ORIGINAL

Memorandum

From the office of
Commissioner Bob Burns
Arizona Corporation Commission
1200 W. WASHINGTON
PHOENIX, ARIZONA
(602) 542-3682

TO: Docket Control

DATE: February 27, 2015

FROM: Commissioner Bob Burns

SUBJECT: Integrated Resource Planning Docket No. E-00000V-13-0070

The agenda and presentations from the February 26, 2015 Integrated Resource Planning/ Emerging Technologies Workshop have been docketed. If for some reason you cannot access eDocket, please contact my Executive Aide, Jessica Perry, to receive copies of the presentations.

Original copy of
the memo, agenda and presentations
and thirteen (13) copies of the memo
filed this 27th day of
February, 2015 with:

Docket Control
Arizona Corporation Commission
1200 West Washington Street
Phoenix, Arizona 85007

Copies of the memo mailed
this 27th day of February, 2015, to:

Service List

REVISEDN O T I C E
SPECIAL OPEN MEETING
OF THE ARIZONA CORPORATION COMMISSION

Commission Workshop on Integrated Resource Planning
Docket No. E-00000V-13-0070
Emerging Technologies
Docket No. E-00000J-13-0375

DATE: Thursday, February 26, 2015 **START TIME: 9:00 a.m.**

Arizona Corporation Commission
Hearing Room One
1200 W. Washington Street
Phoenix, Arizona 85007

This shall serve as notice of a special open meeting of the Arizona Corporation Commission at the above location for consideration, discussion, and possible vote of the items on the following agenda and other matters related thereto. Please be advised that the Commissioners may use this open meeting to ask questions about the matters on the agenda; therefore, the parties to the matters to be discussed or their legal representatives are requested, though not required, to attend. The Commissioners may move to executive session, which will not be open to the public, for the purpose of legal advice pursuant to A.R.S. §§ 38-431.03.A.2, 3 and/or 4 on the matters noticed herein. The Commissioners may also move to executive session, which will not be open to the public, for other purposes specified in A.R.S. §§ 38-431.03, including discussions, consultations or considerations of Commission personnel and salary matters, on matters noticed herein.

The Arizona Corporation Commission does not discriminate on the basis of disability in admission to its public meetings. Persons with a disability may request a reasonable accommodation, such as a sign language interpreter, as well as request this document in an alternative format, by contacting Shaylin A. Bernal, phone number (602) 542-3931, E-mail sabernal@azcc.gov. Requests should be made as early as possible to allow time to arrange the accommodations.

Jodi Jerich
Executive Director

Agenda

Opening Comments

Presentations:

1. **Andy Satchwell, Senior Scientific Engineering Associate, Lawrence Berkeley National Laboratory**

   "Utility Resource Planning Practices and Trends: Experiences from Western Regional Planning"

2. **Tom Eckman, Power Division Director, Northwest Power and Conservation Council**

   "IRP Practices in the Pacific Northwest: Lessons Learned"

3. **Sam Newell, Principal, The Brattle Group**

   "Perspectives on the IRP Process: How to get the most out of IRP through a collaborative process, broad consideration of resource strategies and uncertainties, and validation or improvement through market solicitations"

4. **Michael Wheeler, Vice President of Policy Initiatives, RECURRENT ENERGY**

   "Structuring a Competitive Solicitation: What the Ocotillo RFP Can Teach Us"

5. **Mike Sheehan, Director of Resource Planning, Tucson Electric Power**

   "Improving Arizona's IRP Process"

6. **Jim Wilde, Director of Resource Planning, Arizona Public Service Company**

   "Resource Planning Process Improvement Recommendations"

7. **Lon Huber, Special Project Advisor, Residential Utility Consumer Office**

   "Realizing Ratepayer Savings Through Improved Planning and Procurement"

Closing Comments

LBNL's research and technical assistance on regional electric system planning

- LBNL reviews and analyzes Western utility resource plans, including:
  - Comparative analyses of renewable energy and energy efficiency
  - Risk of future carbon regulations
- LBNL has also worked with WECC staff and the State and Provincial Steering Committee (SPSC) over the past several years to develop DSM-related assumptions and modeling inputs, and inform scenario development for WECC's regional transmission planning studies

Simplification of steps in the resource planning process

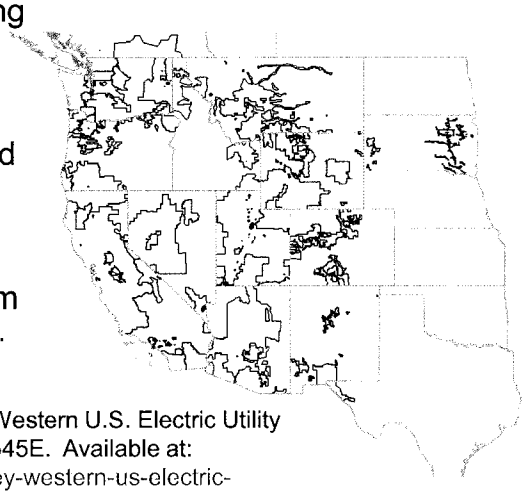
Load forecasts
- What are the future energy and demand requirements?

Resource portfolios
- What portfolio(s) of supply- and demand-side resources can meet future requirements?

Portfolio risk and uncertainty
- What are sources of and approaches to address inaccuracies in forecasts and portfolio selection?

Resource plan analysis coverage

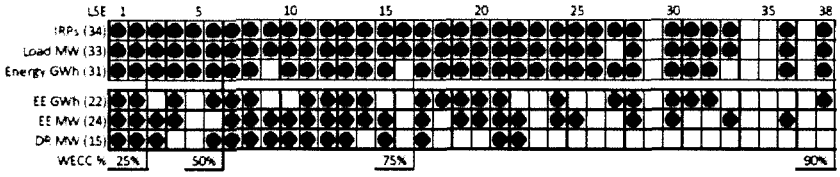
- Over 200 Load Serving Entities (LSEs) operating in WECC
- 38 LSEs account for 90% of WECC delivered energy (2011)
- LBNL focused on the "preferred portfolio" from the most recent plans…



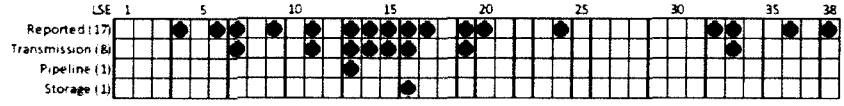
Wilkerson, et al. (2014). Survey of Western U.S. Electric Utility Resource Plans. LBNL Report – 6545E. Available at: http://emp.lbl.gov/publications/survey-western-us-electric-utility-resource-plans

One consistency is the *in*consistency

- Most LSEs report peak load and energy forecasts, but not always both



- Fewer report interconnection infrastructure



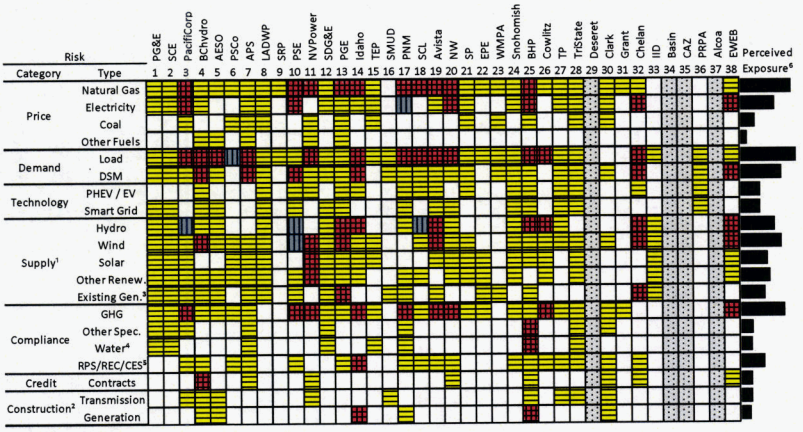
Notes on figure: (1) Each column is individual LSE; (2) Columns are arranged left-to-right by largest to smallest WECC LSE; (3) Dots=Data Exists

Techniques to address uncertainty

Uncertainty Technique	Definition
Scenario analysis	Alternative visions of the future are created. Next, appropriate combinations of resources are identified that best fit each future. Finally, the best options are combined into a unified plan.
Sensitivity analysis	Candidate resource plan (i.e., a combination of future resource options) is identified. Key factors are then varied to see how the plan responds to these variations.
Probabilistic analysis	Probabilities are assigned to different values of key uncertain variables (possibly identified through the sensitivity analysis). Outcomes are identified that are associated with different values of the key factors in combination. Results often include the expected outcome and probability distribution for these key factors (e.g., natural gas prices).

Source: Hirst and Schweitzer (1989)

How are Western LSEs considering risk?



key:
- Scenario or Sensitivity Analysis
- Probabilistic Analysis
- Scenario/Sensitivity and Probabilistic
- Not identified in plan
- Plan not available
- Aggregate of perceived exposure to risk

notes:

[1] All LSEs considered traditional future generation resources, so not summarized here

[2] Risk to construction time or cost overruns

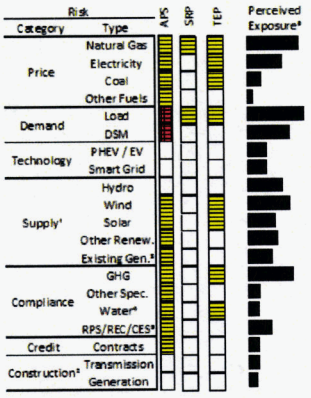
[3] LSE considered changes to existing generation such as early retirements or upgrades

[4] Risk to water contamination or exceeding use limits

[5] LSE considered some form of energy mix compliance or credit including Renewable Portfolio Standards, Renewable Energy Credits, Clean Energy Standards, Installed Tax Credits, Production

[6] Data bar is sum of counts for the number of LSEs that addressed risk in their portfolios. One count for the use of Scenario or Probabilistic Analysis; two counts for those that considered both.

Detail on Arizona utility risk analysis



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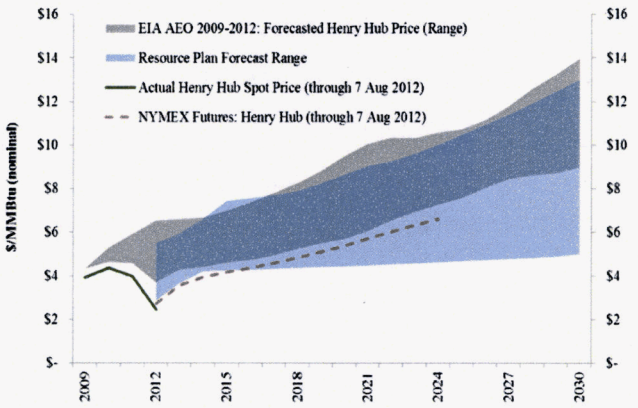
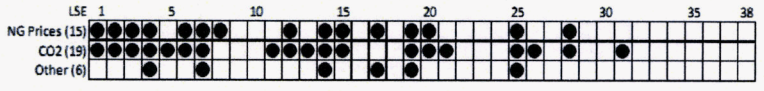
Natural gas "Boom" = low prices?



- National natural gas price forecasts show increasing trend
- LSEs tend to report similar trend across resource plan vintage and geographic region

How are environmental externalities accounted for?

