To: DAWG Energy Savings subgroup for January 13 meeting   Jan. 11, 2011

From: Sy Goldstone

Subject: Note on "naturally occurring" (NOC) energy savings

This note attempts to briefly explain why "naturally occurring" (NOC) energy savings is an important concept that relates to a number of issues raised at our January 6th DAWG Energy Savings Subgroup meeting by NRDC, TURN and others. [NRDC end note 1]

The note is divided into four main parts: (1) a description of the CPUC's four Bucket conceptual framework, (2) Lessons from the CEC's 2008 and 2009 IEPR experience, (3) new lessons that may help explain the puzzling 2009 IEPR results, and (4) a concluding recommendation.

The CPUC's "four Bucket" Conceptual Framework

As a point of departure, I note that interest in the amount of NOC savings has been heightened because of a new "four Bucket" conceptual framework that the CPUC introduced in response to the "increasing significance of the CPUC's energy saving goals in relation to CPUC's long term procurement proceedings and the central role that the CPUC's commitments to the California Air Resources Board in meeting statewide emissions reductions required under AB32." [CPUC Goals Update end note 2]

Under this framework potential cost effective energy savings may be divided into four Buckets:

Bucket A: net savings from IOU programs.

Bucket B: naturally occurring savings.

Bucket C: savings from codes and standards. &

Bucket D: unrealized cost effective savings,

Under this "four Bucket" framework the CPUC's "IOU efficiency goals should be set in a way that optimizes Bucket A (net savings from IOU programs relative to what can be achieved in Bucket B (naturally occurring savings) and Bucket C (savings from codes and standards such that the sum of A,B, and C are as large as possible. [end note 3]

This analytical framework thus supports the recent CPUC decision, reported by Carmen, to use "Total Market Gross" in determining their future energy efficiency savings goals.

The use of this framework also raises the salience of how energy efficiency savings are allocated between the different Buckets. For example, both the NRDC and TURN have noted that there has been a major shift in the CEC's estimates of cumulative historical savings, as depicted in IEPR graphs, in amounts allocated to the different buckets between the CEC's 2005 IEPR and 2009 IEPR demand forecasts. This includes what appears to be a major increase in the amount of NOC savings that was absent in the 2005 graph, but present in 2009. In order to assure confidence in how they will be made in the future it is necessary to provide a clear explanation of how these determinations were made in the past

Lessons from the CEC's 2008 and 2009 IEPR experience.

By way of some important background it is next helpful to briefly review recent experience in the 2008 and 2009 IEPRs with regards to the estimation of savings in the Utility program versus the NOC savings Buckets.

The controversy

This concern is at the center of a controversy that arose during the CEC's 2008 IEPR Update called "the overlap problem". Some members of the Subgroup will remember that the controversy arose because the utilities claimed that that some of the savings that they were claiming in order to satisfy CPUC efficiency goals would overlap savings embedded in the Energy Commission's baseline demand forecast [2008 IEPR end note 4]. In other words, in terms of the CPUC's conceptual framework was primarily about the allocation of FORECAST savings between Bucket A (IOU program savings) and the other Buckets.

As part of their study to assist the CPUC in updating their efficiency goals Itron clarified that the "overlap problem" was rooted in their inability to determine how much naturally occurring energy savings was in the CEC baseline forecast. [Goals Update end note 5].

The 2009 IEPR quantitative results (report from the modelers)

In order to help resolve this issue during the 2009 IEPR cycle a new Demand Forecast and Energy Efficiency Quantification Project (DFEEQP) group was established. As part of this DFEEQP (recently renamed to become the DAWG), Itron and CEC's DAO staff undertook a collaborated in attempt to compare their modeling results, and then reconcile any differences "in a way that would avoid systematic bias" [Incremental Impacts Attachment A end note 6]

Unfortunately, this 2009 IEPR attempt at reconciling the CEC and Utility (Itron) modeling were not successful. Despite significant effort ITRON and DAO modelers could not reconcile their estimates of NOC savings. Particularly difficult to explain is their reported result on the residential sector that 'the energy commission's estimates of naturally occurring are well below both Itron's estimate and the free ridership rates implied by the net-to-gross ratio assumptions applied to residential measured" **[see Technical Attachment end note 7p66]**

The result is difficult to explain because NOC savings are defined as being driven by market forces that depend primarily on price response parameters. Since the DAO's model was run assuming a 15% real increase as against an Itron model assumption of no price change we would expect that the DAO's model would yield a higher NOC savings estimate.

Compounding matters, the report provides no explanation for this puzzling result.

Still worse from the point of view of realizing the kind of effective transparent communication that we, in the ACI group, are trying to foster throughout the CEC's Electricity Analysis Division, of which the DAO is a part, this important albeit disappointing result is not mentioned until page 66 of a long Technical Attachment where it is hidden from view and seems to have gone largely unnoticed.

