "decrease factor" (Reijnen and Foppen 1995; Reijnen et al. 1995). These two variables, the threshold and the decrease factor, describe the impact of road noise on breeding birds. Empirical measurement of the threshold value in woodlands shows that for all bird species combined the threshold value is 42–52 dB(A), with individual species exhibiting thresholds as low as 36 dB(A) and as high as 58 dB(A) (Reijnen and Foppen 1995; Reijnen et al. 1995). Furthermore, years with overall low population densities showed lower threshold levels. This information can be used to evaluate the impacts of noise from the proposed project from construction, maintenance, and operation (corona noise).

The least Bell's vireo and southwestern willow flycatcher are small songbirds that rely on hearing songs to attract mates and defend territories. Habitat for both species would be impacted by noise from the proposed project (Figs. Ap8C-06, Ap8C-10). The studies of road noise from Europe include similar small songbirds that use acoustical communication. The threshold levels for two European warbler species (*Phylloscopus sibilatrix* and *Phylloscopus trochilus*) are 26 dB(A) and 39 dB(A), with decrease factors of 0.61 and 0.38, meaning breeding density was diminished to ~40–60% of undisturbed levels (Reijnen et al. 1995). From the published literature, therefore, a reasonable threshold based on similar species for least Bell's vireo and southwestern willow flycatcher would be 40 dB(A) or below. Data from California support this conclusion. In 1999, Haas recorded sound levels (one hour A-weighted Leq) at 87 locations in the vicinity of the southwestern willow flycatcher colony along the San Luis Rey River in the vicinity of the Lake Henshaw Dam. The study site harbors the most robust and stable southwestern willow flycatcher colony in California. Sampling locations were established along the river; 100 meters

(the approximate average length of a southwestern willow flycatcher territory within the colony) separated each location. The territories were nearly identical in all habitat characteristics except sound level. Of these territories, 44 were occupied by either a pair of flycatchers (n = 42) with a nest, a solitary male (n = 1), or a solitary female (n = 1). Using sound as the independent variable, and occupancy as the response variable, I completed a logistic regression on these data. The results were highly significant ($p < 0.0001$, $r^2 = 0.49$), indicating with certainty that territory occupancy is reduced by sound levels in the 50–60 dB(A) range.

A conclusion that noise impacts on sensitive bird species such as southwestern willow flycatcher and least Bell's vireo start below 50 dB(A) is robust. Thresholds for other bird species have been determined to be in the 40–50 dB(A) range (Reijnen et al. 1997). The 60 dB(A) threshold currently used by the DEIR/EIS will be ineffective at eliminating noise impacts, and in fact noise at the 50–60 dB(A) level could deter breeding activity altogether for some species. According to the DEIR/EIS, corona noise from the 500 kV transmission line would increase ambient noise levels within the project right of way to 52 dB(A) along a number of project links under certain weather conditions (Table D.8-13). Noise from construction and maintenance activities would also increase noise levels for sensitive bird species. These impacts should be evaluated with a lower threshold that is based on the published scientific literature rather than the unsubstantiated 60 dB(A) threshold.

Helicopter Disturbance

The DEIR/EIS discloses that 111 towers will be built using helicopters to deliver materials (p. B-84) and furthermore describes complete inspection of the system using helicopters on at least an annual basis (p. D.2-149). Yet the DEIR/EIS only describes helicopter disturbance within the context of impacts to Peninsula bighorn sheep (p. D.2-114). The DEIR/EIS gives no limits to the frequency of helicopter flyovers for the lines (p. D.8-18). Many other wildlife groups are affected by helicopter disturbance than bighorn sheep (Efroymson and Suter 2001), and the DEIR/EIS does not contain a complete discussion of the impacts of helicopter disturbance on these groups. Efroymson and Suter (2001) summarized the literature on the effects of military overflights on wildlife and found thresholds for impacts to wildlife from rotary-wing aircraft for raptors, waterfowl, and ungulates. For example, flights within 15 km can disturb waterfowl,

which only sometimes become habituated to such disturbance (Efroymson and Suter 2001). Raptors can similarly be disturbed and while some species can become habituated (such as red-tailed hawks, which are known for habituating to human activity) other species may abandon an area that has been disturbed by helicopter overflights (Andersen et al. 1989). The DEIR/EIS uses a mitigation approach for golden eagles that limits disturbance from helicopters (and other noise sources) to the period outside of breeding season when within 4,000 feet of a nest site (Mitigation Measure B-7h). This measure is not sufficient to protect golden eagles from adverse impacts. Scientific literature on this subject is clear, "The presence of humans detected by a raptor in its nesting or hunting habitat can be a significant habitat-altering disturbance even if the human is far from an active nest" (Richardson and Miller 1997). Regardless of distance, a straightline view of disturbance affects raptors, and an effective approach to mitigate impacts of disturbance for golden eagles involved calculation of viewsheds using a three-dimensional GIS tool and development of buffers based on this (Camp et al. 1997; Richardson and Miller 1997). The DEIR/EIS assumes that impacts to golden eagles can be avoided by a 4,000-foot buffer from nest sites, but this approach will not avoid disturbance to hunting habitat or line-of-sight impacts from nest sites, regardless of distance. Helicopters will be a chronic intrusion into areas that currently have no such artificial disturbance.

Electromagnetic Fields

The DEIR/EIS contains an electromagnetic field (EMF) management plan, but places undeveloped land as the lowest priority for implementation of low-cost measures to reduce EMFs (Appendix 7, p. 6). This approach ignores the adverse impacts of EMFs on wildlife that have been documented in the scientific literature.

Birds are closely associated with powerlines through perching, nesting on supporting structures, and exposure to EMFs in habitats below and adjacent to lines (Fernie and Reynolds 2005). An experimental study exposed America kestrel (a raptor found along the project route) to electromagnetic fields equivalent to being under a 735 kV transmission line (Fernie et al. 2000). The pairs exposed to EMFs had higher fertility but poorer hatching success (Fernie et al. 2000). Behavior was affected as well, with pairs exposed to EMFs maintaining higher activity levels.

Such activity is not desirable during nesting when reductions in activity levels are associated with egg-laying and protection of eggs (Fernie and Reynolds 2005).

A German study showed increased egg size in one species nesting under a 100 kV power line, decreased egg size in another species, and no difference in two other species (reported in Fernie and Reynolds 2005). A review of studies of embryonic development found that most studies (88%) found adverse effects resulting from exposure to EMFs similar to that experienced by nesting under power lines (Fernie and Reynolds 2005). Exposure to EMFs also has been shown to inhibit production of the hormone melatonin, which helps to regulate seasonal behaviors such as nesting, molt, and migration (Fernie et al. 1999). Even though relatively few studies of the effects of EMFs on birds have been completed, "much of the research has found that EMF exposure has generally affected birds, and most of the effects have been adverse" (Fernie and Reynolds 2005). The DEIR/EIS errs in failing to consider the impacts of EMFs on birds and other wildlife and consequently fails to identify significant adverse impacts to bird habitat across the aboveground portions of the proposed transmission line.

Fragmentation Impacts

The proposed project will have impacts to native ecosystems that extend well beyond the footprint of the transmission towers and associated road infrastructure. These impacts are not adequately described in the DEIR/EIS. One such mechanism is through "bottom-up" effects whereby invertebrate communities are disrupted, which then affects other wildlife. Disturbance of natural scrub and chaparral communities will promote the invasion of alien insect species, such as the Argentine ant (*Linepithema humile*). The deleterious effect of Argentine ants on native arthropods is well documented; many studies report a decrease in arthropod diversity as Argentine ant abundance increases (Erickson 1971; Cole 1983; Human and Gordon 1996, 1997; Holway 1998a; Kennedy 1998). The proposed project will promote invasion of Argentine ants by providing two conditions that increase invasion: a water source (Holway 1998b; Human et al. 1998; Holway and Suarez 2006) and increased disturbance (Human et al. 1998). These are provided in the form of watering for dust suppression (D.2-165), washing of insulators on towers (B-98), and by construction and maintenance activities. Argentine ants invade far beyond dis-

turbed areas and water sources and into surrounding undisturbed habitats, with increased abundance documented to a distance of up to 650 feet (Suarez et al. 1998).

The proposed project will also involve destruction of habitat as part of the fuels management program (p. D.15-64). Community level analysis indicates that arthropod species composition will change and overall diversity will decrease when native habitats are subjected to fuel modification. Disturbed coastal sage scrub sites have fewer arthropod predator species such as scorpions and trap-door spiders, and are dominated by exotic arthropods such as Argentine ants, European earwigs (*Forficula auricularia*), pillbugs and sowbugs (*Armadillidium vulgare* and *Porcellio* sp.), and the sowbug killer (*Dysdera crocata*) (Longcore 2003). These changes in arthropod species diversity will have resonating impacts on vertebrates that use arthropods as prey species. Suarez et al. show that coast horned lizards prefer native ants (*Pogonomyrmex* and *Messor* spp.) as their food source and suffer when these species are eliminated by invading Argentine ants (Suarez et al. 1998).

Disturbance associated with road building and vegetation clearance promotes the invasion of plant species already associated with residential development. Alien plant species found in southern California wildlands are largely associated with disturbed areas, including cleared areas (Rundel 2000). This relationship between invasive exotics and disturbance is found throughout California and in other Mediterranean regions (Kotanen 1997; Rundel 1998). The understories of areas subject to fuel modification are rapidly dominated by invasive exotic grasses and forbs. As described by Keeley, "Prefire fuel manipulations such as fuel breaks produce conditions that favor weedy aliens and thus act to increase the alien presence, increase the movement of aliens into wildlands, and increase seed sources capable of invading after fire" (Keeley 2002). Incidentally, this increases fire frequency as well (Minnich and Dezzani 1998).

As discussed extensively in the literature (Mooney et al. 1986; Minnich and Dezzani 1998; Rundel 1998), invasive plant species can profoundly affect ecosystem structure and function by modifying fire regimes, nutrient cycling, and erosion patterns. The roads, towers, and associated fuel modification will affect an area far greater than the footprint of these activities themselves by promoting the invasion of exotic plants and animals into wildlands.