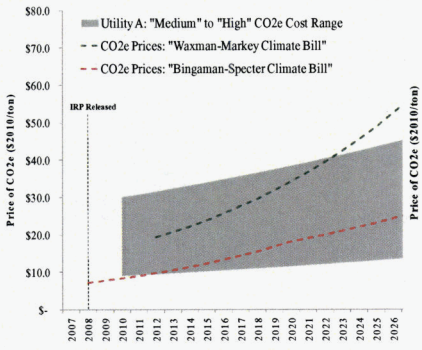
- 19 LSEs assumed GHG prices in at least one scenario
- 6 LSEs also reported other externalities (e.g., NOx, SOx, Hg, PM, water)
- Inconsistent reporting
  - Dollar year of price forecast?
  - CO2e, Carbon, CO2?
  - Units of measurement: What kind of ton?



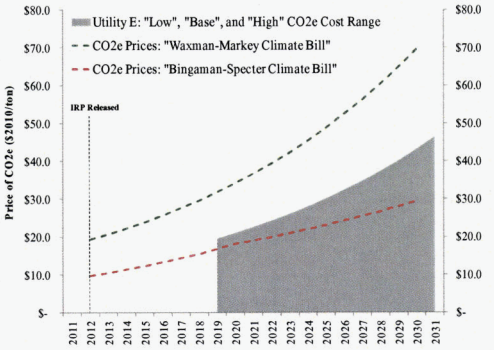
CO2e forecast by resource plan vintage

- Older plans tend to assume *higher* CO2e prices with *more* certainty
- Newer plans tend to assume *lower* CO2e prices with *less* certainty
- This analysis was limited to a subsample of resource plans

2008 IRP



2012 IRP

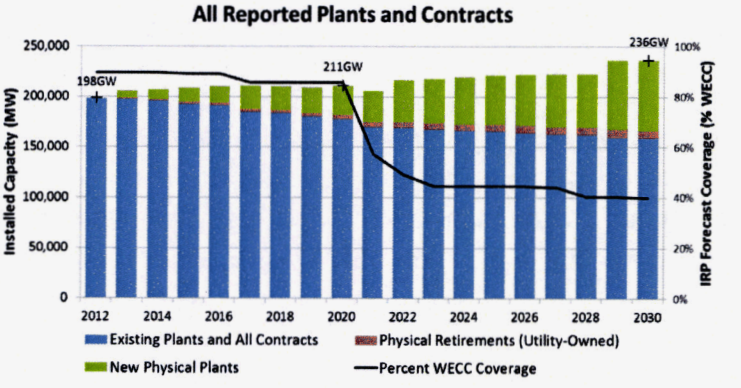


Summary of LSE risk analysis approaches

- LSEs tend to focus risk analysis efforts on evaluation of (1) natural gas prices; (2) load forecasts ; and (3) exposure related to GHG regulations
- Recent planning discussions tend to reflect current regulatory environment:
  - Less focus on GHG regulation (except in CA); more focus on other regulations (RPS)
  - Impact of emerging technologies (e.g., electric vehicles)
- Increased quality and level of detail in newer resource plans

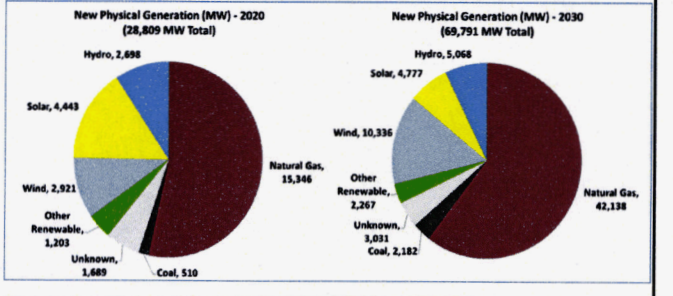
Despite inconsistencies, resource plans are informative

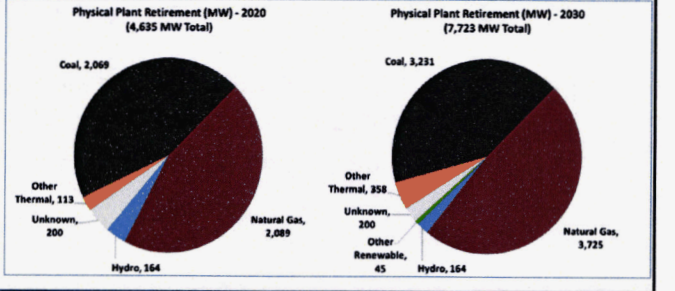
- Installed WECC LSE capacity was 198 GW in 2012 (n=38), which is forecasted to grow ~20% by 2030;
- Not all IRPs include a forecast through 2030, so the analysis becomes less useful in later years.



Incremental generation and planned retirements among WECC LSEs

- Fuel mix of new capacity is dominated by natural gas
- Retirements are split almost entirely between natural gas and coal-fired generation
- Steady growth in utility-owned or contracted renewable generation





Improving consistency and accuracy of DSM-related planning assumptions

- LBNL has worked with WECC staff and the State and Provincial Steering Committee (SPSC) over the past four years to develop DSM-related assumptions and modeling inputs for WECC's regional transmission planning studies
- WECC's two planning study horizons and modeling frameworks
  - **10-Year Studies**: Production cost modeling to identify congested pathways
  - **20-Year Studies**: Capacity expansion modeling to identify optimal generation and transmission build-out to meet future needs
- DSM-related assumptions and modeling inputs developed for:
  - Reference case and High DSM/DG scenarios
  - Energy efficiency, demand response, and distributed generation

Example: developing DR resource quantities

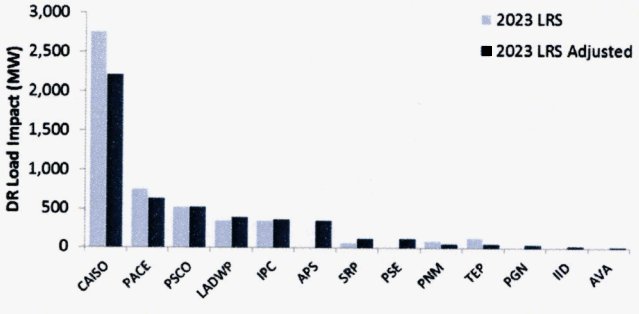
- **2024 Common Case**: DR resource quantities are based on non-firm load forecasts reported by balancing authorities (BAs) to WECC
  - Four categories of non-firm load (i.e., DR program types): Interruptible, Direct Load Control, Pricing, and Load as a Capacity Resource
- Non-firm load forecasts were validated against IRPs, regulatory filings, and other public sources; adjustments, as necessary, confirmed with utility staff
- This process yielded an adjusted non-firm load forecast for the year 2023; this forecast is used in the 2024 Common Case
  - Minimal change expected in DR programs between 2023 and 2024

Summary of adjustments to 2023 LRS forecast

- Across the WECC footprint, adjustments made to demand response programs resulted in a small overall change to the expected load impact of DR programs in 2023
- However, there were substantial changes in the types of DR programs identified (as well as their locations)

DR Program Type	2023 LRS Forecast (MW; NCP)	2023 LRS Adjusted Forecast (MW; NCP)	Percent Change
Interruptible	2,240	2,082	-7%
Direct Load Control	1,800	2,096	+16%
Price Responsive	8	217	+2615%
Load as a Capacity Resource	1,576	1,117	-29%
Total	**5,624**	**5,513**	**-2%**

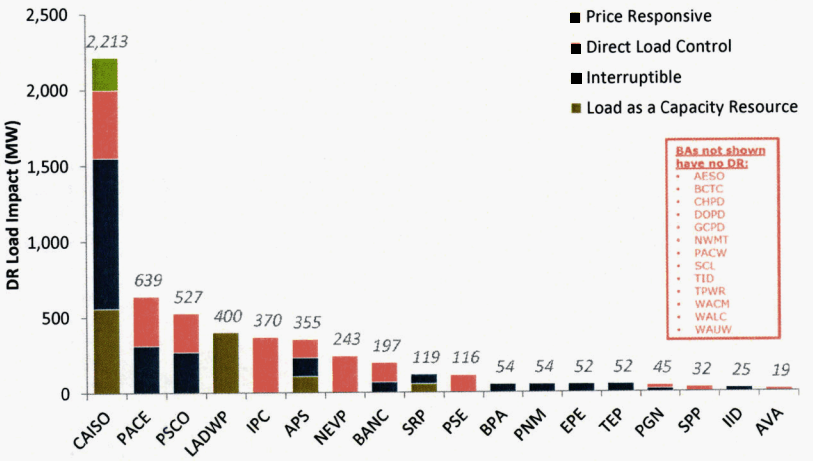
Major adjustments by WECC BA



Balancing Authority	2023 LRS Adjusted	2023 LRS Original	Change
CAISO	2,213	2,760	(547)
PACE	639	763	(124)
PSCO	527	531	(4)
LADWP	400	350	50
IPC	370	351	19
APS	355	-	355
SRP	119	63	56
PSE	116	-	116
PNM	54	95	(41)
TEP	52	133	(81)
PGN	45	-	45
IID	25	-	25
AVA	19	-	19

Figure and table exclude BAs with no non-firm load submission to LRS and no recommended changes

2023 adjusted forecast by BA and DR program type



Comparison of Arizona utilities between 2021 and 2023 adjusted forecasts

- **APS: 250 MW increase from 2021 to 2023**
  - Increase seen from 2009 to 2012 IRPs in the amount of DR in preferred portfolio
- **TEP: 25 MW reduction from 2021 to 2023**
  - Staff provided revision to WECC non-firm load forecasts consistent with amount identified in EE plan
- **SRP: 318 MW reduction from 2021 to 2023**
  - Interruptible program shrank from 359 MW to 63 MW and change in expected future CPP programs per FERC survey

For more information

Andy Satchwell | asatchwell@lbl.gov

For publications on LBNL's resource planning work:

http://emp.lbl.gov/reports/resp

IRP Practices in PNW
Lesson Learned*

Tom Eckman
Director, Power Division
Northwest Power and Conservation Council

Spoiler Alert:
It Takes More Than A IRP to Succeed!

Northwest Power and Conservation Council

Today's Topics

- What is the Council?
  - Reason for Formation
  - Charge Under Federal Statute
  - Role in Northwest Region
- The Council Planning Process
  - Technical Approach to Resource Planning
  - Public Process and Stakeholder Involvement
- Q and A

Northwest Power and Conservation Council

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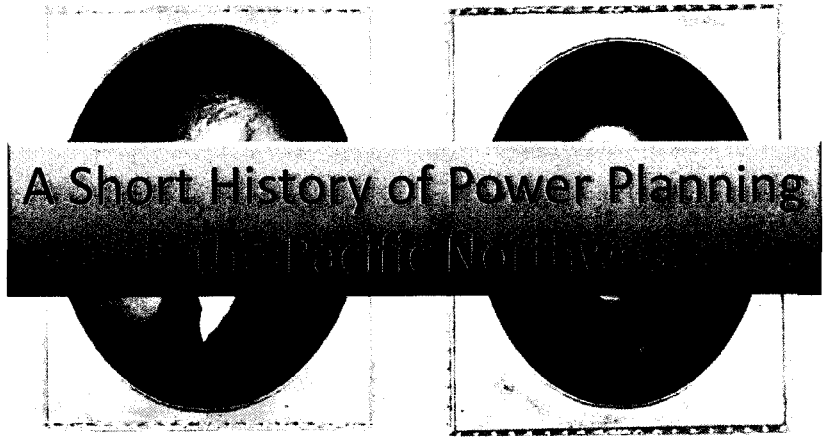
What Happened After Lewis and Clark Left?