2009 IEPR 2009 Qualitative results (report from DFEEQP Taxonomy subgroup)

One additional finding during the 2009 IEPR pertains to the results reported by the DFEEQP taxonomy subgroup. This subgroup aimed at clarifying concepts to help policy makers and others interpret the technical language that demand forecast and energy efficiency analysts and modelers use in the demand assessment reports. Because it was so central to the 2009 IEPR "overlap problem" controversy connected to proper implementation of the CPUC's new "four Bucket" conceptual framework the Taxonomy subgroup put significant effort on clarifying the concept of naturally occurring energy savings.

Briefly, the main results were as follows:

(1) There is a general agreement that naturally occurring energy savings are driven by market forces such as price effects that would occur in the absence of demand reducing interventions that policy makers are interested in.

(2) Despite this agreement at the general level, when it comes to operational definitions that the DAO and Itron modelers actually use to quantify the amounts of NOC savings were very different. In other words, the aforementioned difficulties that the DAO and ITRON modelers had in reconciling their estimates of NOC savings were lurking in substantial inconsistencies between the two modeling approaches.

(3) The operational definitions and approaches that both the ITRON and the DAO were and, as far as I am aware, are still using to quantify naturally occurring savings are unsatisfactory. Albeit for very different reasons, their estimates are both prone to systematic low side bias.

(4) In addition to being inconsistent with one another, the definitions, even at a general level, are incomplete. For example, beyond the reference to price effects, the definitions provide no indication that the market forces associated with energy efficiency frequently suffer from systemic distortion. As pointed out in NRDC's comment these market distortions often create barriers (called "market barriers") to the supply and demand for such goods and services. [NRDC end note 1]

(5) By way of a preliminary attempt to address these definitional inadequacies the DFEEQO Taxonomy subgroup recommended adopting a broader definition that accounted for the complexity, often associated with perverse interactions between supply and demand sides of the markets, and changes in such underlying and potentially market transforming factors as product market information (e.g. such as energy star labels) and societal norms (e.g. increased salience and adherence to the norms of "green" consumption), as follows:

> "Naturally occurring savings are energy savings that are independent of specific programs or standards effects, caused instead by the combination of customer energy conservation choices and supplier product mix and development choices that result from the interacting forces of market supply and demand, which, in turn, respond to changes in societal norms, prices and

other energy product information." [see Appendix A Glossary of Terms end note 8]

2009 IEPR acknowledgement of a key uncertainty pertaining to "take back" behavior

The CEC's 2009 IEPR also took note, albeit in a rather limited way, of a potentially important kind of market distortion that may be an inadvertent consequence of certain kinds of energy efficiency policy interventions that lead to "take back' behavior (also sometimes called "rebound behavior") as follows:

"There is also great uncertainty about the nature of consumer response to subsidized efficiency programs and whether savings from various measures translate into actual changes in consumer demand for electricity. For example, the financial benefits of increased efficiency gains may induce some consumers to "take back" some of the efficiency gains by increasing their energy use" [2009 IEPR end note 9p57-58]

New Lessons that may help explain puzzling 2009 IEPR results

I conclude this note by a brief description of two DAO staff findings that go beyond the 2009 IEPR and which may be helpful in (a) clarifying the puzzling 2009 IEPR modeling results and(b) providing a direction or correcting the associated biases that these 2009 results seem to create for the allocation of savings between the four Buckets in the CPUC's new conceptual framework .

Short term versus long term price elasticity

A recent review of the literature on empirical estimates of price elasticity found that elasticity with respect to electricity prices depends heavily on whether it applies to the short term or the long term. Since they allow time for the turnover in long lived electricity using appliances and equipment estimates of long term price elasticity are much higher than estimates of short term elasticity. But the DAO's 2009 IEPR forecast relied of estimates of short term price elasticity.

The DAO's unusually low 2009 IEPR forecast NOC savings may thus be explained by using short term rather than long term price response parameters.

Need to account for two kinds of price elasticity (one for megawatts and one for "negwatts")

A second finding derives from the recognition that it is particularly difficult to make empirical estimates of price elasticity in the presence of significant improvements in energy efficiency. .

This is not a new finding so much as it is rediscovery of an old difficulty that was previously raised in a technical companion report to the 2005 IEPR Staff's demand forecast called the "Energy Demand Forecast Methods Report".

As pointed out in this 2005 Methods Report

"The product of the energy price and efficiency is the cost of energy service at the end use level, and is often referred to as the "efficiency price". Since the efficiency tends to improve when price increases.. it is conceivable that an increase in price would lead to a decrease in the efficiency price and, thus, an increase in the demand for energy services" [Methods Report end note 10]

This means that there are two price elasticity effects. One is the elasticity with respect to the price of electricity. The other is the elasticity with respect to what the staff calls the efficiency price that responds to changes in the price of the underlying service (i.e. what Amory Lovins famously referred to as Negawatts).