Inadequacy of Analytical Approach

The presentation of significant impacts categorized by impact class and associated mitigation measures without the necessary studies is a hallmark of the DEIR/EIS. In numerous instances the DEIR/EIS makes conclusions about the severity of impacts based on incomplete information and defers the surveys necessary to gather this information until after project approval. An environmental disclosure document fails if it simply acknowledges vague significant impacts but does not actually provide information about the scope and nature of those impacts. This information is critical because it is needed for the public and decisionmakers to determine if mitigation measures can offset the impacts, whether impacts can be avoided, and whether it is tolerable to approve the project even though the significant impacts remain. The non-specific approach characterized by the entire DEIR/EIS denies the public and decisionmakers knowledge of the actual extent of the impacts on biological resources. For example, the DEIR/EIS acknowledges that the development of a project in Mexico near La Rumorosa would create a significant impact from the collision of birds with turbines (p. D.2-263) but provides no further detail on the scope of this impact or the species that are likely to be involved, save for a general species list (p. D.2-248). It might have been possible, based on site surveys and comparison with other wind projects, to predict that the project would kill around 815 birds per year (using the equation in the caption of Figure 1 of Barclay et al. 2007 as a rough approximation, assuming 125 440-foot tall turbines). This number could include golden eagles and other sensitive species. Collision mortality would be a significant impact that cannot be mitigated, which is the same conclusion reached in the DEIR/EIS, but such descriptions of magnitude would allow decisionmakers to weigh whether the overall benefit of the proposed project would be greater than the significant impacts it would have.

Another example illustrates the need for more specificity in the impact analysis. The DEIR/EIS provides no estimate of the number of birds that might collide with the transmission wires or what species they might be. Absent the field surveys necessary to describe such risks, the scientific literature provides some guidance. Janss and Ferrer (1998) found 43 birds in 20 surveys conducted over two years with some spans marked with diverters during the second year on 4.5 km of 380 kV line on lattice towers through scrubland, grassland, and agricultural lands in Spain, equaling 1.7 birds per mile per year. Approximately 30% of these birds were common cranes

Of the several routes running south down Route 79 from the Lake Henshaw area, the Santa Ysabel SR79 Underground option is superior because it avoids the fragmentation and habitat loss associated with the aboveground route and its access roads.

Farther along in the Coastal Link, the Los Peñasquitos Canyon Preserve and Mercy Road Alternative is an underground route that is worse than the proposed project because it disturbs existing preserve areas. This raises an additional question for the evaluation of project impacts. The DEIR/EIS reports on the compliance of various routes with federal, state, and local land use plans. It is not evident, however, whether the project would involve construction and impacts in areas that were set aside as mitigation in previous CEQA or NEPA documents. Many of the developments in San Diego County were approved based on assumptions about the protection of habitats set aside within and adjacent to the developments in addition to off-site mitigation sites.

The southern transmission route is superior to the northern route because it follows an existing transmission line through much of the inland reaches, then follows Interstate 8 through the mountains. By staying close to existing development and disturbance sources this route is somewhat less damaging than the northern route. The DEIR/EIS, however, identifies Modified Route D as part of its "environmentally superior" southern route. From a biological perspective, Route D is worse than the Interstate 8 alignment because it is longer, destroys more native vegetation, and would disturb an additional golden eagle nest site and additional least Bell's vireo habitat. The only reason the DEIR/EIS identifies Modified Route D as superior is because of reduced visual impacts, but this choice comes at the expense of biological resources.

Wind Development

The DEIR/EIS contains a description of impacts and mitigation measures for the development of a wind power generation project to be located at an undetermined site in northern Mexico near La Rumorosa. The DEIR/EIS does not describe the exact route for the transmission line either in Mexico or the United States or the location of the wind turbines. This portion of the DEIR/EIS fails to meet common standards for provision of a complete and consistent project description. It furthermore fails to show adherence to the State of California's guidelines for design and siting of wind facilities to reduce impacts to birds and bats (California Energy Commission 2007).

These guidelines identify the need to collect one or more years of field data on bird and bat populations for projects located in areas that may impact special status species (California Energy Commission 2007, p. 9). The DEIR/EIS simply cannot support any conclusions about the proposed project element without conducting the necessary field studies.

The description of the impacts of wind development contains the assertion that taller towers would decrease raptor mortality at the La Rumorosa site (D.2-262). However, recent research has shown that turbine height is weakly and positively correlated with bird mortality, and taller turbines kill exponentially more bats than shorter turbines (Barclay et al. 2007). Bat mortality at wind projects is a grave conservation concern (Kunz et al. 2007; Arnett et al. 2008) and recent research should be incorporated into the DEIR/EIS to identify and avoid these impacts.

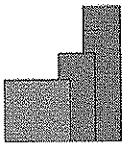
Conclusion

The absence of detail about the magnitude and species-specific context of impacts is a pervasive problem with the DEIR/EIS. The logical and factual basis upon which evaluation of mitigation and minimization measures rests is absent in many instances. Useful comparative information from other similar projects that might help quantify impacts is missing. In sum, the DEIR/EIS is insufficient because it fails to identify significant impacts that will result from the project, it fails to provide adequate descriptions of the identified significant impacts and their mitigation measures, and it lacks the analytical connective reasoning to place impacts to biological resources in context.

I declare under penalty of perjury this testimony is, to the best of my knowledge, true and correct.

/s/ Dr. Travis Longcore

EXHIBIT 7



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Re: Proposed "**Project**" in joint PUC/BLM Draft EIS / EIR
ECO / Boulevard Substation, Tule Wind and Energia Sierra Juarez (ESJ)
Gen-tie line to US/Mexico border.
&
Cumulative Projects include Campo Wind, Manzanita Wind and Jordan Wind
(Enel Jewel Valley Project)

Dear Messrs.' Thomsen and Fisher:

On behalf of Backcountry Against Dumps, The Protect Our Communities Foundation, East County Community Action and Donna Tisdale, I am submitting this real estate impact evaluation for your consideration and use in addressing the captioned wind energy projects. The scope of work and my professional opinions have been developed independently.

The Project is comprised of several wind turbine projects and related HVTL and substation infrastructure. Compliance of the proposed facilities with the County of San Diego Zoning Ordinance requirements for Major Use Permit(s) (MUP) has been evaluated from a real estate valuation and land use perspective, and I have also evaluated the combined projects pursuant to the issue of economic impacts, in consideration of EIR/EIS requirements.

My professional opinions are effective as of the current date, and my evaluation and this Consulting Report have been prepared and submitted pursuant to applicable licensing laws that mandate compliance with the Uniform Standards of Professional Appraisal Practice (USPAP), and my opinions are certified accordingly.

Professional Opinions

Briefly stated, based upon my review of the proposed Project facilities, the Project does not comply with the County of San Diego Zoning Ordinance requirements for a MUP, as it is not compatible with adjacent and nearby residential uses and will have a harmful effect on the desirable character of the neighborhood. The Project will cause substantial diminution and injury to property values in the area, averaging approximately 25% as far as 2 to 3 miles, and with approximately 5% value loss from the nearest turbines out to as far as 5 miles. The basis for my professional opinions are described and summarized herein.

Further, the HVTL infrastructure and substation facilities will cause varying levels of value impairment, separate and apart from the impact of industrial scale (400-500 foot) turbines.

Also, in my opinion, the EIR/EIS is deficient with regard to addressing property value impacts, and identifies no measures to mitigate against value losses in the surrounding area, particularly for residential property. In the event that the Project is approved, it should be conditioned upon implementation of a Property Value Guarantee (PVG). From a property value perspective, and to mirror the criteria of the EIR/EIS, implementation of a PVG that leaves property owners economically "whole" would Change a Class I impact to a Class II. A Class III level of mitigation is not possible, as marketing times will still be impaired for properties with the most visible impairment of vistas and/or an increase in noise levels (audible and low frequency) beyond the level of "noticeable" to "nuisance", or equivalent terms.

Finally, the reasonably foreseeable projects cited in the caption of this consulting report and described herein will cause a disproportionate and cumulative adverse impact on Boulevard, surrounding rural residential property, and the general Project area. The combined effect will be to surround and "blight" these residential uses and residents, and significantly expand the area of value impairment from the ECO / Boulevard Substation, Tule Wind and Energia Sierra Juarez (ESJ) Gen-tie line Project.

My specialized and unique experience with utility scale wind energy developments, as well as 30 years of real estate, land use evaluation and appraisal background has enabled and qualified me to evaluate whether the proposed Project meets the criteria described in the San Diego County Zoning Ordinance, the overall issue of economic impact, from a real estate and land use perspective, and the methodology that is appropriate for measuring property value damages from disamenities or environmental impairment.

My research continues, and I reserve the right to supplement my opinions at a later date, as may be warranted if the Project proceeds, testimony at hearing and/or in litigation becomes necessary. Other records considered in developing my opinions are retained in my work file for future reference.

Project Summary
Following review of Project documents and review of issues with the Boulevard Planning Group, the Project is summarized as follows:

Proposed Project in joint PUC/BLM Draft EIS / EIR includes ECO / Boulevard Substation, Tule Wind and Energia Sierra Juarez (ESJ) Gen-tie line to US/Mexico border. Full DEIR/EIS:
http://www.cpuc.ca.gov/environment/info/dudek/ecosub/ECO_Draft_EIR.htm

Project Description:
http://www.cpuc.ca.gov/environment/info/dudek/ecosub/Draft_EIR/B_ProjectDescription.pdf

Project Overview map at page 5 of link above.
Additional proposed projects whose impacts are analyzed at a qualitative program level include the Campo, Manzanita, and Jordan Wind projects. The entire impacted area is totally groundwater dependent.

The ECO Substation Project, as proposed by San Diego Gas &Electric , will be located east of the rural low income community of Jacumba CA 91934. It includes the following major components:

- Construction of a 500/230/138-kilovolt (kV) substation in Eastern San Diego County
- Construction of the Southwest Powerlink (SWPL) loop-in, a short loop-in of the existing SWPL transmission line to the proposed ECO Substation
- Construction of a138 kV transmission line, approximately 13.3 miles in length, running between the proposed ECO Substation and the rebuilt Boulevard Substation
- Rebuild of the existing Boulevard Substation.

Linked source of information above:
http://www.cpuc.ca.gov/environment/info/dudek/ecosub/Draft_EIR/00-NoticeofAvailability.pdf

Additional ECO Substation details:

- 58 acres with 25 acres of additional cut and fill
- 15 X 30 120,000 gallon water tank
- 2 retention basins, 1.2 and 1.9 acres
- Microwave communication tower and backup generator
- Tallest structure 135'
- Approximately 1,500' from nearest property line
- A new custom off-the-grid home is less than 3,600 feet just north side of I-8, at base of Table Mountain, with a gorgeous view over the proposed 80 plus acre substation site and on into Baja where the ESJ turbines will be.
- Document / maps do not disclose proximity of multiple vacant private properties within 1 mile.