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The First Three "Eras" of Power Planning in the PNW

- "New Deal" Mysticism (1930-1950)
  - Politicians plan using "chicken entrails and crystal balls" legislate what's needed and when
- Engineering Determinism (1950-1970)
  - Engineers, using graph paper and rulers, schedule the next power plants
- Economic Determinism (1970 to April 27, 1983)
  - Economist, using price elasticity, slow the engineer's construction schedules

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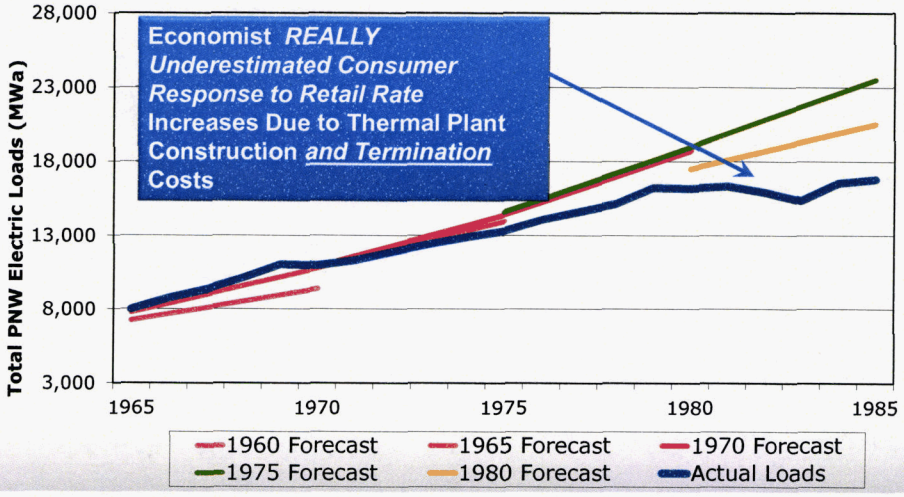
Actions Taken in Response to "Engineering and Economic Determinist's" Forecasts

- PNW Utilities planned and/or started construction on 28 coal and nuclear power plants to be completed over a 20-year period.
- Native American tribes sued the state and federal government over loss of salmon
- Environmental groups sued Bonneville Power Administration over plans to turn the Columbia River into "Wave World"

Northwest Power and Conservation Council

Regional Electricity "Engineering and Economic Determinist's" Forecast vs. Actual Use 1960 to 1985



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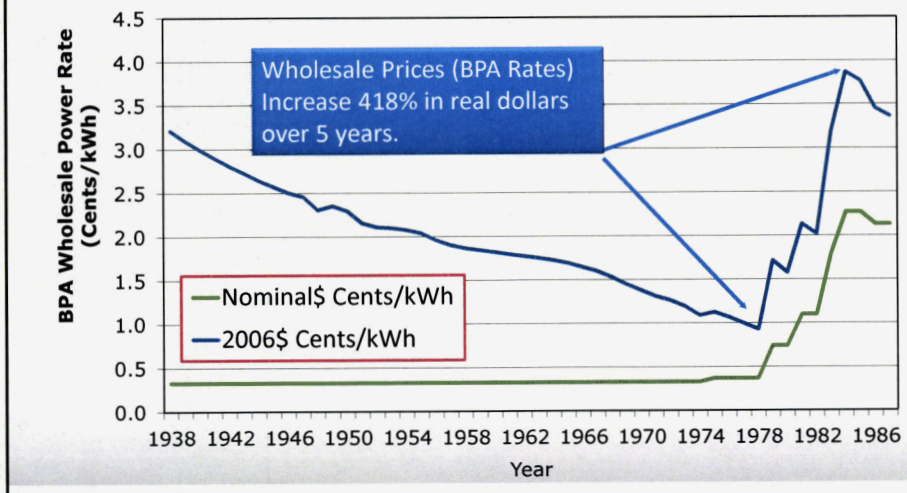
Impact of Actions Taken in Response to "Engineering and Economic Determinist's" Forecasts and Resource Development



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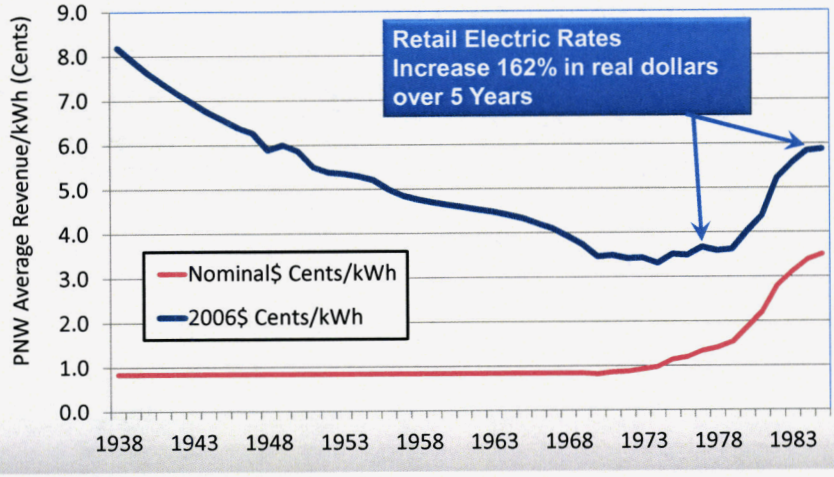
BPA's Wholesale Rate Increases Translated in Dramatic Changes in PNW Retail Electric Rates



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Political Impact of Actions Taken in Response to "Engineering and Economic Determinist's" Forecasts

- Utilities terminated or mothballed 9 nuclear and 5 coal plants at a cost to the region's consumers of more than $7 billion.
- The region's politicians, utilities, larger industries and public interest groups agreed to accept the "deals" embodied in the Northwest Power Planning and Conservation Act of 1980

Northwest **Power** and **Conservation** Council

Pacific Northwest Electric Power Planning and Conservation Act (PL96-501)

- Authorized the states of Oregon, Washington, Idaho and Montana to form an *interstate compact* (aka, "the Council")
  - Council is comprised of two members from each state appointed by their Governors
- Directed the Council to develop:
  - Fish and Wildlife *Program* to *"protect, mitigate and enhance" F&W impacted by hydro-system development*
  - Regional Power *Plan*
- Mandated *public involvement* in the Program and Plan development processes

The Council Is Unique!

Northwest **Power** and **Conservation** Council

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NW Power Act's Statutory Charge

- Council is to Prepare a Regional Power Plan that contains:
  - A 20-year load forecast for electricity demands
  - A ***"least cost"*** resource strategy to meet forecast demand
  - Review and update its Plan every five years
- Conservation (i.e., energy efficiency) is defined as a *resource* and given 10 percent cost advantage
- Established Resource Development Priorities:
  1. Conservation
  2. Renewable Resources;
  3. Generating resources utilizing waste heat or generating resources of high fuel conversion efficiency
  4. All other resources.

*Note: This statute was enacted 23 years before California issued its "loading order."

Northwest **Power** and **Conservation** Council

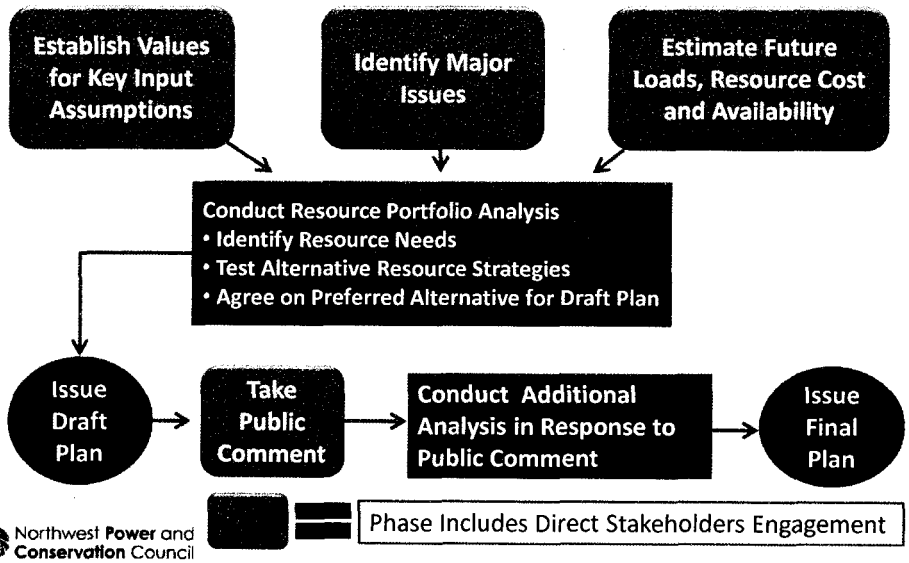
Council's Planning Process

- Longest running Integrated Resource Planning Process in US (and likely the world)
- Council has published six regional plans since 1983 (7th is currently under development)
- All Plan's have called for ***significant reliance on energy efficiency***
- Council has ***no regulatory authority*** over utilities or state commissions*

*Resource acquisitions by the Bonneville Power Administration (BPA), a federal power marketing agency, must be "consistent with the Plan"

Northwest **Power** and **Conservation** Council

Plan Development Process



Northwest Power and Conservation Council

Public Involvement in Plan Development

The **Northwest Power Act** requires the Council to insure widespread public involvement in the formulation of regional power policies

Before the Act

After the Act

•Establish a voluntary scientific and statistical advisory committee (SSAC) to assist in the development and amendment of the power plan

•Ensure membership includes representatives of the Federal and various regional, State, local, and Indian Tribal Governments, consumer groups, and customers

Northwest Power and Conservation Council

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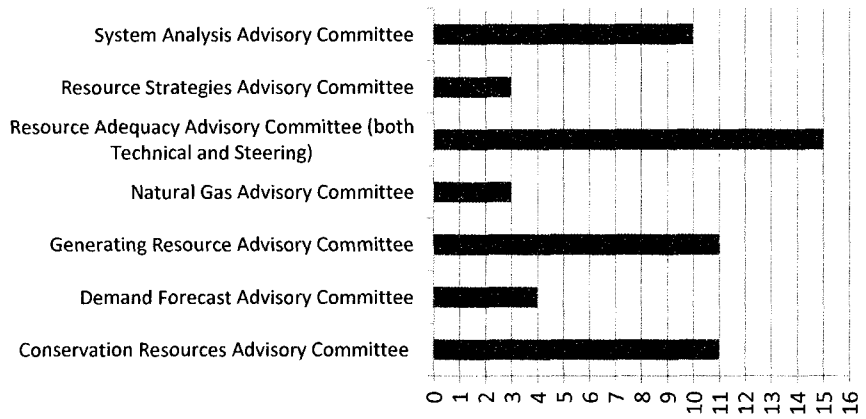
Seventh Power Plan
Power Plan Advisory Committees

- Conservation Resources Advisory Committee (CRAC)
- Demand Forecasting Advisory Committee (DFAC)
- Natural Gas Advisory Committee (NGAC)
- Generating Resources Advisory Committee (GRAC)
- Resource Adequacy Advisory Committee (RAAC)
- System Analysis Advisory Committee (SAAC)
- Resource Strategies Advisory Committee (RSAC)

Formation and Operation of Power Plan Advisory Committees

- Committees chartered for two years
- Committees report to the Executive Director
- Council staff usually chair & vice chair, though not required
- Members selected based on their technical expertise and experience.
  - Council solicits nominations for membership from regional stakeholders
  - Final appointments made by the Executive Director
- All meetings are open to the public
  - All notices, agendas, materials, minutes, membership lists, etc. are posted on each committee's webpage
- Committees serve in *advisory* capacity only
  - No votes are taken
  - Role is to review information, vet assumptions and information and make recommendations to the Council.
- All advisory committees help develop action plan

Public Involvement Means More Than a Few Workshops or Hearings



Northwest Power and Conservation Council

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Role of Council Members and Staff

- Council members are free to participate in all Advisory Committee meetings
- Staff
  - Prepare agenda and materials for the meetings
  - Facilitate meetings
  - Certify meeting minutes (required by law)
  - Report to the Executive Director and Council Members on all progress and recommendations

Northwest Power and Conservation Council

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Another Advisory Committee that Also Assist in Plan Development

- Regional Technical Forum – Assist with review of energy efficiency potential assessments
- RTF's primary role in region is to develop standardized savings estimates and protocols for assessing savings.