In order to estimate an unbiased total price elasticity the "effective price" of the service which properly combines changes in both the electricity prices and "efficiency prices" [Movassagh end note 11].

The CEC's unusually low 2009 estimate of NOC may thus also be due to electricity price elasticity estimates that are too low because they overlook the confounding effect of the significant reductions that California has experienced in the efficiency price (a.k.a. the price of Negawatts)

A Concluding recommendation

In conclusion, I recommend that at the upcoming January 20th DAWG meeting that the ES Subgroup urge the DAWG Demand Forecasting Subgroup attend to and effectively communicate back on these matters. This should include (1) answers to the questions from the NRDC and TURN about historical allocations between the four Buckets, and (2) how they propose to address the puzzling results from the 2009 IEPR experience pertaining to naturally occurring savings Bucket as well as related questions that may arise as a result of answering these questions about the other energy saving Buckets.

Endnotes

[1]NRDC Lara Ettinson, "NRDC Documentation of Concerns with Graphs of Historical Energy Savings to be addressed on January 6, 2010 and January 13, 2010 Energy Savings Subgroup Calls", January 3, 2010.

[2] Itron "Assistance in Updating the Energy Efficiency Savings Goals to Support Savings Goals for 2012 and Beyond" submitted to Michael Wheeler, CPUC March 24, 2007, page 2.

[3] supra note #2 at page 3.

[4] CEC 2008 Integrated Energy Policy Report Update Chapter 2 Energy Efficiency and Demand Forecasting. pp. 42-43.

[5] Supra note 2 at page 12. The specific Itron quote is as follows: "A key analytical issue is associated with calibrating our baseline forecast to then CEC's baseline forecast is accounting for the amount of assumed energy efficiency improvements embedded in the CEC forecast going forward. Our working assumption is that our estimate of "naturally occurring" savings is fully embedded in the CEC's baseline forecast..but that our forecasts of uncommitted utility program savings incremental to naturally-occurring savings are not embedded in the CEC's forecast. However, the exact amount of naturally-occurring savings embedded in the CEC forecast is currently uncertain."

[6] CEC "Incremental Impacts of Energy Efficiency Policy Initiatives Relative to 2009 Integrated Policy Report Adopted Demand Forecast Attachment A Technical Report" January 2010, p. viii.

[7] supra note #6 at page 66.

[8] CEC "Incremental Impacts of Energy Efficiency Policy Initiatives Relative to 2009 Integrated Policy Report Draft Staff Report Appendix A Glossary of Terms p. A-1. January 2010.

[9] CEC 2009 Integrated Energy Policy Report p57- 58

[10] CEC 2005 "Energy Demand Forecast Methods Report, Companion report to the CEC Energy Demand Staff Energy Demand Forecast Report" June 2005 p.3-6

[11] see Movassagh, Nahid "Rebound as part of the overall price effect: A brief description with illustrative examples" an internal e-mail DAO staff communication that provides a simple easy to understand explanation of why we should think of what is normally called the "rebound" effect as part of the overall price effect as follows:

This is how I understand these things. Your less efficient frig produces 10 c.f. of cool per each kWh (e = c.f./kWh). Your more efficient one produces 20 c.f. of cool for the same kWh (these are the inverses of your numbers). Now suppose the price of electricity is $0.40/kWh. Then the price of "cooling" is $0.40/10=$0.04 for the less efficient frig. This is how many dollars you pay to cool one c.f. for one hour (sometimes called effective price). The price of cooling is cut in half for the more efficient frig, to $0.02.

	KWH	Cu. Ft./Hour	e = CF/KWH	$0.40/e
Less Efficient	2	20	10.000	0.04
More Efficient	1.2	24	20.000	0.02

This is similar to cars. Guy has a car with a mpg of 20. If the price of gasoline is $4, then the price per mile driven equals $0.20 per mile ($4/mpg). Guy drives 400 miles and buys 20 gallons of gasoline. Now replace his car with the one with mpg of 40. Price per mile driven goes down to $0.10. We mistakenly think that he will keep driving 400 miles so that he will use 10 gallons. But since the price per mile driven has gone down, he will drive more miles. So gasoline consumption will rebound back up to 15 gallons (50% rebound). Some define rebound in terms of the increase in miles driven. In my example, percentage-wise they are the same. (I like to define it as the increase in gasoline consumption due to a reduction in effective price after it goes down due to increased efficiency; otherwise, what is the meaning of "Re" in Rebound?)

	Gallons	Miles Driven	e=mpg	$4/mpg

Less Efficient	20	400	20	0.2
More Efficient, if drive same miles	10	400	40	0.1
More Efficient, if drive more miles (50% Rebound)	15	600	40	0.1
More Efficient, if drive more miles (100% Rebound)	20	800	40	0.1

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