- 13.3 miles of new 138 kV transmission line to connect with new Boulevard Substation.
- 14 homes reportedly located within 500 feet of new 138 kV line (DEIR/EIS D.85 Noise)

" The ECO Substation will be designed so that it will ultimately be expanded to include the following components:

- Five 500 kV bays
- Nine 239 kV bays
- Nine 138 kV bays
- Four 500/230 transformer banks
- Three 230/128 kV transformer banks
- One or more 500 kV series capacitors
- Two 230 kV , 63 MVAR shunt capacitors
- Four 12 kV. 180 MVAR shunt reactor banks
- One 230 kV static VAR compensator

The maximum amount of oil required for the transformers at the ECO Substation will be approximately 569,800 gallons. There does not appear to be any indication of where all these new transmission lines will run through the neighboring rural communities.

SDG&E's application states they planned to purchased approximately 6 parcels 500 acres of private undeveloped land in the In-Ko-Pah area. Source:
http://www.cpuc.ca.gov/environment/info/dudek/ECOSUB/SDG&E%20ECO%20Application_A0908003.pdf

The ECO Substation site appears to have been purchased. Large no trespassing signs have been erected in the area. Eminent domain was reportedly used to obtain several parcels.

Boulevard Substation:

- New 2-acre substation will be built on residential property immediately east of the existing substation.
- Currently designated 1 DU 4/8/20 acres and zoned S 92 Multiple Use. Pending General Plan Update will be rezoned as Semi-rural SR -10 1 DU/20, 20 acres.)
- Existing home and structures will be removed. Mature Oaks may be removed.
- 2 single family homes are located within 500-600 feet (DEIR/EIS D.85 Noise)
- Nearby homes are located south, west, north, and east of new site. (see current views at -14AFigure D.34 existing setting :http://www.cpuc.ca.gov/environment/info/dudek/ecosub/Draft_EIR/D-3_VisualResources.pdf

- About 50 homes are within about 1,500' of proposed substation and new 138 kV line as shown in Figure D.4-5c. More are out of site in the Calexico Lodge area across Old 80 to the Northwest.
- At least one known sensitive receptor, ill with cancer and suppressed immune system, lives less than 2,000 feet southwest of proposed substation. Their home is also about 750 feet from the SDG&E easement that is a potential route for two or more new 138 kV lines that will serve Campo and Manzanita Wind projects.
- Two steel poles 85' tall will be installed southwest of new substation
- Boulevard Expansion will allow for up to four generation tie-lines
- New 138 kV lines will come in from Jewel Valley to the south from ECO Substation
- New 138 kV lines will come in from the north from Tule Wind
- 2 New 138 kV lines will come in from the west along an unidentified SDG&E Easement (likely along the line that comes into the existing substation from the west) from unidentified new substation locations that will serve SDG&E's and Invenergy's proposed Campo and SDG&E's Manzanita Wind projects
- New 138 kV line will come in from the Jewel Valley area (south) , from the Ribbonwood Road area (northwest), and potentially from the McCain Valley Road / Old Hwy Road area (northeast)

http://www.cpuc.ca.gov/environment/info/dudek/ECOSUB/SDG&E%20ECO%20Application_A0908003.pdf

Iberdrola Renewables 200 MW Tule Wind Project (Pacific Wind)

The proposed Tule Wind Project, consisting of up to 134 wind turbines in the 1.5 to 3.0–megawatt (MW) range generating up to 200 MW of electricity, would be located in the McCain Valley in southeastern San Diego County, California. In addition to wind turbines and associated generator step-up transformers, the Tule Wind MW Project would include the following components:

- Proposed for approximately 15,000 acres of public land, some private ranch land, tribal land and State Land Commissions Land near Boulevard.
- Closet homes and the Lark Canyon and Cottonwood Campgrounds are 900 feet or more from turbines, transmission lines and ancillary facilities (DEIR/EIS D.86 Noise)
- The residence of an elderly couple, Robert and Kathryn McCallister (APN 61103002 & 61107002 McCallister Robert & Kathryn Trust), will be about 2,000 feet east of turbines, and less than 1,000 feet west of both the proposed 500 kV Sunrise Powerlink and Tule Wind 138 kV line.
- A 34.5 kV overhead and underground collector cable system linking the wind turbines to the collector substation
- A 5-acre collector substation and a 5-acre operations and maintenance (O&M) facility
- Two meteorological towers and one sonic detecting and ranging (SODAR) unit
- A 138 kV overhead transmission line running south from the collector SG&E Boulevard Substation

- 36 miles of newly constructed access roads and temporarily widened and improved existing access roads.
- Turbines in J string on tribal land will be 100 feet from Sawtooth Wilderness Area
- 11 Turbines on private inholdings in R string, East of McCain Valley Road would be surrounded BLM In-Ko-Pah Area of Critical Environmental Concern
- Turbines will be located within McCain Valley National Cooperative Land and Wildlife Management Area and inside the Lark Canyon Off-Highway Vehicle Park.
- BLM lands were down-zoned from Visual Resource Management Class II to Class IV, in the 2008 Eastern San Diego Resource Management Plan revision, specifically to accommodate the Tule Wind project. That downzone is the subject of unresolved federal litigation.

For public safety, permanent fences would be erected around the collector substation, meteorological towers, O&M facility, and the equipment storage area

ESJ Gen-Tie Project (Sempra Generation)

- Approximate 10 acres of impacts
- Proposed by Energia Sierra Juarez U.S. Transmission, LLC, the ESJ Gen-Tie Project
- Capacity to import up to 1,250 MW of wind / energy generated in northern Baja
- Will connect to existing SWPL Transmission Line through ECO Substation, east of Jacumba
- Constructed on three to five 150-foot lattice towers or 170-foot steel monopoles, extending south from the point of interconnection for about 0.5 mile to the U.S.-Mexico border.
- The DEIR/EIS addresses the gen-tie line including any potential impacts to the U.S. associated with wind turbines constructed in Mexico.
- This project also requires a Presidential Permit (PP-334) from the United States Department of Energy and a Major Use Permit from the County of San Diego.
- The County of San Diego will use the EIR/EIS to issue the Major Use Permit for its compliance with CEQA

Cumulative Projects include Campo Wind, Manzanita Wind and Jordan Wind that is now the Enel Jewel Valley Project with 158 MW of wind and 10 MW of solar.

Campo Wind Project

- SDG&E and Invenergy propose to construct and operate approximately 106 turbines capable of generating 160 MW of electricity on Campo tribal lands. (west of Tisdale ranch)
- Turbines (approximately 450 feet tall from ground to tip of the fully extended turbine blade) would be located on available ridgelines on the reservation.
- In addition to the 160 MW of generating capacity proposed for this project, the Campo Tribe has requested that an additional 140 MW of generation be

analyzed in the Bureau of Indian Affairs' NEPA review of the project for future development purposes.

- The proposed Invenergy and SDG&E Campo Wind Project would connect with the Boulevard Substation Rebuild component of the ECO Substation Project.

Manzanita Wind Project

- SDG&E proposal for 57.5 MW, which could include up to 25 wind turbines depending on the turbine size selected.
- Turbines to be located on the same ridgeline as the existing Kumeyaay Wind facility.
- Turbines are proposed to be approximately 414 feet tall from ground to tip of the turbine blade fully extended.
- Project would connect with the Boulevard Substation Rebuild component of the ECO Substation Project.
- It is expected that the Campo and Manzanita wind energy projects would develop a switchyard for both facilities on non-tribal lands and a new 138 kV transmission line would be constructed along the existing ROW of the 69 kV transmission corridor that currently connects to the existing Boulevard Substation.
- The new 138 kV transmission line would interconnect with the proposed Boulevard Substation Rebuild component of the ECO Substation Project.

Jordan Wind Project (now Enel Jewel Valley Project)

- Enel Green Power Jewel Valley Project changed the proposed 40 2.3 MW turbines (total generating capacity of 92 MW) into 158 MW wind and 10 MW solar tracking units on over 7,000 acres of ranch land.
- The towers of the proposed wind turbines would be approximately 260 feet tall (height from ground to tip of fully extended blade would be approximately 430 feet).
- Enel's preferred point of interconnection is the Boulevard Substation Rebuild component of the ECO Substation Project.

Proximity of turbines to residence: See Figure D. 4-9 at page D-43 in DEIR/EIS

- When you use the scale on the Figure D.4-9 map, you can see that most of Boulevard will be impacted within a 1 to 3 mile radius.

EIR Comments

The Draft EIR Executive Summary clearly **recognizes a Class I, Substantial adverse effect on scenic vistas**. These scenic impacts are also listed in the EIR as adverse and unavoidable. Permanent noise levels are also listed, and are shown as Class II noise levels that can be mitigated by placement configuration. However, after researching the subject of noise from wind turbines, reviewing substantial literature on the subject, being an eyewitness to extensive live testimony from residents and experts regarding the distances that low frequency noise and other noise is broadcast, and given the close proximity of numerous residences and even the entire town of Boulevard, for example, it is highly doubtful that configuration of turbines on ridges will be successful in mitigating noise impacts for neighbors of the project. Further, existing resident reports of disturbing noise from the first area wind project casts much doubt on such conclusions of the EIR.