Northwest Power and Conservation Council

Sample of Issues On Which Advisory Committee Input Might Be Sought

- What should the Plan assume about the adoption of Emerging Technologies, such as solid-state lighting and solar photovoltaics (PV)?
- How should the Plan incorporate the 2020 provisions of the Energy Independence and Security Act's (EISA) general service lighting requirements?
- What cost reductions and performance improvements should be assumed for new wind and solar photovoltaic generating resources?
- What should be the upper and lower bounds of natural gas prices from 2016 – 2025?

Northwest Power and Conservation Council

PNW State IRP Requirements

- Washington requires IRPs from any utility with 25,000 or more customers
  - All IOUs are covered
  - Only public utilities that are not a "full requirements" customer of the BPA are covered
- Idaho, Oregon and Montana only require IRPs from IOUs
- Montana also requires IRPs from power marketers but terms differ

Role of Council and Council Plans in Utility IRPs

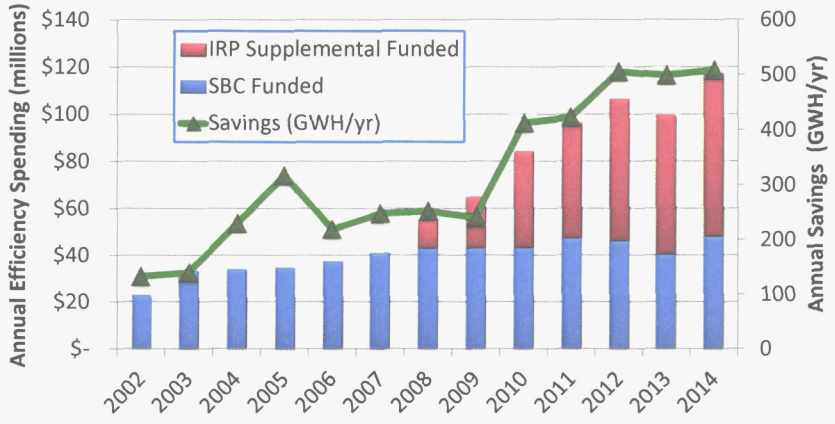
- Council analysis and data viewed as independent
- Council's plans serve as a reference against which utility specific IRPs are reviewed by both regulators and other stakeholders
- Specifically, Council's regional energy efficiency goals viewed by policy makers, regulators and stakeholders as appropriate "yardstick" against which regional achievements should be measured

Relationship Between IRP and EERS

The two most populous NW states have both IRP and "EERS"

- Oregon has a "system benefits charge" to fund energy efficiency and independent "administrator" (Energy Trust of Oregon)
  - Oregon also permits utilities to supplement "SBC" funding for EE if IRP shows additional resources are cost-effective to acquire
- Washington electric utilities (both IOU and POU) with >25,000 customers must acquire "all cost-effective energy efficiency"
  - Washington utilities, by state law, are now required to follow "Council methodology" for assessing EE potential and setting EE acquisition goals

Energy Trust of Oregon's SBC Funding Represents a Floor for EE Acquisitions



IRPs Are Used To Justify Supplemental EE Acquisitions

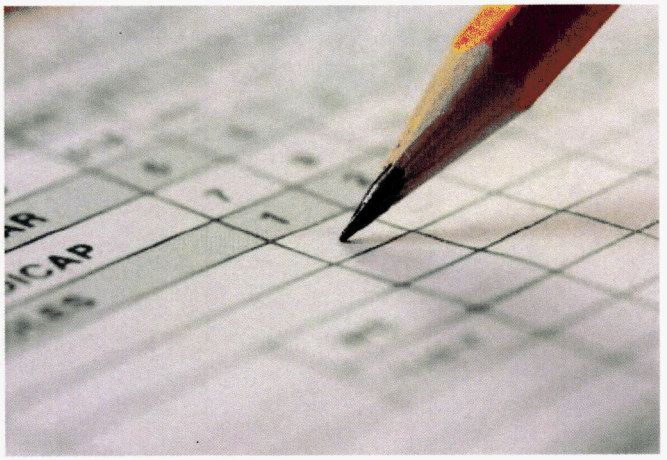
Major Differences in Achievable Potential Assessments Should Require Stakeholder Explanation

	Potential As A Share of 2032 Loads					
Consultant	A	A	A	B	A	Council Staff
Potential Type	Utility A	Utility B	Utility C	Utility D	Regional PMA	Council*
Achievable	12.2%	18.7%	17.3%	16.0%	Low - 10.6% - High - 19.8%	20.90%
Economic	22.8%	26.4%	22.8%	Not Reported	24.8%	
Technical	37.4%	37.8%	31.0%	22.0%	31.6%	25%

*Council Estimates "Economically Achievable" Potential in single step

Same Consultant, Different IRP Client

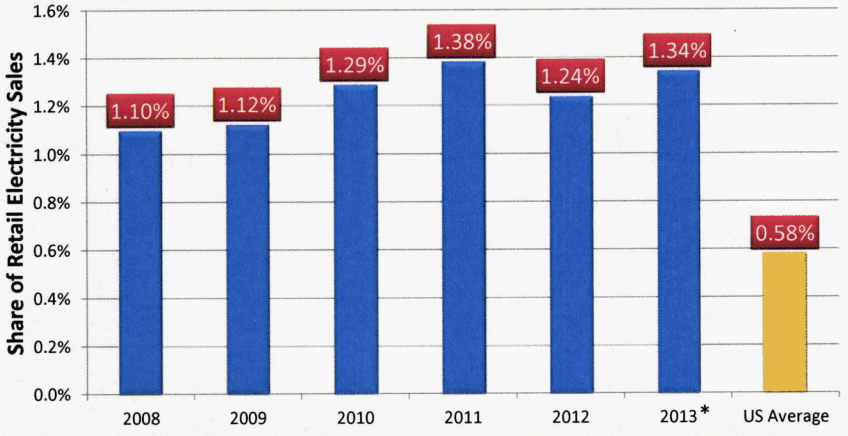
Achievable Potential As A Share of Economic Potential		
Measure	Utility A CPA	Utility B CPA
Central AC	40%	85%
Air Source Heat Pump	40%	85%
Ductless Heat Pump	N/A	73%
Water Heater ≤ 55 gal	16%	50%
Water Heater > 55 gal	32%	50%
Clothes Washer	40%	85%
Dishwasher	40%	85%
Refrigerator	40%	85%
Interior Lighting - Screw In	27%	55%
Interior Lighting - Linear Fluorescent	53%	55%
Interior Lighting - Specialty	16%	55%
Exterior Lighting - Screw In	27%	55%



Now to the "Score Card"

Northwest Power and Conservation Council

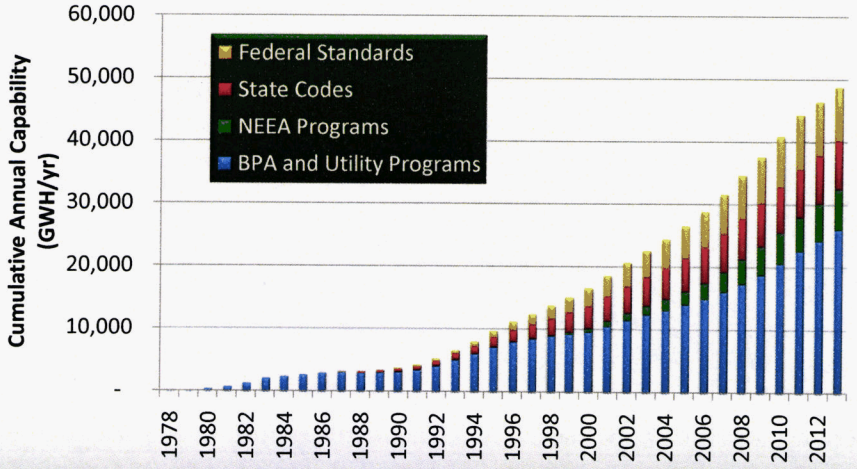
Utility/SBC-Funded Savings Equaled 1.3% of Regional Electricity Sales in 2013 More Than Double the US Average



* 2013 is based on 2012 loads data from EIA. 2013 data is expected in October/November 2014

Northwest Power and Conservation Council

Since 1978 Utility & BPA Programs, Energy Codes & Federal Efficiency Standards Have Produced Almost 49,000 GWH/yr of Savings



Northwest Power and Conservation Council

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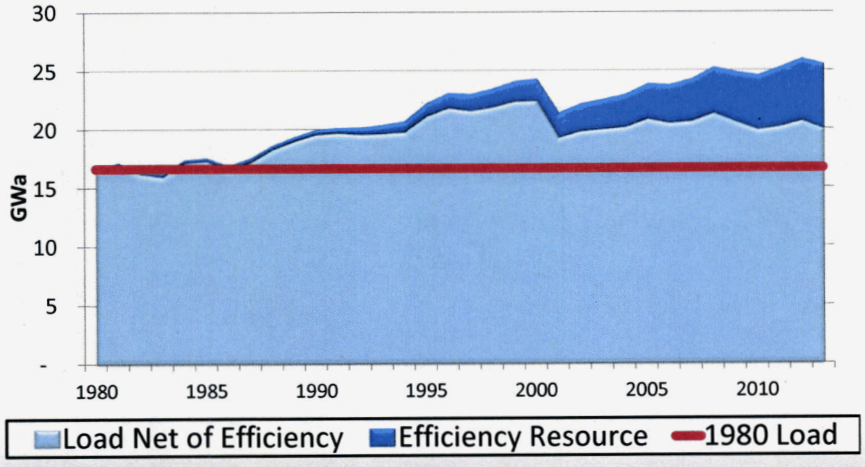
So What's 49,900 GWH/yr?

- It's enough electricity to serve the ***entire state of Oregon***
- It saved the region's electricity consumers nearly *$3.51 billion* in 2013
- It lowered 2013 PNW carbon emissions by an estimated *21.9 million* MTE.