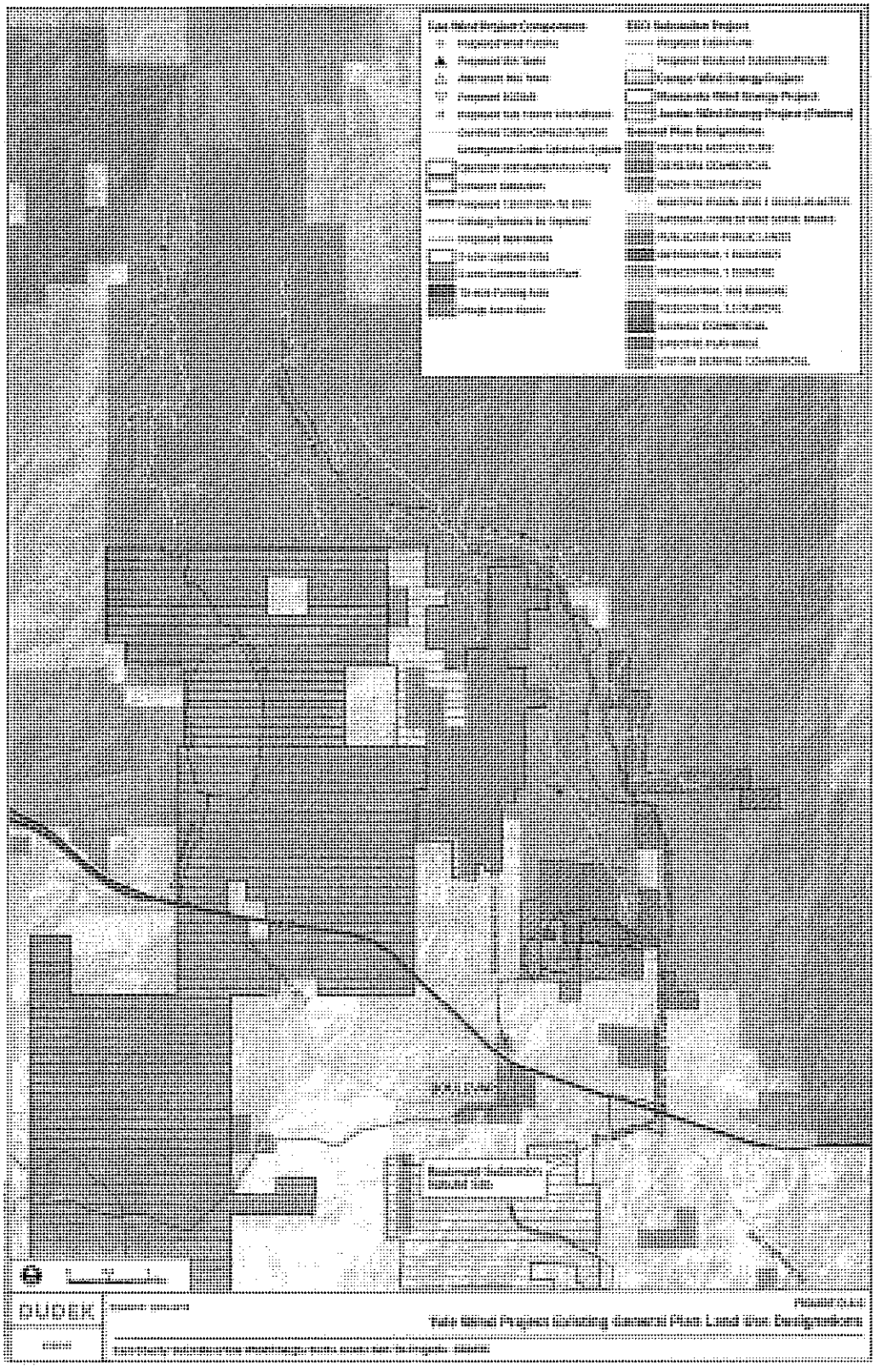
During a site visit and area tour (January 18-20, 2011) I personally inspected the Project area and numerous locations with scenic (premium & above average) vistas of future turbine, substation and HVTL infrastructure sites. At the time of this visit, I also was invited to speak at a community meeting, and had the opportunity to talk with neighbors of an existing wind energy project about their experiences. I am aware that noise levels have been disturbing to some residents, resulting in sleep disturbances as far as 3 miles from the nearest turbine. This often results in impaired use and enjoyment, and for some, results in a decision to sell and move from their homes.

In my judgment, there will be significant degradation and impairment of the scenic amenities, in varying degrees, throughout the entire Project area. Aesthetic and noise impacts are often comingled and variable from day to evening and property to property, but as the following discussion will illustrate, impacts can and do extend for miles, in many instances.

In fact, the EIR addresses social and economic conditions, and based upon a literature review, the EIR Table D.16-7 concludes there will be a decrease of property values, but classifies the impacts as "not adverse".

This is the primary focus of the McCann Property Value Impact Analysis, as residential owners and the "market" reactions regarding property values are an objective measure of the desirable characteristics of any community and an empirical method to measure economic impact, even though limited to property values.

However, while each of the Project components is considered separately, they are also considered cumulatively, inclusive of the reasonably likely future projects mentioned previously. The following EIR/EIS Exhibit, Figure D.4-9 reveals the close proximity of the various wind energy projects, individually, and how ultimately Boulevard would essentially be surrounded by an expansive, industrial overlay character. The impact on the character of a given area can be measured in terms of property value, as well as nuisances, aesthetic impairment and vistas from within and nearby the project area.



Property Value Impacts

The contrast of such man made towers with natural views and the highly valued amenity derived from views is analyzed herein, with focus on ratings of the view from, or "Vista" of residential properties.

It is important to understand that high quality or natural views are an asset to real estate market values and, in particular, residential property and land. Other types of "value" can be identified and described in non-real estate terminology, but my focus as an appraiser is on the market value of property.

Similarly, detraction from such premium views can and does have a measurable adverse effect on residential property values. This is well studied in the real estate appraisal profession, and in fact by proponents of wind energy funded by the USDOE such as:

- ERNEST ORLANDO LAWRENCE BERKELEY NATIONAL LABORATORY The Impact of Wind Power Projects on Residential Property Values in the United States: Ben Hoen, Ryan Wiser, et al, Environmental Energy Technologies Division December 2009. (LBNL)

The 2009 LBNL report is the main study relied on in the DEIR/DEIS to attempt to support the conclusion that the Tule wind turbines will have insignificant property value impacts. The LBNL study is the "literature review" in Pacific Wind Development's Environmental Document that the DEIR/DEIS discusses on page D.

This USDOE funded study is often cited by wind energy developers to claim there is no value impact from such projects, even though the study acknowledges that nearby properties may experience losses and further recommends that more study in the immediate project areas is needed. This study is useful to understanding the minimum level of probable impact from the Project at distances out to 5 miles, but is insufficient to gauge impacts at closer setbacks. Further, despite public funding, the study authors have repeatedly declined to make available the raw underlying sale data records used in the regression analysis, thereby eliminating any testing of their conclusions using accepted, tried and tested regression models for mass appraisal purposes.

VISTA IMPAIRMENT

In the LBNL study, the authors attempt to analyze the impact of wind projects on residential property values. They also separately address the statistically measured impact on residential values from scenic vistas, or views based on ***regression analysis of over 4,700 sale transactions,*** for this component of the study.

As graphically depicted within the LBNL report (pg xiii) on Figure ES-2, the following observations are prima facie evidence that impairment of scenic views results in a measurable loss of property values, as follows:

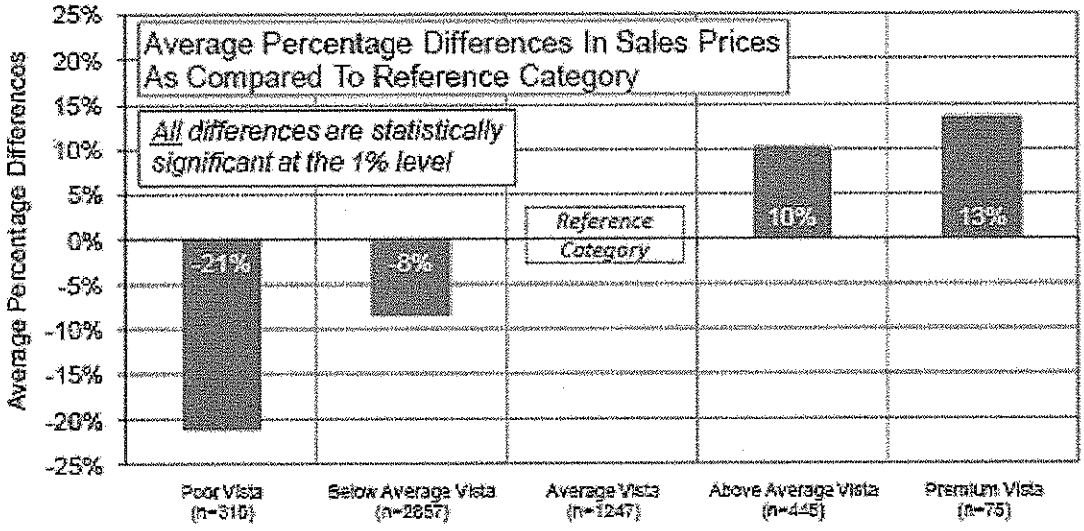
- A premium Vista adds 13% above the value of an average vista.
- A poor vista results in values 21% below the base-line average vista.
- An above average vista adds 10% to the value of an average vista.
- A below average vista reflects values 8% lower than an average vista.

To illustrate examples of the LBNL findings as it applies to the impairment of vistas for residential property, it is first acknowledged that the vista of any given residential property is going to be rated differently before introduction of the Project which will later have a view of the Project turbines and infrastructure, albeit at varied distances.

My personal inspection and review of photographic evidence of existing vistas in the project area indicates strong similarity with premium and above average vistas, as defined and characterized in the LBNL report. On balance, the LBNL report provides examples of premium, above average, average, below average and poor vistas.

In my opinion, below average and poor vista ratings are consistent with the impairment of vistas that will be caused by the Project itself. In scale, the below average "after" vista rating is reasonably applicable to distances of approximately 3 to 5 miles, while the poor vista rating will result from setbacks of less than 3 miles. At less than 1 to 1.5 mile setbacks, the poor vista is considered severe, and is often exacerbated by noise nuisances, etc. ***(see McCann Exhibit A)***

Figure ES-2: Base Model Results: Scenic Vista



The reference category consists of transactions for homes with an Average Vista, and that occured after construction began on the wind facility

Source: December 2009 LBNL report

Thus, in project area residential locations with a premium vista, the Project downgrading the amenity to a poor or below average vista will result in a **value loss of 21% to 34%.** Similarly, residential property possessing a current average vista, if downgraded to poor or below average vista from the Project will suffer **between 8% and 21% value diminution.**

At 400 to 500 feet in height, the view of the Project will be present at considerable distances that extend beyond the nearest residential property, particularly if blinking lights are required at night for aviation safety purposes.

In addition to the findings of the LBNL research report, I have also considered several peer reviewed studies published in The Appraisal Journal, that relate to value losses and impairment caused by other industrial "towers", such as cell towers, high voltage transmission lines, as well as the higher values that are derived from premium views from property.

Each of these studies generally confirms the findings summarized by the data reflected in LBNL Figure ES-2, and are maintained in the appraiser's work file for future reference.

NUISANCE IMPAIRMENT

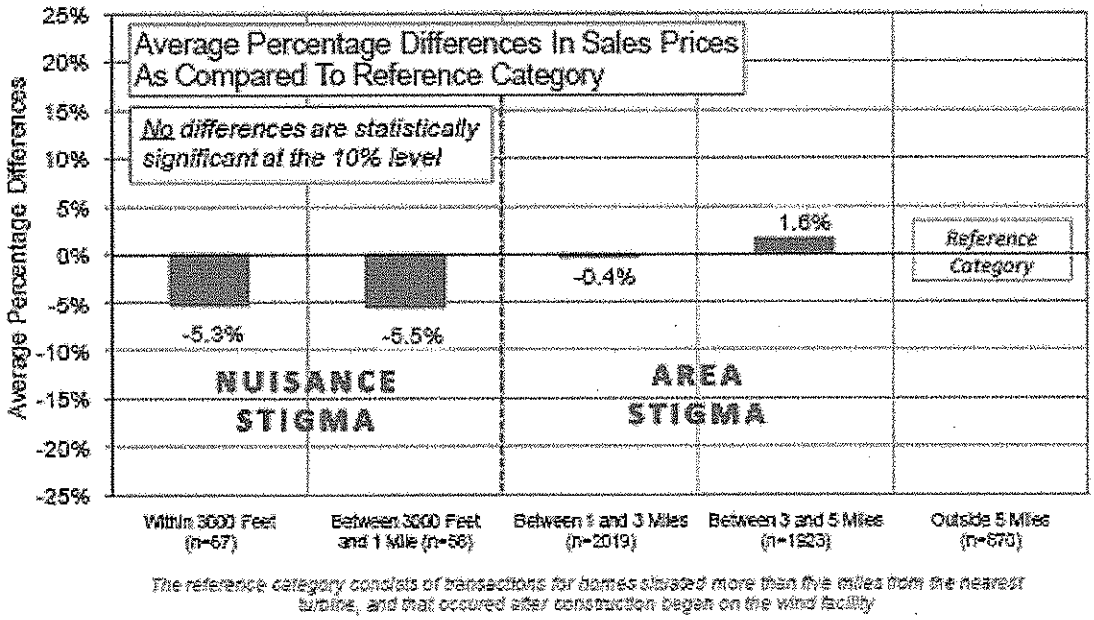
For many residents, the introduction of the Project will constitute a nuisance, based on the noise, the unprecedented height and the impairment of aesthetics related thereto, the blinking aviation light in the night sky, if required by the FAA, etc. The LBNL study attempts to separately isolate the impact of nuisance on value, as depicted in the following Figure ES-1 from the LBNL study.

This figure separates the nuisance by distance from residential property, and clearly reveals that properties in the 3,000 feet and less, and 3,000 feet to 1-mile range **suffer value loss of 5.3% to 5.5%,** respectively.

While the author discounts the statistical significance of the LBNL findings, this dismissal of relevance must be understood in the context of the largely irrelevant data from greater distances having provided the baseline property characteristics in a disproportionately sized data pool or sample, and which "waters down" the statistical indications. The LBNL report must also be understood as a study commissioned with the intent of furthering the government policy of expanding wind energy development in the United States.

Nevertheless, even exclusion of certain impacted property data did not eliminate the downward indication of value resulting from proximity to a nuisance.

Figure ES-1: Base Model Results: Area and Nuisance Stigma

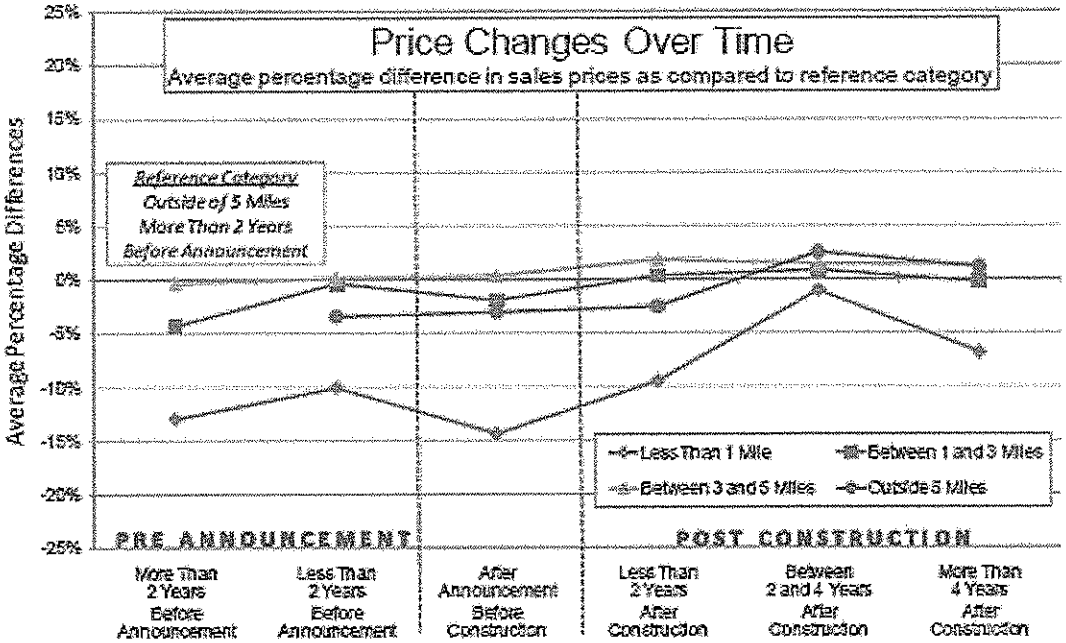


Source: December 2009 LBNL report

Pre-Construction "Constructive Notice"

Further, the following LBNL study Figure ES-4 depicts value changes over time, at varied distance from wind turbines. The applicability of this focus of the LBNL study to the subject Project can be understood in the post-announcement but pre-construction phase of turbine projects, at which point the Project has not been erected and impacts are evidenced by market reaction to "constructive notice" served on surrounding neighbors and property owners. Properties within 1-mile of such projects reflect the largest decline in value, and **confirm that wind turbines have measurable negative impact on property values within 1-mile**. I also note the reference category of home sales beyond 5 miles increased over time, whereas homes within 5 miles of the studied projects typically did not increase in value, showing downward pressure from the market at even a distance of 5 miles.

Figure ES - 4: Temporal Aspects Model Results: Area and Nuisance Stigma



The reference category consists of transactions of homes situated more than five miles from where the nearest turbine would eventually be located and that occurred more than two years before announcement of the facility

The EIR/EIS fails to reconcile the differences between the Project turbines and neighbors' homes with the distances cited in the LBNL study. No effort to mitigate through increasing setbacks is cited, and no Property Value Guarantee is mentioned as another measure to mitigate value impacts. In short, the EIR/EIS stopped short of truly addressing the issue, in the process of "filling out the form".

The LBNL study is not the only pro-wind study that refutes the claims of developers regarding property value loss, due to their utility scale wind energy projects. A recent study focuses more on the pre-construction or "constructive notice" phase of development, as characterized by MET facilities.

A separate academic study conducted by Jennifer L. Hinman, J.L. , Illinois State University, WIND FARM PROXIMITY AND PROPERTY VALUES: A POOLED HEDONIC REGRESSION ANALYSIS OF PROPERTY VALUES IN CENTRAL ILLINOIS

The background of this study author is a Master's Thesis, prepared by the author in partial fulfillment of degree requirements. ISU is heavily funded by wind energy developers, the American Wind Energy Association, the USDOE and other grant programs that are decidedly "pro-wind", and which seek to refute the actual experience of many neighbors to such projects.

In fact, ISU newsletters disclose that "corporate partners" that include wind energy development companies have access to the renewable energy programs, include advising on research direction and the right to review any applied research developed by ISU.

An excerpt of the Hinman report is presented as follows:

This study uses 3,851 residential property transactions from January 1, 2001 through December 1, 2009 from McLean and Ford Counties, Illinois. This is the first wind farm proximity and property value study to adopt pooled hedonic regression analysis with difference-in-differences estimators. This methodology significantly improves upon many of the previous methodologies found in the wind farm proximity and property value literature. ***The estimation results provide evidence that a "location effect" exists such that before the wind farm was even approved, properties located near the eventual wind farm area were devalued in comparison to other areas****. Additionally, the results show that property value impacts vary based on the different stages of wind farm development. These stages of wind farm development roughly correspond to the different levels of risk as perceived by local residents and potential homebuyers. Some of the estimation results support the existence of "wind farm anticipation stigma theory," meaning that* ***property values may have diminished in "anticipation" of the wind farm*** *after the wind farm project was approved by the McLean County Board. Wind farm anticipation stigma is likely due to the impact associated with a fear of the unknown, a general uncertainty surrounding a proposed wind farm project regarding the aesthetic impacts on the landscape, the actual noise impacts from the wind turbines, and just how disruptive the wind farm will be.*

Property Value Guarantee (PVG)
Property values have been shown to decline based on pre-construction anticipation of wind projects. As such, there is ample evidence to either deny such related projects within 1 to 3 miles of homes for actual turbines.

Despite all the industry claims to the contrary, significant value impacts have in fact occurred, and have even resulted in the abandonment of homes, as well as nuisances, health problems, etc.

Even the principal author of the LBNL study, Ben Hoen, now recommends implementation of Property Value Guarantees (PVG's) in the context of wind energy project mitigation of impacts. Thus, the EIR/EIS is not current with the available updated conclusions and information, as determined by the author of the study they cited to make limited mention for inadequately classifying the issue of property value impacts.

(Per page 32 of linked webinar)
http://www.windpoweringamerica.gov/newengland/pdfs/2010/webinar_neweep_property_values_hoen.pdf

Property Value Risks Will Persist Unless They Are Measured, Mitigated and Managed

Manage

Manage risks in the short term for homeowners through tenable/workable measures

- Offer some combination of neighbor agreements/incentives and/or property value guarantees (e.g., Dekalb County, IL) to nearby homeowners as are economically tenable and legally workable
- Conduct follow up studies (e.g., surveys, appraisals)
- Realize that cumulative impacts may exist
- Realize that real or perceived risks may increase/decrease as more/better information become available

Nuisance can be manifest by close proximity of the Project to homes out to 2 or 3 miles. Distance beyond 3 miles includes visual impacts but at that range, turbines typically have more of an impact on marketing. When noise issues are known to occur, typical development practices leave homeowners wishing to sell with the ethical dilemma of making full disclosure of known nuisances to potential buyers, or facing possible legal repercussions and financial liability for failing to make such a disclosure. Pre-construction failure to notify buyers of pending projects has resulted in litigated judgments in favor of buyers who did not get full disclosure from the seller.