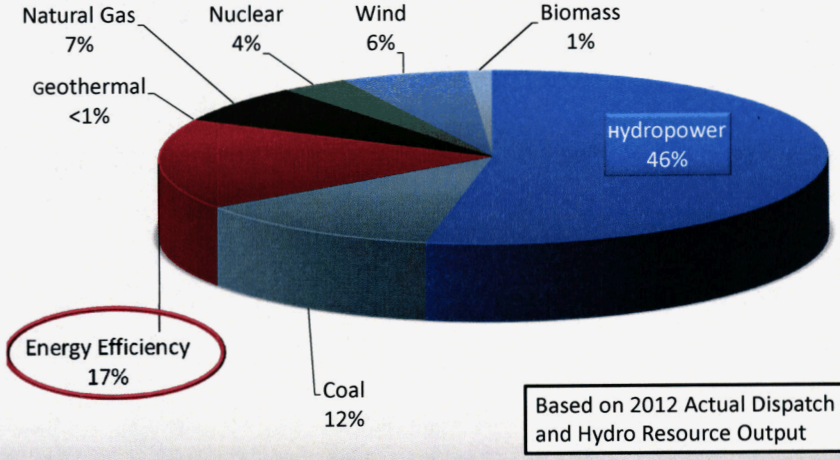
Northwest Power and Conservation Council

Efficiency Has Met Nearly 62% of PNW Load Growth Since 1980



Northwest Power and Conservation Council

Energy Efficiency Has Been The Region's Second Largest Resource Since 2012



Based on 2012 Actual Dispatch and Hydro Resource Output

Northwest Power and Conservation Council

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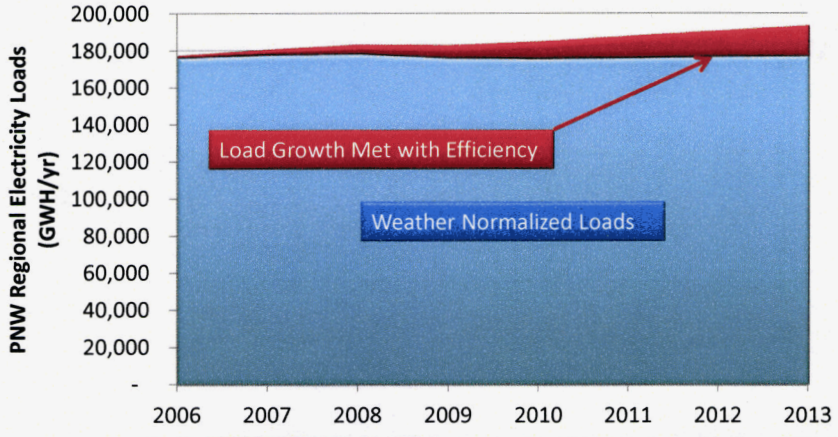
Northwest Regional Electric Loads Have Remained Virtually Unchanged for Seven Years, Because We've Been Meeting Most Load Growth With Efficiency

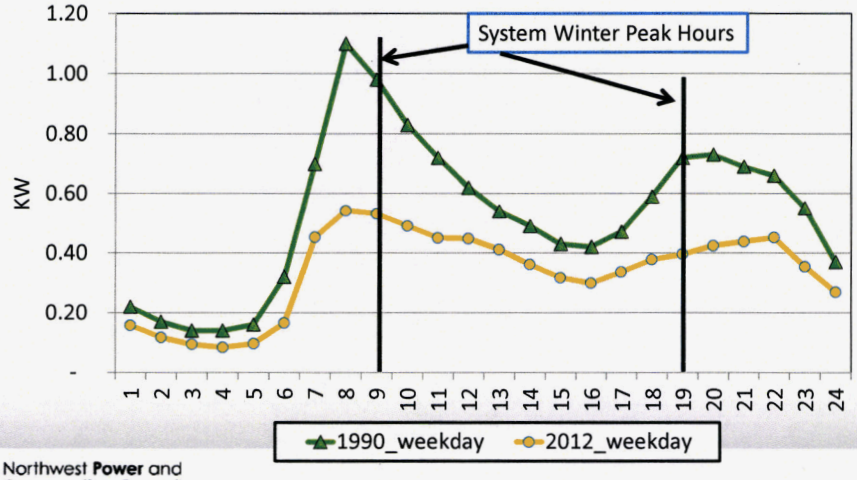


Since 2006 Energy Efficiency Has Offset 1.1% Annual Load Growth

Northwest Power and Conservation Council

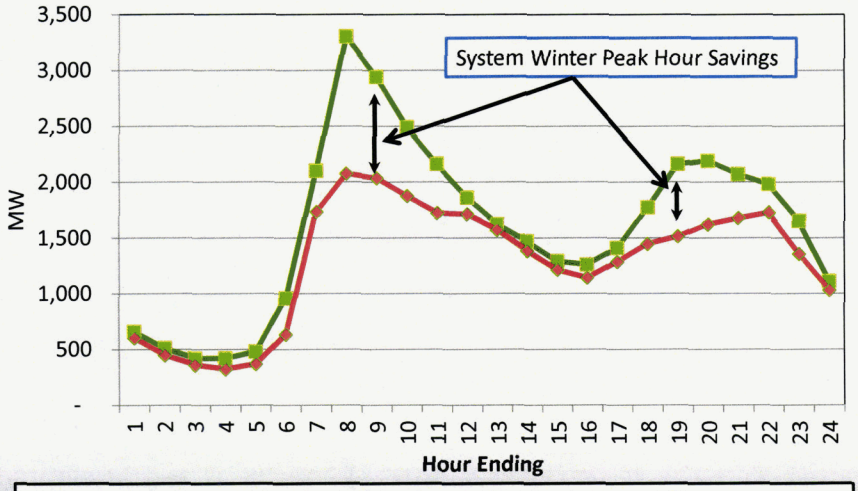
Energy Efficiency Also Changes Peak Demands

Residential Water Heating Load Shape in 1990 vs. 2012



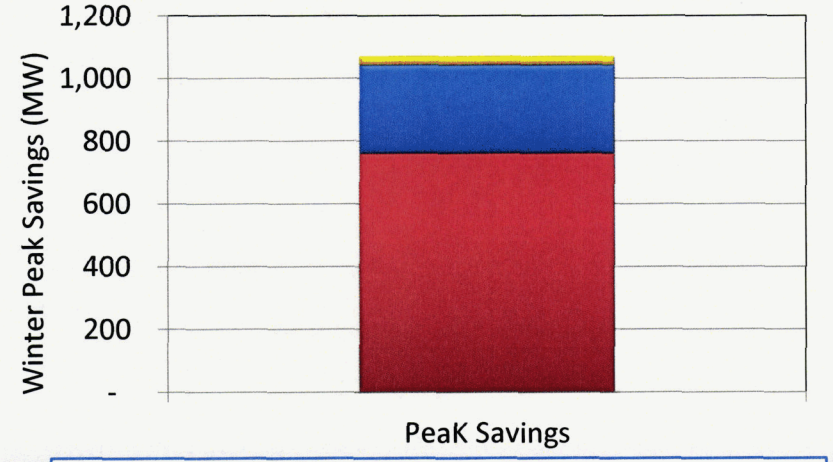
Northwest Power and Conservation Council

Efficiency Improvements in Residential Water Heating Have Reduced PNW Winter Peak Hourly Demand by Over 900 MW Since 1990



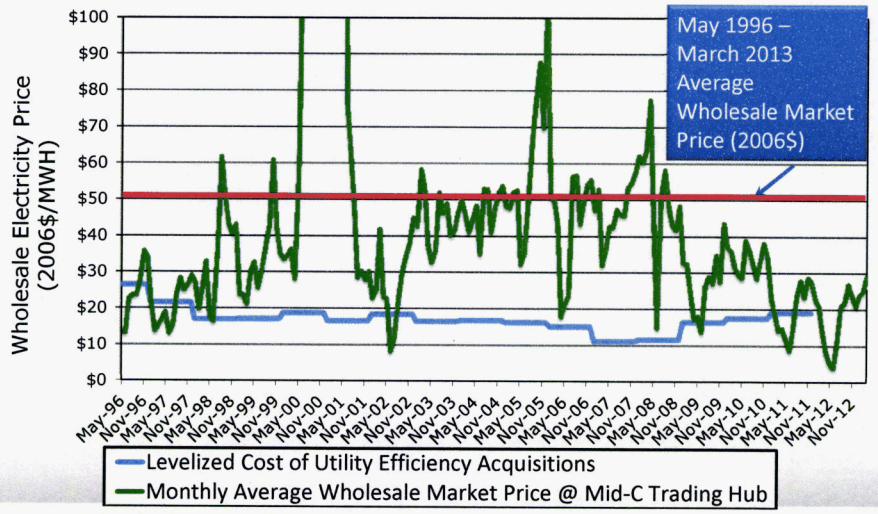
Northwest Power and Conservation Council

Winter Peak Savings from 2010-2012 Utility Efficiency Programs Were Nearly 1,100 MW



Northwest Power and Conservation Council

Average Cost of Utility Acquired Savings Continues to Be Lower and Less Volatile Than Wholesale Market Electricity Prices



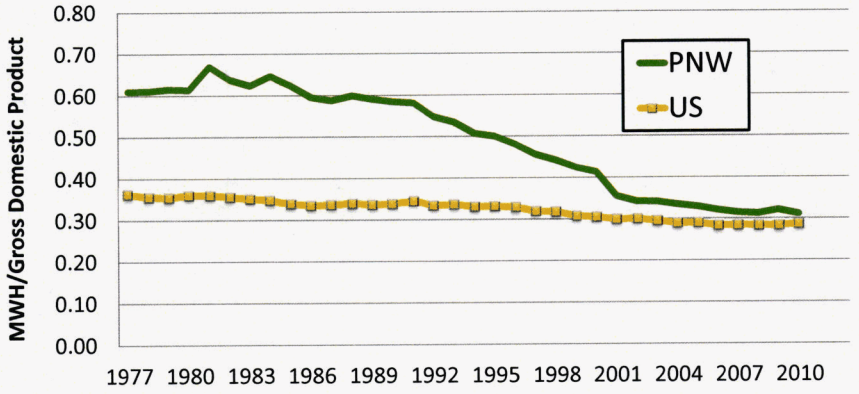
Northwest **Power** and **Conservation** Council

Questions?

Northwest **Power** and **Conservation** Council

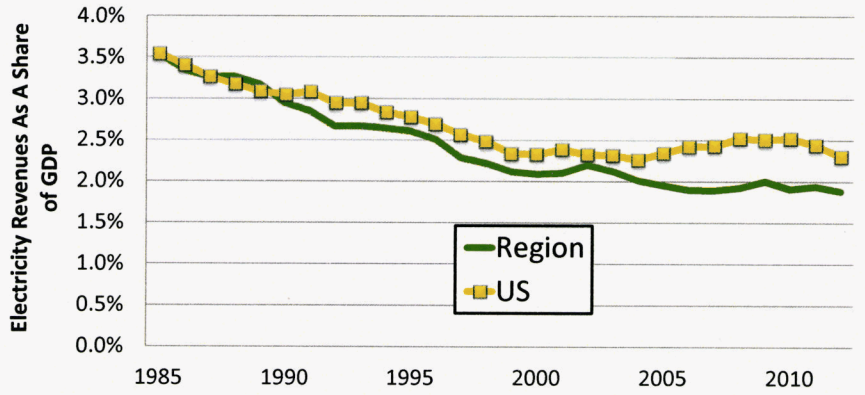
Backup Slides

Northwest Electricity Intensity Per Unit of Economic Output Has Been Decreasing



Gross Domestic Product : BEA- 2005 constant dollars
Energy Consumption: State Energy Data

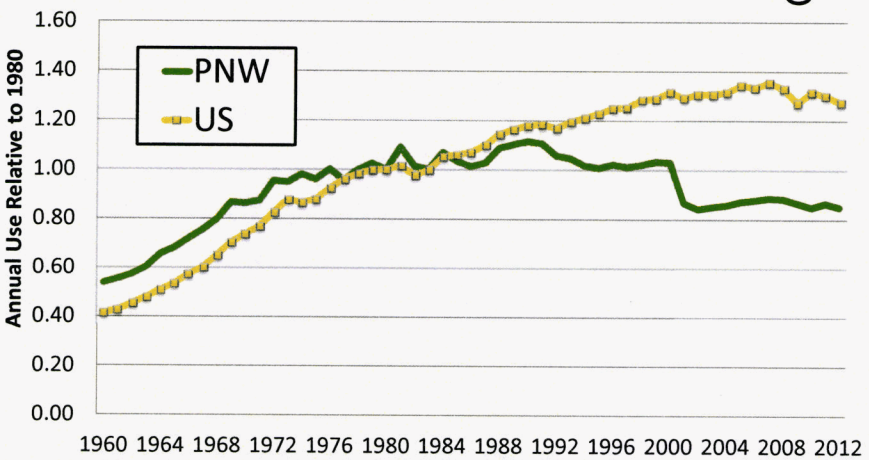
Northwest Electric Revenues Comprise A Smaller Share of GDP Than The National Average



Gross Domestic Product : Based of Bureau of Economic Analysis- measured in $2005 dollars.
Electric revenue from : State Energy Data System- includes electricity sales to all sectors (i.e., residential, commercial, industrial and transportation).