The prospective turbine developments will have a negative impact or "nuisance" under circumstances of each receptor location when that the project or use has a dominant presence, impairs aesthetics, negatively changes the character of a property setting or perception thereof (single or multiple properties), causes the need for financial and/or time expenditures by neighbors that they would not otherwise have, or in any number of potential ways has a demonstrable adverse impact on the use, enjoyment, marketability or value of the neighboring use, then it could create a man-made detriment to neighboring property and result in a negative impact for any homes that "got in the way". This is exactly why adequate setbacks are important. To mitigate against adverse impacts on neighboring property.

Thus an impaired view from a property possessing a "premium" vista, based upon LBNL data analyzed and claimed to be statistically significant, indicates that a 13% premium could become a 21% reduction, or a net property value reduction of 34%.

This range of value loss for the nearest residential properties is fairly classified as a nuisance, and is quantified as significant with empirical data rather than subjective "fears" or speculation.

I have also reviewed the photo simulations contained in the EIR/EIS and, in my professional opinion, the "after" photos depict an impairment of views consistent with the ratings for poor and below average vistas, depending on the distance of, and view from homes in the area.

Mendota Hills – McCann Study

I have undertaken independent research and study of property value impacts, which includes numerous individual case studies of homes that either could not be sold due to close proximity of wind turbines, or that sold for substantial discounts. Individual discounts typically range from 20% to 40%, with some examples of 60% to 80% resales from developers, when they have bought out homeowners experiencing a high level of noise nuisances and/or health impacts.

The following table depicts property value impacts s within 2 miles of the first Illinois wind energy project, in contrast to home sale prices over 2 miles from the turbines. It is noted that the study sales all occurred between early 2003 and early 2005, during one of the strongest markets in modern history. Thus, there is NO value loss due to market conditions that have evolved since, and this study is extremely useful for eliminating market decline impacts that were not caused by development of the industrial scale turbines.

This rural residential location is relatively homogenous, in that there is a range of home size and styles in both the near and far distances, having a comparable market appeal prior to the construction and operation of the Mendota Hills project. It is also prima facie evidence that property values within 2 miles have been lower than further homes by 25%, or $25.89 per square foot lower.

Mendota Hills Wind Energy Project

Sale #	Address	Sale Date	Price	Grantor	Grantee	Style	Size SF	$/SF
1	629 W. Chestnut	Oct 2003	$37,000	Estes	Lipe	1.5	1,161	$31.87
2	323 W. Chestnut	Oct 2004	$40,000	Reed	Hovious	1.5	1,425	$28.07
3	1019 Steward Rd.	May 2003	$40,000	Houle-Ward	Reyns	2	1,408	$28.41
4	91143 Paw Paw	Mar 2005	$167,000	Zaylik	Pachero	2	1,571	$119.03
5	1224 IL Rte. 251	Jun 2003	$138,000	Gittleson	Kowalski	2	1,272	$108.49
6	339 Chestnut St.	Jan 2003	$72,000	White	Flynn	2	1,684	$42.76
7	630 W. Chestnut	Sep 2003	$126,000	Eddy	Morath, Sr.	1.5	1,728	$72.92
8	427 Chestnut St.	Oct 2003	$87,000	Hesik	Rourke, Jr.	1.5	1,380	$63.04
9	138 Cherry St.	Sep 2004	$80,000	Hammond	Alexander	1.5	1,326	$60.33
10	536 W. Cherry	Oct 2004	$63,500	Johnson	Fitzpatrick	1.5	999	$63.56
11	885 Compton Rd.	Oct 2004	$68,900	Boysen	Gellings	1	480	$143.54
12	518 W. Cherry St.	Apr 2003	$87,500	Allen	Beckman	1	927	$94.39
13	222 Maple St.	Dec 2004	$150,000	Clark	Cummings	1	1,852	$80.99
14	444 W. Main St.	Mar 2005	$109,900	Miller	Michaels	1	1,402	$78.39
15	2874 Beemerville	Jul 2003	$367,000	Finkboner	DGNB TRT	1	2,201	$166.74
						Average sale price		$78.84
16	1318 Melugins Grove	Apr 2004	$179,000	Lyons	Overton	2	1,952	$91.70
17	2612 Shady Oaks Rd.	Apr 2003	$131,000	Smith	Paplech	1.5	1,208	$108.44
18	3448 Cyclone Rd.	Mar 2003	$105,900	Munyon	Pippenger	2	1,456	$72.73
19	2524 Johnson St.	Aug 2004	$61,800	Copeland	Lampson	1.5	948	$65.19
20	741 Third St.	Feb 2004	$63,500	Eckhardt	Rosales	1.5	868	$73.16
21	613 Church Rd.	May 2003	$115,000	Merkel	Parpart	1.5	1,458	$78.88
22	3435 Willow Creek	Jun 2003	$118,000	Swiatek	Brydun	2	884	$133.48
23	3021 Cottage Hill	Mar 2005	$182,000	Russ	Curtis	1.5	1,239	$146.89
24	3385 Willow Creek	Mar 2003	$180,000	McCoy	Carver	2	2,840	$63.38
25	745 Second St.	Dec 2004	$59,000	Wilson	Calderon	1.5	1,161	$50.82
26	761 4th St.	Mar 2003	$68,000	Stewart	Elsinger	1	724	$93.92
27	2774 Welland Rd.	Apr 2003	$93,000	Batha	Crumpton	1.5	1,104	$84.24
28	558 Earlville Rd.	Jan 2003	$145,000	Hodge	Ikeler	2	1,280	$113.28
29	2505 Wood St.	Aug 2004	$105,000	Janiak	Bullock	2	1,812	$57.95
30	355 Earlville Rd.	Aug 2004	$280,000	Rago	Diehl	2	2,142	$130.72
31	3095 Cyclone Rd.	Dec 2004	$169,900	Summerhill	Raimbolt	2	2,048	$82.96
32	742 Second St.	Jan 2003	$103,000	Delhotal	Stewart	2	1,876	$54.90
33	395 Angling Rd.	Mar 2005	$119,000	BMV Prop.	Herendeen	1	680	$175.00
34	2515 Wood St.	Apr 2004	$80,000	Jones	Sarver	1	912	$87.72
35	1218 Locust Rd.	Jan 2005	$169,000	Wachowski	Gembeck	1	1,040	$162.50
36	901 Melugens Grove	Aug 2003	$228,000	Kidd	Rajan	1	2,000	$114.00
37	1490 German Rd.	Aug 2004	$85,000	Firth	Challand	2	2,144	$39.65
38	603 Ogee Rd.	Apr 2004	$285,000	Anderson	Miller	1	1,920	$148.44
39	546 Carnahan Rd.	Jan 2005	$110,000	Coley	Sarabia	1	1,296	$84.88
40	1353 County Line	Nov 2003	$185,000	Vallejo	Bozzeth	1.5	1,338	$138.27
41	2512 Johnson St.	Feb 2005	$123,000	Montavon	Sutton	2	2,232	$55.11
42	2509 Herman Rd.	Apr 2004	$142,900	Bresson	Arjes	1	1,404	$101.78
43	955 Woodlawn	Jul 2003	$265,000	Swan	LaRosa	1.5	1,918	$138.16
44	1279 Locust Rd.	Mar 2003	$270,000	Witte	olin	1	2,156	$125.23
45	648 Ogee	Nov 2003	$225,000	Fickenscher	Rojas	1	1,768	$127.26
46	1339 Woodlawn Rd.	Sep 2003	$230,000	Howell	Barnhill	1	1,701	$135.21
47	1349 Woodlawn Rd.	May 2003	$207,500	Howell	Wiskari	1	1,809	$114.70
48	711 O'Gee Rd.	Aug 2004	$185,000	Groevengoed	Carabal	1	1,352	$136.83
49	1295 Locust Rd.	May 2004	$300,000	Hagan	Lowe	1	2,672	$112.28
50	860 Paw Paw Rd.	May 2004	$185,000	Wiskur	Pogreba	1	1,148	$161.15
51	3011 Honeysuckle	Mar 2005	$355,000	Abbott	Brandt	2	3,655	$97.13
52	489 Earlville Rd.	Nov 2004	$165,000	Schlafke	Fromhertz	2	1,400	$127.85
53	2512 Shaw Rd.	Jun 2004	$153,500	Hlavin	Kapinski	2	1,638	$93.71
						Average sale price		$104.72

Sales 17 - 53 located > 2 miles from turbines	$104.72	sq ft
Sales 1 - 16 located within 2 miles of turbines	$78.84	sq ft
Difference in sale price per square foot	$25.89	sq ft
Average Value diminution within 2 miles of turbines	25%	

Conclusion

The LBNL study cited in the EIR/EIS actually demonstrates that there are measurable and significant value losses for residential property, after the introduction of wind turbine energy projects into the neighboring communities. The author of the report has updated his conclusions to include recommendation of PVG's, as well as recognition of cumulative impacts.

A separate academic study (Hinman thesis) used similar regression methodology as LBNL, and found that values decline even pre-construction, which appears to be a market reaction in anticipation of the studied wind project.

The Mendota Hills study is based simply on a near-far comparison of average value per square foot for residences within and outside a 2 mile setback from turbines. Other independent and industry studies have also consistently found that actual sales reflect lower values for homes, under different distance scenarios, as well as Project sizes, locations and even different countries.

The common denominator is that turbines are being constructed too close too people to avoid tangible and intangible adverse impacts and impairment of character of the areas developed with wind projects, the use, enjoyment and value of neighboring homes, and the stability of real estate value within distanes out to 5 miles. However, the majority of data reveals the most onerous impacts of 25% to 40% value decline within 2-3 miles, which is still far greater than the deminimus setbacks proposed for turbines from residents in the Project.

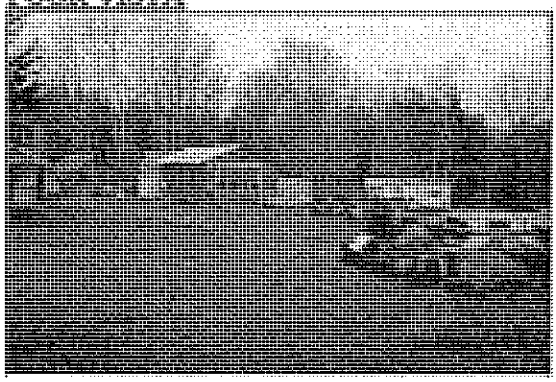
I also note that HVTL are well studied in the appraisal profession, and 10% lower values is the approximate value loss within close proximity to suburban locations. With expansive, premium vistas at the subject Project locations, the impact distances are not only expected to be greater, but also cumulatice. The same is true for the more localized impact of substation development, as far as cumulative impacts. Thus, under the worse case scenario, any residence located immedialetly adjacent to a substation, where HVTL towers and lines connect, that is also within 2-3 miles of turbines, is likely to be so impaired as to be unmarketable at any price.

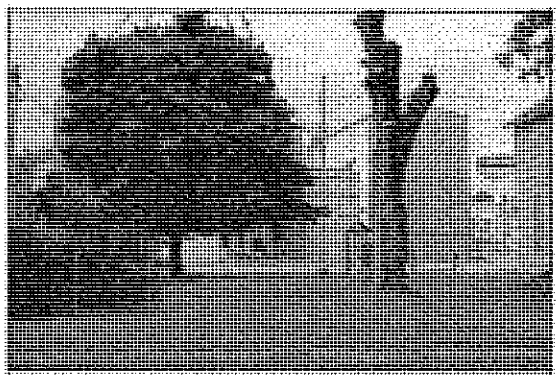
The EIR/EIS inadequately addresses any of these impacts, and should be considered as irrelevant to support any findings on real estate values and economic impact. Similarly, the Project fails to meet the criteria for a MUP from the San Diego Zoning Ordinance, and EIR/EIS documentation provides no basis to demonstrate compliance with such zoning requirements.