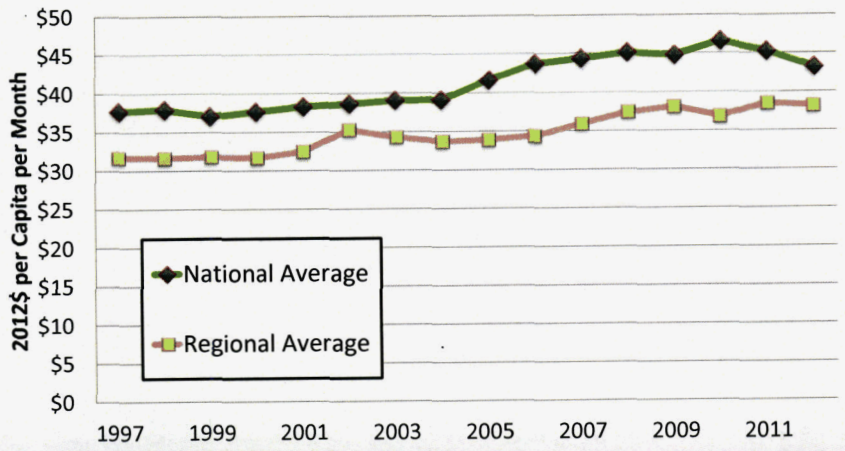
Northwest **Power** and **Conservation** Council

Northwest Electricity Use Per Person Has Been Decreasing



Northwest **Power** and **Conservation** Council

Northwest Electric Bills Are Lower Than the National Average



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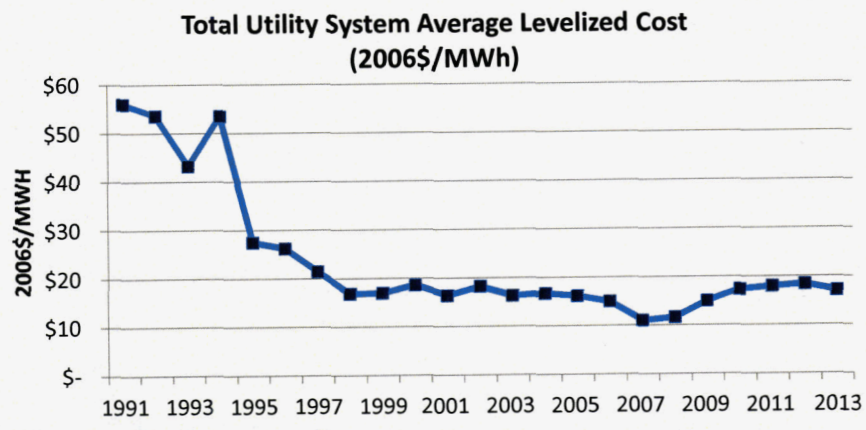
Average Utility Levelized Cost of Energy Efficiency Remains Low



Northwest Power and Conservation Council

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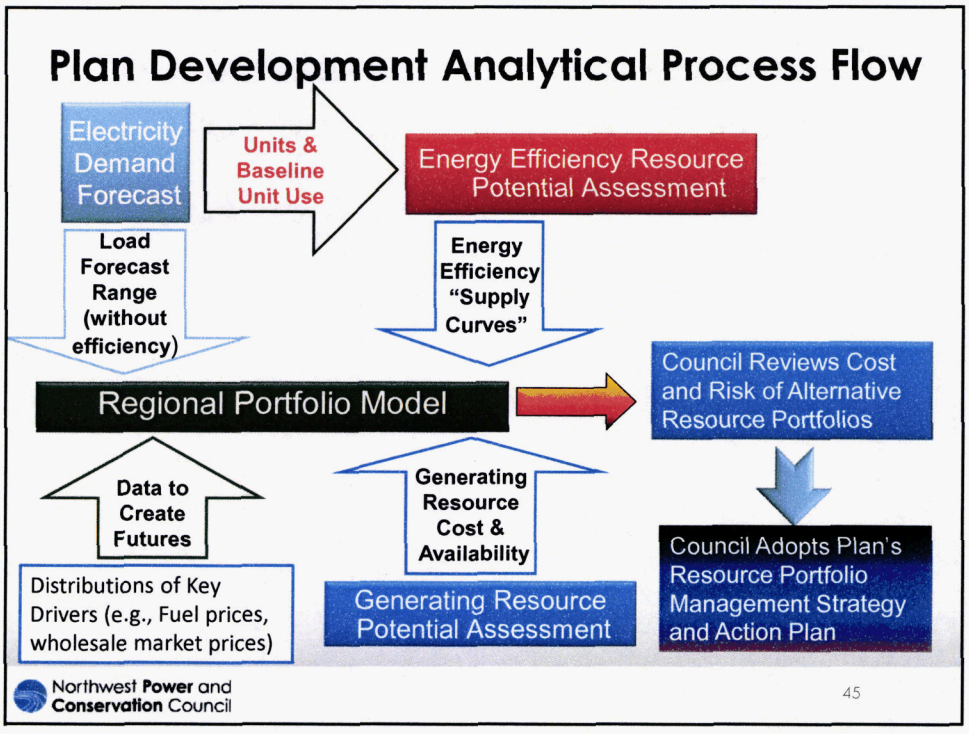
Plan Development Analytical Process Flow
Electricity Demand Forecast
Units & Baseline Unit Use
Energy Efficiency Resource Potential Assessment
Load Forecast Range (without efficiency)
Energy Efficiency "Supply Curves"
Regional Portfolio Model
Council Reviews Cost and Risk of Alternative Resource Portfolios
Data to Create Futures
Generating Resource Cost & Availability
Council Adopts Plan's Resource Portfolio Management Strategy and Action Plan
Distributions of Key Drivers (e.g., Fuel prices, wholesale market prices)
Generating Resource Potential Assessment
Northwest Power and Conservation Council
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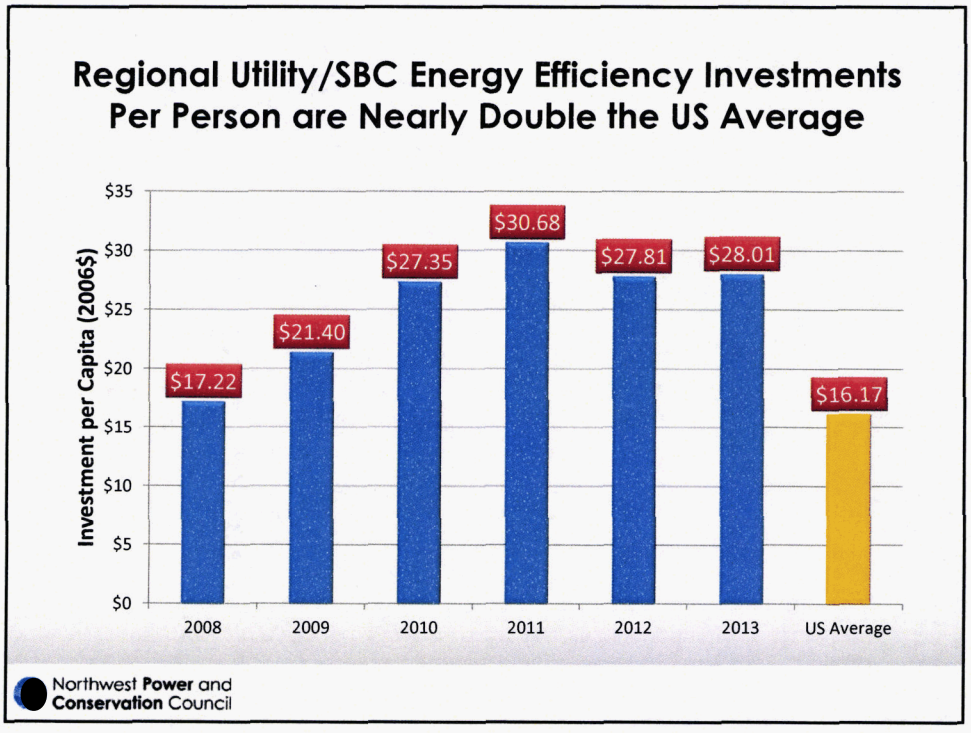
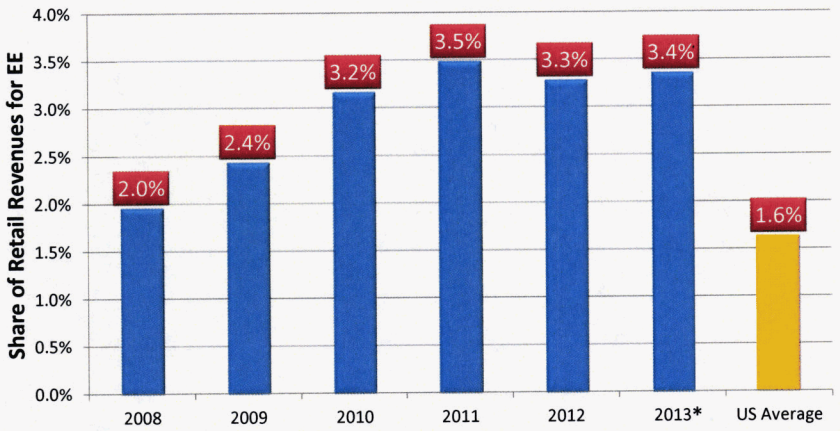

Regional Utility/SBC Energy Efficiency Investments Per Person are Nearly Double the US Average
Investment per Capita (2006$)
$35
$30
$25
$20
$15
$10
$5
$0
$17.22
$21.40
$27.35
$30.68
$27.81
$28.01
$16.17
2008
2009
2010
2011
2012
2013
US Average
Northwest Power and Conservation Council