McCann Exhibit A

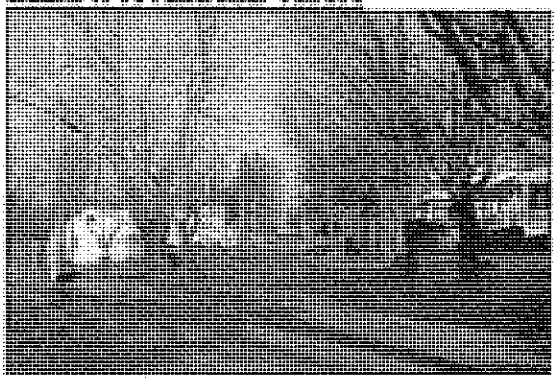
Appendix D: Vista Ratings with Photos

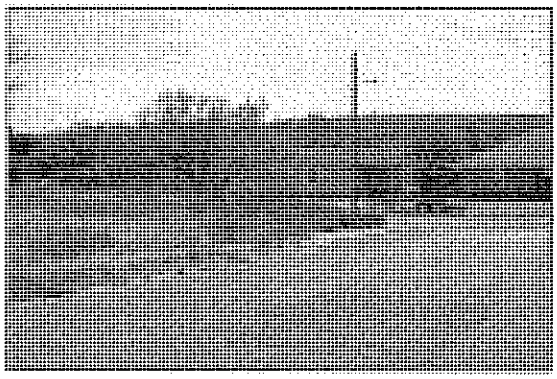
POOR VISTA



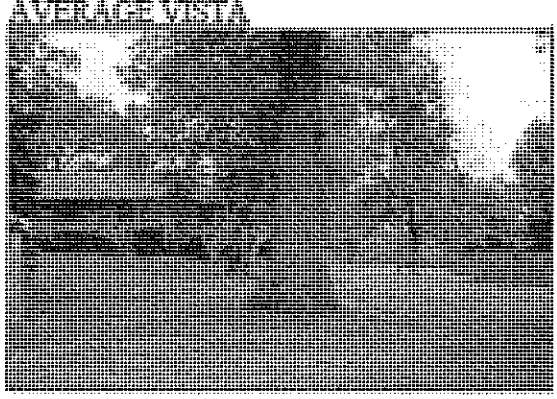


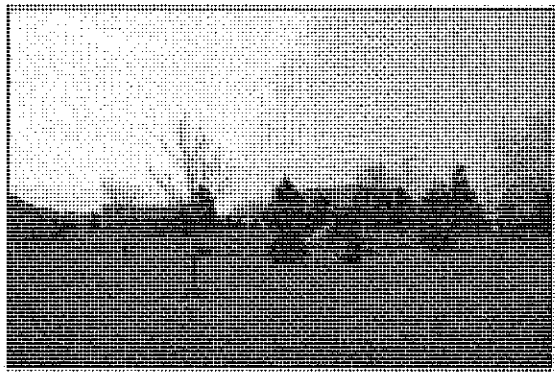
BELOW AVERAGE VISTA



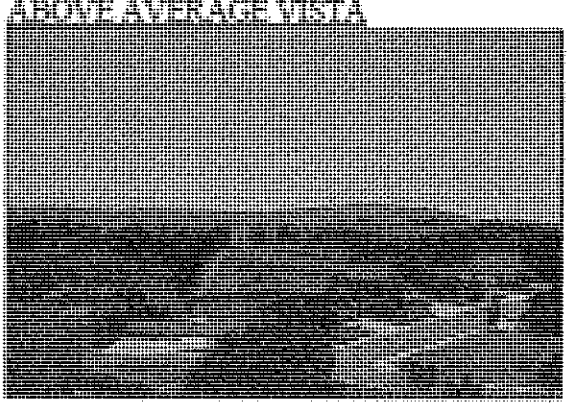


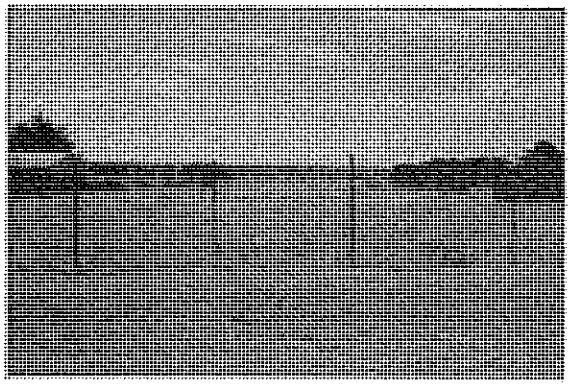
AVERAGE VISTA



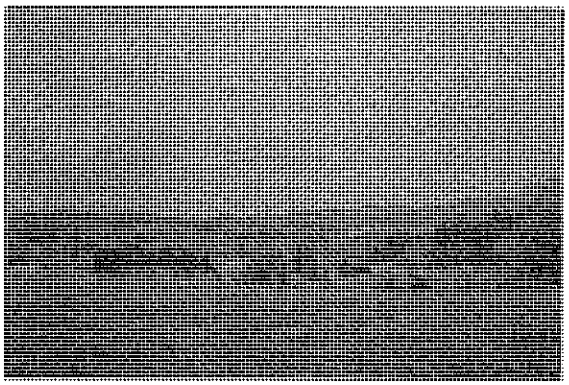


ABOVE AVERAGE VISTA



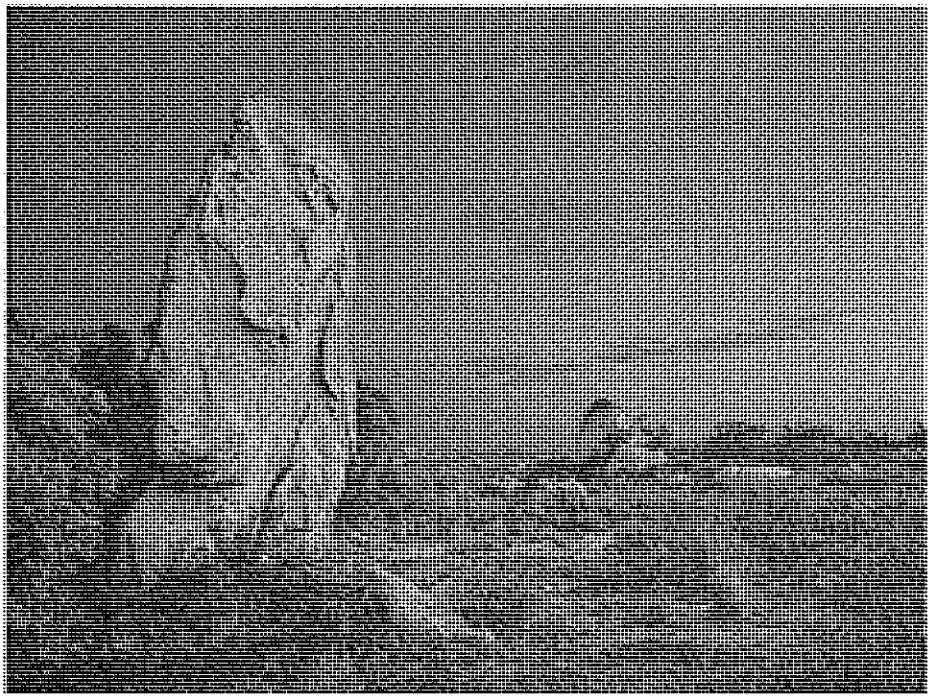


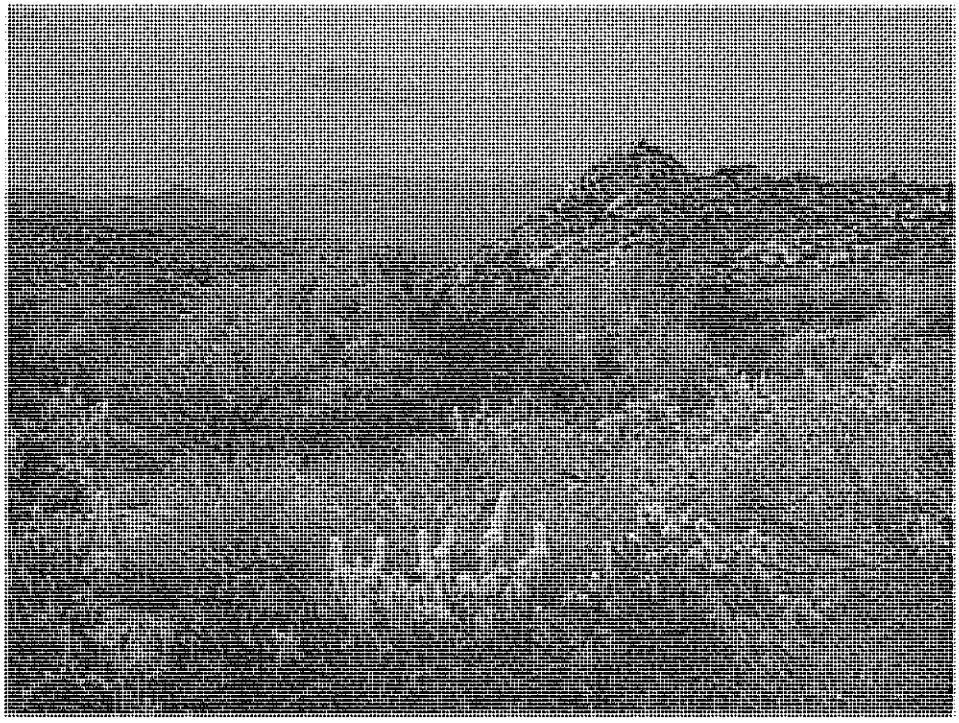
PREMIUM VISTA

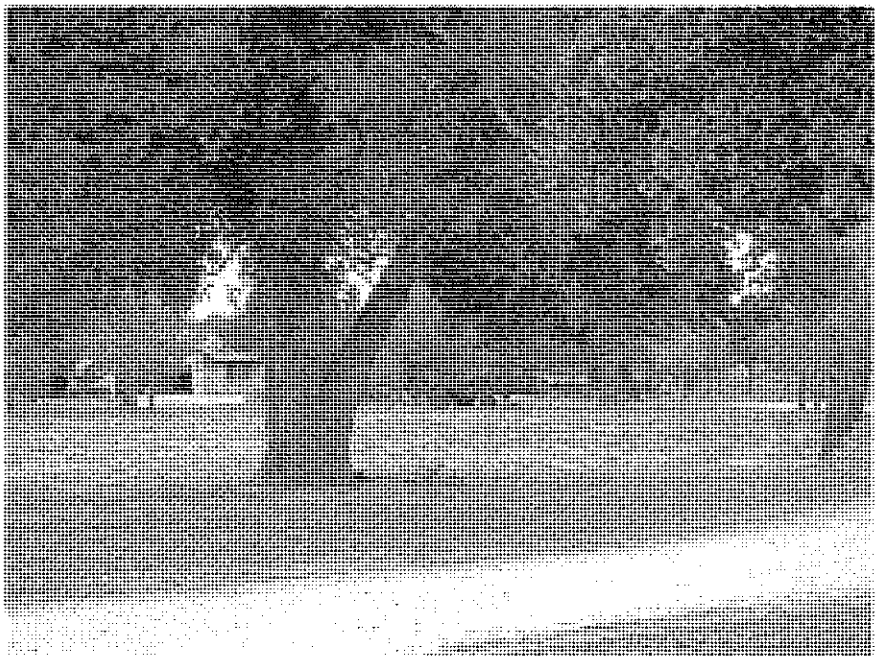


Source: LBNL Appendix D, report page 120 & 121

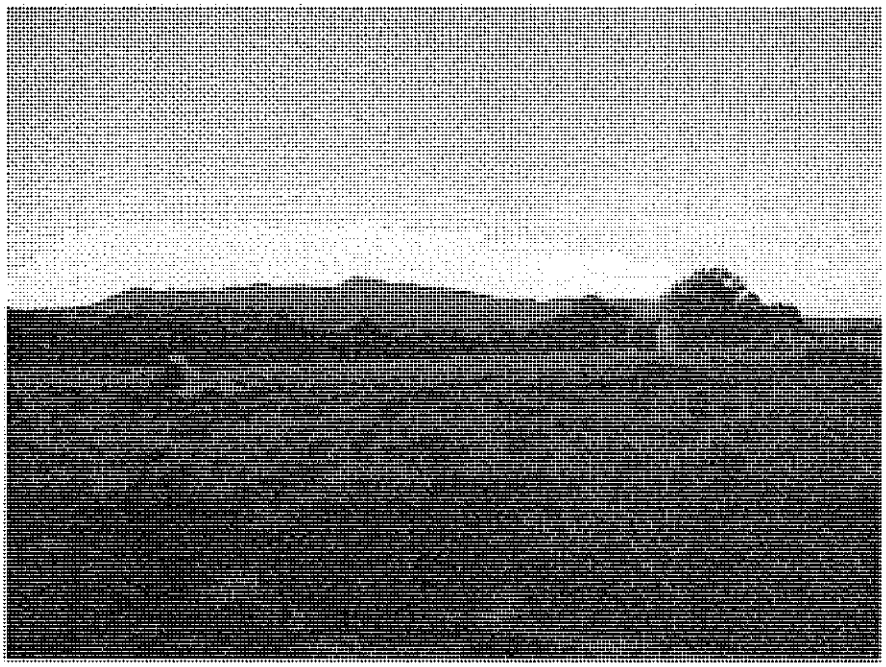
Examples of Premium Vistas – Subject Area







2810 Ribbonwood Rd, Boulevard, CA



Premium Vista

Proposed northern portion of Enel Jewel Valley Project

CERTIFICATION

The undersigned, representing McCANN APPRAISAL, LLC, do hereby certify to the best of our knowledge and belief that:

FIRST: The statements of fact contained in this appraisal report are true and correct.

SECOND: The reported analyses, opinions and conclusions are limited only by the reported assumptions and limiting conditions and represents the personal, impartial and unbiased professional analyses, opinions, and conclusions of the undersigned.

THIRD: We have no present or prospective interest in the property that is the subject of this report and no personal interest with respect to any of the parties involved.

FOURTH: We have no bias with respect to the property that is the subject of this report or to the parties involved with this assignment.

FIFTH: Our engagement in this assignment was not contingent upon developing or reporting predetermined results.

SIXTH: Our compensation for completing this assignment is not contingent upon the development or reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value opinion, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of this appraisal.

SEVENTH: Our analysis, opinions, and conclusions were developed, and this report has been prepared in conformity with the Uniform Standards of Professional Appraisal Practice.

EIGHTH: For preliminary valuation purposes only an exterior inspection was made by McCann Appraisal, LLC of the property that is the subject of this report:

NINTH: No one other than the undersigned provided significant real property appraisal assistance to the person signing this certification.

TENTH: McCann Appraisal, LLC has been previously engaged to consult regarding appraisal issues in the subject market area.

IN WITNESS WHEREOF, THE UNDERSIGNED has caused these statements to be signed and attested to.

Michael S. McCann, CRA
State Certified General Real Estate Appraiser
License No.553.001252 (Expires 9/30/2011)

PROFESSIONAL BIOGRAPHY
MICHAEL S. MCCANN, CRA

Michael S. McCann has been exclusively engaged in the real estate appraisal profession since 1980, and is the owner of McCann Appraisal, LLC.

EXPERIENCE

His appraisal experience has included market value appraisals of various types of commercial, office, residential, retail, industrial and vacant property, along with a wide variety of unique or special purpose real estate, such as limestone quarries, hotels, contaminated properties, etc. He has gained a wide variety of experience in real estate zoning evaluations and property value impact studies, including analysis of utility scale wind turbine generating facilities, gas-fired electric generating plants, shopping centers, industrial facilities, limestone quarries, sanitary landfills and transfer station waste disposal facilities. He has been retained as an independent consultant to municipalities, government agencies, corporations, attorneys, developers lending institutions and private owners, and has spoken at seminars for the Appraisal Institute, the Illinois State Bar Association and Lorman Education Services on topics including the vacation of public right of ways (1986), and Property Taxation in the New Millennium (2000), Zoning and Land Use in Illinois (2005, 2006).

In addition to evaluation of eminent domain real estate acquisitions for a wide variety of property owners & condemning authorities, Mr. McCann has served as a Condemnation Commissioner (2000-2002) appointed by the United States District Court - Northern District, for the purpose of determining just compensation to property owners, under a federal condemnation matter for a natural gas pipeline project in Will County, Illinois.

EXPERT TESTIMONY

Assignments include appraisals, studies and consultation regarding real estate located in 21 states. He has qualified and testified as an expert witness in Federal Court, and for condemnation, property tax appeal and zoning matters in the Counties of Cook, Will, Boone, Lake, Madison, St. Clair, Iroquois, Fulton, McHenry, Ogle & Kendall Circuit Courts, as well as the Chicago and Cook County Zoning Boards of Appeal, the Property Tax Appeal Board (PTAB) and tax court & Commissions of Illinois, Wisconsin, and Ohio, Circuit Courts in New Jersey and Indiana, as well as zoning, planning, and land use and County Boards in Texas, Missouri, Idaho, Michigan, New Mexico and various metropolitan Chicago area locales. He has also been certified as an expert on the Uniform Standards of Professional Appraisal Practice (USPAP) by the Cook County, Illinois Circuit Court. Mr. McCann has substantial experience in large-scale condemnation and acquisition projects and project coordination at the request of various governmental agencies and departments. These include appraisals for land acquisition projects such as the Chicago White Sox Stadium project, the Southwest Transit

(Orange Line) CTA rail extension to Chicago's Midway Airport, the United Center Stadium for the Chicago Bulls and Blackhawks, the minor league baseball league, Silver Cross Field stadium in Joliet, Illinois, as well as many other urban renewal, acquisition and neighborhood revitalization projects.

REAL ESTATE EDUCATION

Specialized appraisal education includes successful completion of Real Estate Appraisal Principles, Appraisal Procedures, Residential Valuation, Capitalization Theory and Techniques Part A, Standards of Professional Practice Parts A, B and C, Case Studies in Real Estate Valuation, Highest and Best Use and Market Analysis, Advanced Income Capitalization, Subdivision Analysis and Special Purpose Properties, Eminent Domain and Condemnation, and Valuation of Detrimental Conditions in Real Estate offered by the Appraisal Institute. In addition, he has completed the Society of Real Estate Appraisers' Marketability and Market Analysis course, the Executive Enterprises - Environmental Regulation course, and a variety of continuing education real estate seminars.

DESIGNATIONS & PROFESSIONAL AFFILIATIONS

Mr. McCann is a State Certified Associate Member of the Appraisal Institute, and the National Association of Review Appraisers & Mortgage Underwriters designated him as a Certified Review Appraiser (CRA). He was elected in 2003 as a member of Lambda Alpha International, an honorary land economics society, and he served several years as a member of the Appraiser's Council of the Chicago Board of Realtors.

LICENSES

State Certified General Real Estate Appraiser in the State of Illinois (License No. 533.001252) and is current with all continuing education requirements.