Average Utility Levelized Cost of Conservation Remains Low

Northwest **Power** and **Conservation** Council

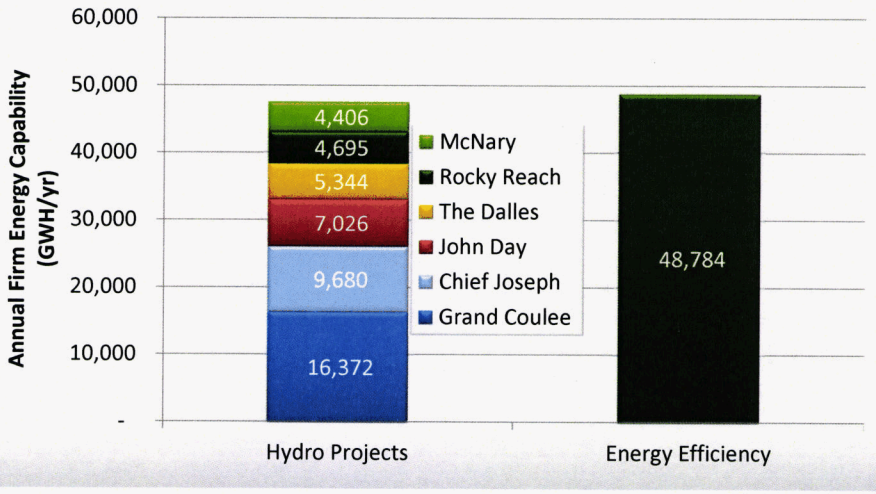
Region Invests about Twice the National Average Share of Its Retail Electric Revenues in Energy Efficiency



* 2013 is based on 2012 revenues data from EIA. 2013 data is expected in October/November 2014

Northwest **Power** and **Conservation** Council

Savings from Energy Efficiency Since 1978 Nearly Equal the Annual Firm Energy Output of the Six Largest Hydro Projects in the Region



Northwest Power and Conservation Council

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Perspectives on the IRP Process

Special Open Meeting on Integrated Resource Planning
Docket No. E-00000V-13-0070

PRESENTED BY
Sam Newell

February 25, 2015

THE Brattle GROUP

Agenda

Overview of IRP Objectives

Getting the Most out of the IRP Process

- Collaboration: utilities, stakeholders, commission staff, and consultants
- Scenario development
- Broad consideration of resource strategies

Complementing IRP with Market Tests

- Solicitations
- Evaluation of PPAs vs. self-build

Overview of IRP Objectives

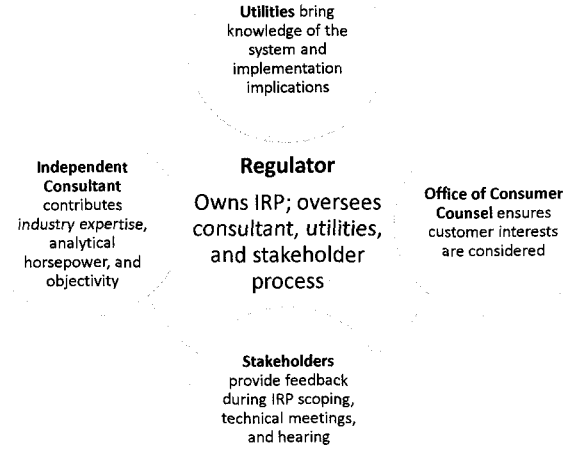
High-level scope and objectives

- Identify and analyze resource needs for reliably meeting customer demand and other public policy objectives over a long-term horizon
- Analyze risks that could change the nature, timing, or magnitude of needs
- Evaluate resource options for cost-effectiveness and ability to meet needs, including from market sources; assess risks to customers and utilities
- Develop a short, medium, and long-term plan
- Monitor industry and policy development for future actions (e.g., new technologies, cyber-security, fuel security, etc.)

Why is the IRP process valuable?

- Inform investments with an in-depth understanding of the evolving electricity industry and local systems
- With significant upfront involvement from utilities, policymakers, and key stakeholders, the utilities (and state) can identify innovative and cost-effective forward-looking solutions, with significant buy-in
- Balance the need of the customers, utilities and meeting public policy objectives

Collaboration: The Connecticut Example



Collaboration (cont.)

Collaboration can identify better solutions and can achieve transparency & buy-in, based on:

- The utility's essential technical knowledge
- Stakeholder input
- The regulator's guidance
- Independent consultants bring standards of objectivity

As consultants for the CT regulator and utilities, Brattle helped to:

- Define IRP objectives, design scenarios, and broaden the set of resource options considered
- Vet input data and run modeling system
- Develop evaluation criteria
- Present results at hearing as part of expert witness panel

Scenario Development Steps

1. Identify Future Trends, Drivers and Uncertainties

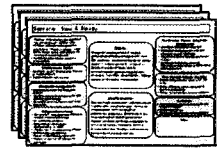
- Industry experts and stakeholders present views on a range of topics
- Identify and summarize trends, drivers and uncertainties
- Address load, fuel prices, environmental regs, market structure, policies in neighboring states, game-changing technologies, etc.

2. Define Future Scenarios

- Participants (working in small teams) draft descriptions of future scenarios based on key drivers
- Participants review and further refine the scenarios to ensure that they capture the desired range of futures

3. Translate Scenarios into Planning Assumptions

- Planning team translates scenarios from qualitative descriptions to specific planning assumptions with input and feedback from stakeholders



	Current Trends	Econ Boom	High Gas	Strict Env.
Gas Prices	Base	Low	High	High
CO2 Costs	Base	Low	Base	High
Renewable Costs	Base	Low	High	High
Inflation	Base	Low	Base	Base
Gross Load	Base	Low	Base	Low

Some Arizona utilities are already doing much of this...

Broad Consideration of Resource Options

"Scenarios" consider the uncertain factors that the State/Utility cannot control.

"Resource Options" (or policies) represent decisions that the utility or regulator can make, aiming for good performance under a range of scenarios.

IRP should consider a broad range of resource options

- Demand-side options as well as supply-side
- G&T joint options (esp. w/ renewables)
- Different ownership options to achieve efficient scale and risk sharing
- Multi-stage decision-making as uncertainties resolve
- Market-based options for purchases

Evaluation of Resource Options against Scenarios

Primary criterion is PVRR for meeting reliability requirements and other policy objectives

But also need to consider risks, informed by scenario analysis

- Risk of not meeting reliability needs or other objectives, e.g., RPS or EE
- Risk of high relative costs (vs. alternatives) in some scenarios

Short-term vs. long-term considerations

- Option value of delaying major investment under uncertainty, using short-term purchases or demand response as a bridge

Emissions and other non-price metrics

The Role of Market Tests

If the IRP shows a need for a costly retrofit or new investment, consider market options to meet needs at lower cost.

Market tests may identify special low-cost opportunities that a utility would not be able to find, e.g. excess supply in neighboring states, cogeneration opportunities, etc.

Solicitations allowing a range of terms can reveal market options and lead to contracts if selected.

- If other utilities/IPPs have low-cost existing capacity or can develop demand response, they may offer short- or medium-term supplies at prices below new generation supply
- If no low-cost, short-term supplies are available, the best offers may be for new resources under long (e.g., 15-20 year) terms
- Offers can be compared to self-build options

Comparing Market Options to Self-Build

The primary evaluation criteria are similar to within the IRP

- Minimize PVRR; simplify by evaluating *incremental* PVRR of alternatives
- Compare alternatives on an apples-to-apples basis, e.g., if an IPP alternative would require transmission upgrades, account for those costs
- Consider cost risks to utilities and ratepayers; and risks of not meeting various objectives
- Other non-price attributes

When considering long-term PPAs, need to recognize that payment obligations are similar to debt

- Debt rating agencies recognize this economic reality
- Comparison of PPA to self-build can recognize risk transfer
- Commissions can compensate utilities for increased financial risk

Presenter Information

SAM NEWELL
Principal | The Brattle Group, Cambridge, MA
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Dr. Samuel Newell, a Principal of The Brattle Group, is an economist and engineer with experience in electricity wholesale markets, the transmission system, and RTO/ISO rules. He supports clients throughout the U.S. in regulatory, litigation, and business strategy matters involving wholesale market design, generation asset valuation, transmission development, integrated resource planning, demand response programs, and contract disputes. He has provided testimony before the FERC, state regulatory commissions, and the American Arbitration Association.

Dr. Newell earned a Ph.D. in Technology Management and Policy from MIT, an M.S. in Materials Science and Engineering from Stanford University, and a B.A. in Chemistry and Physics from Harvard College. Prior to joining Brattle in 2004, Dr. Newell was Director of the Transmission Service at Cambridge Energy Research Associates.

About The Brattle Group

The Brattle Group provides consulting and expert testimony in economics, finance, and regulation to corporations, law firms, and governmental agencies worldwide.

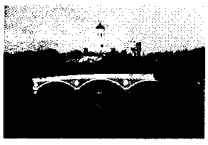
We combine in-depth industry experience, rigorous analyses, and principled techniques to help clients answer complex economic and financial questions in litigation and regulation, develop strategies for changing markets, and make critical business decisions.

Our services to the electric power industry include:

- Climate Change Policy and Planning
- Cost of Capital & Regulatory Finance
- Demand Forecasting & Weather Normalization
- Demand Response & Energy Efficiency
- Electricity Market Modeling
- Energy Asset Valuation & Risk Management
- Energy Contract Litigation
- Environmental Compliance
- Fuel & Power Procurement
- Incentive Regulation
- Market Design & Competitive Analysis
- Mergers & Acquisitions
- Rate Design, Cost Allocation, & Rate Structure
- Regulatory Compliance & Enforcement
- Regulatory Strategy & Litigation Support
- Renewables
- Resource Planning
- Retail Access & Restructuring
- Strategic Planning
- Transmission

Offices

NORTH AMERICA


Cambridge


New York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Washington, DC

EUROPE


London

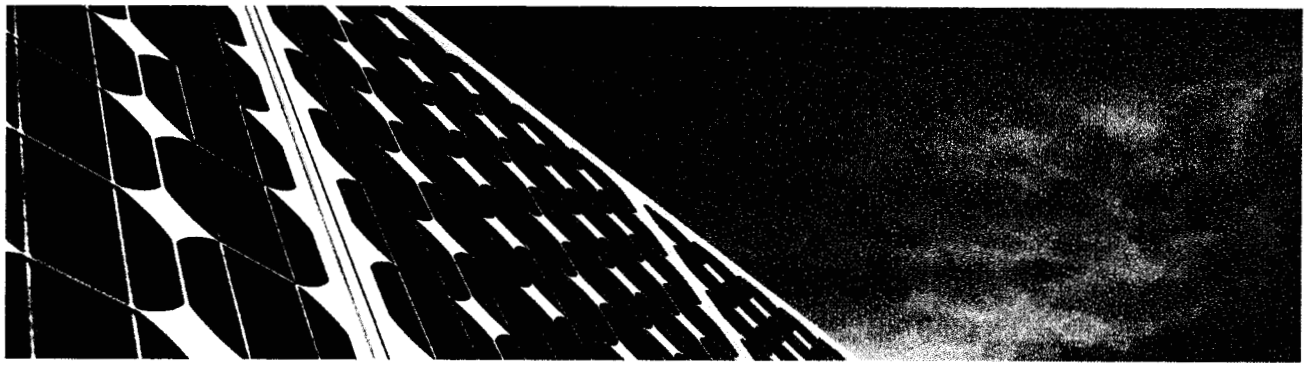

Madrid


Rome

RECURRENT ENERGY

STRUCTURING A COMPETITIVE SOLICITATION: WHAT THE OCCOTILLO RFP CAN TEACH US

February 26, 2015



RECURRENT ENERGY: BUSINESS OVERVIEW

- Leading solar project developer helping our world sustainably meet its energy needs
- Over $4B in project finance secured to date from leading lenders and investors active in the energy sector
- Proven access to capital through a network of financial partners that enables us to deliver utility solar at any scale
- 3.3 GWac/4.3GWp project pipeline, more than 1.1 GWac/1.5GWp of contracts won, more than 520 MWac/680MWp developed and sold
- Seasoned leadership team with experience in conventional and renewable power businesses
- Strong technology and supply chain expertise enable delivery of solar projects at market-leading cost

Recurrent Energy has the resources, experience, technical expertise, and access to capital to deliver utility solar at any scale.

SUCCESSFUL COMPETITIVE PROCUREMENT

- Frequent, scheduled competitive solicitations drive market participants to prepare and provide best value products
- Technology advancement is outpacing utility or regulatory product and pricing awareness
- Utilities are discovering cost-competitive wholesale solar shows up when competitively solicited:
  - Austin Energy: 150MW of solar outside of RPS at 5.0 cents/kwh
  - SRP: 45MW of solar outside of RPS at 5.3 cents/kwh
  - Georgia Power: over 500MW of solar at average of 6.5 cents/kWh
  - Xcel Energy: 100MW of solar selected by Minnesota PUC in IRP process as most economic choice

RECURRENT ENERGY

A LEVEL PLAYING FIELD BENEFITS ARIZONA

- Competition to supply utility demand is an excellent method of identifying the least-cost resources and delivering ratepayer value
- The IRP and resulting procurement process can leverage competition across resources to harvest the best long-term value at the lowest risk for Arizona ratepayers considering:
  - Price Volatility
  - Water Availability
  - Emissions Profile
- Ratepayer satisfaction cannot be assumed unless procurement authorization assures highest value contracts
- APS' Ocotillo RFP is a first step in initiating a competitive "All Source RFP" structure but improvements are needed to make it a fair and viable process for developers to participate in

RECURRENT ENERGY

OCOTILLO RFP FEEDBACK

- **Measuring value:**
  - The most basic issue is understanding what is valued
- **Project and Bid Viability:**
  - Good procurement processes have minimum bid requirements such as demonstrated site control or interconnection studies to promote viability
  - Occotillo RFP has neither and instead relies on a $75/kw Development Security be posted at PPA execution
  - To post this $22.5M deposit and have confidence that Bid Price is accurate a developer must have achieved key milestones to resolve crucial risks and know the majority of its costs
- **One year minimum notice:**
  - Land – Understanding any locational preferences APS has for the project location developers must then secure land via option agreements
  - Permitting – Environmental studies are performed following site control
  - Interconnection – The developer must submit to APS' Interconnection Study process to have the grid's ability to accept the power evaluated and at what cost.
    - Initial studies take a minimum of six months and are performed only twice a year.
    - Final study and cost results may take another six months

CONTACT

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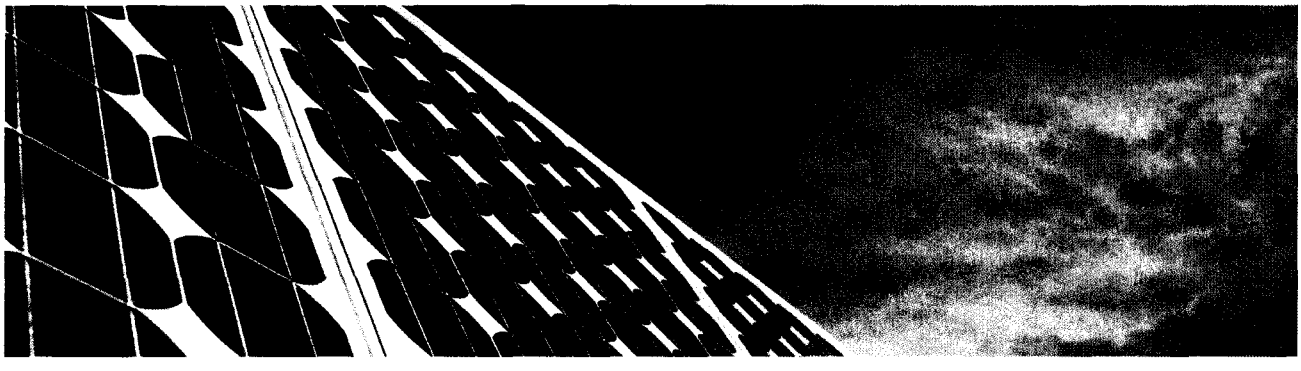
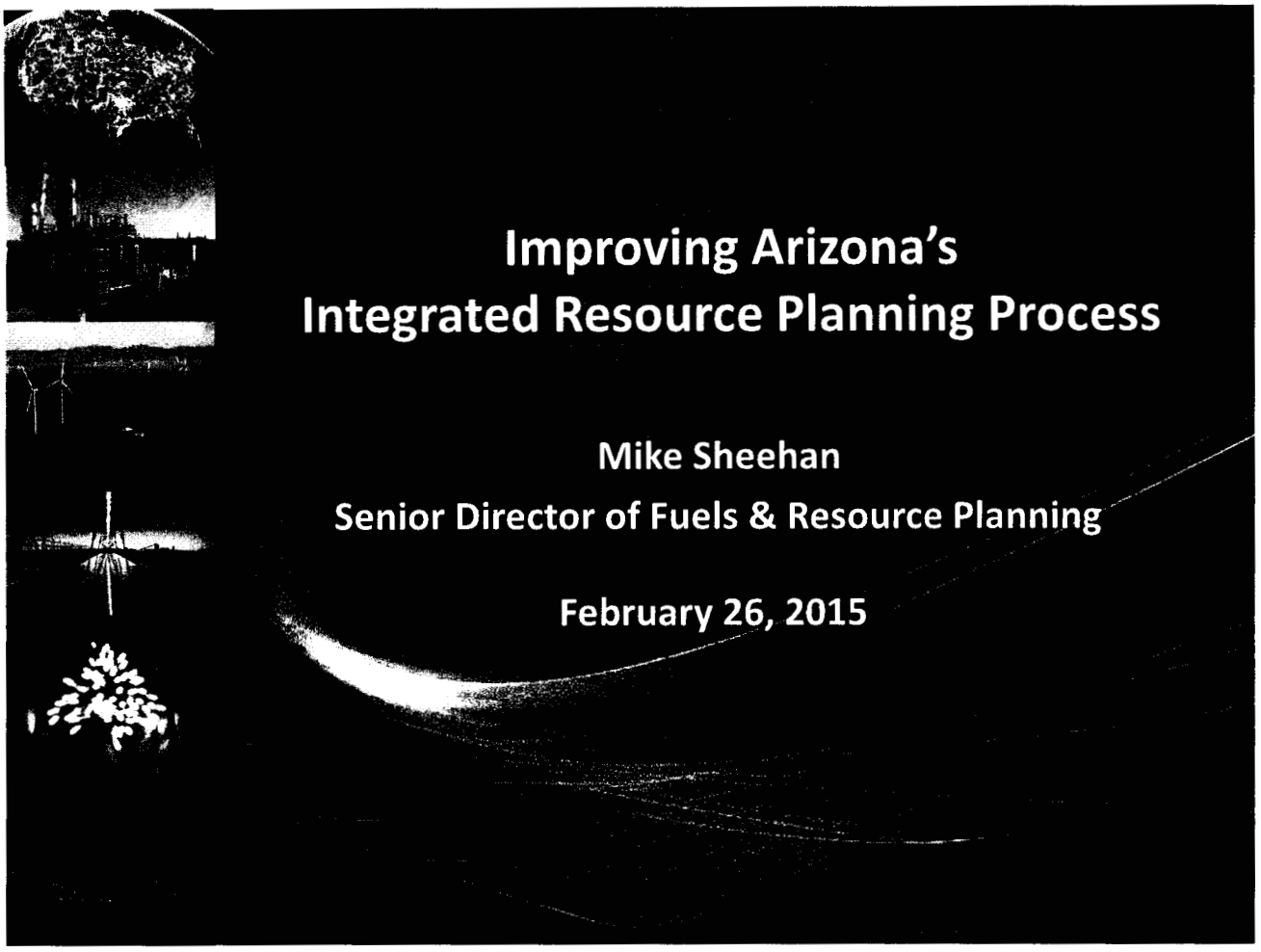




Improving Arizona's Integrated Resource Planning Process

Mike Sheehan
Senior Director of Fuels & Resource Planning

February 26, 2015

Current IRP Process

- TEP and UNSE rely on third party consultants to develop IRP inputs
  - Forward natural gas and power prices
  - Future environmental legislation
  - New technology options and cost inputs
- TEP and UNSE plans assume compliance with the RES and EE standards
- TEP and UNSE plans consider a range of scenarios that are consistent with stakeholder and customer feedback
  - Full Coal Retirement Case
  - High Renewables Case
  - Coal Retrofits Case
  - Market Based Reference Case

Current IRP Process

- TEP and UNSE communicate with Staff and the Commission as events change
  - EPA's Regional Haze Rules and on-going SIP negotiations
  - 2013 Base Load Power Replacement RFP
  - EPA's Clean Power Plan 111(d)

- TEP and UNSE emphasize a balanced approach to resource planning
  - Reliability
  - Rate impacts
  - Portfolio diversity
  - Environmental improvements over time

TEP & UNSE Support Improving the IRP Process

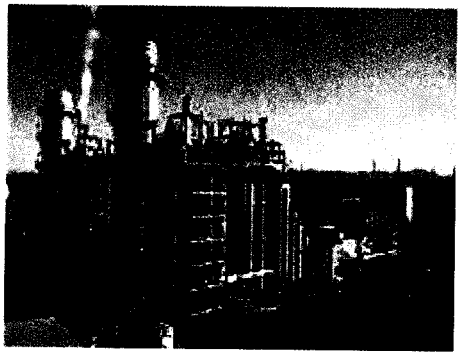
- Commission hosted IRP workshops
- Use of Consultants hired by ACC Staff to serve as facilitators
- Stakeholder input on future scenario development
- Stakeholder input on sensitivity analysis and resource portfolios
- Expanding sections of the IRP to detail emerging technologies, transmission plans and regional developments like energy imbalance markets.

Need for Resource Planning Flexibility

- Significant effort and lead time to develop all assumptions
- Utility specific issues are complex and competitively sensitive
- Need to maintain flexibility to take advantage of opportunities
- Ability to maintain balanced approach on behalf of our customers
- Prudency is ultimately determined in a rate case

TEP and UNSE's Gila River NGCC Opportunity

Entegra



Gila River Power Station
Power Block 3

Future IRP Planning

- **EPA's Proposed Clean Power Plan 111(d)**
  - Arizona
  - New Mexico
  - Tribal Lands

  - EPA Final Rule – Q3 2015
  - State Implementation Plans – 2016 – 2017
  - EPA Approval of SIP – 2017 – 2018

Resource Planning Workshop

Arizona Corporation Commission

February 26, 2015

Jim Wilde
Director, Resource Planning

aps

IRP Process Overview

- Vehicle for dialogue on future resource needs
- Utilities accountable for filing plans every two years
- Resource Planning rules list eleven factors that Commission considers in assessing plans
- Utilities bear the burden of proof for planning and investing for the future
  - Provide for cost-effective system reliability
  - Prudence obligation regarding investments lies with utilities
- Plans independently reviewed by third-party consultant

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Review of Filed Comments

- Collaborative stakeholder process for utility planning assumptions and needs
- Utility-specific requests for information (RFI)
- Integration with transmission, distribution and smart grid planning
- Utilizing IRP to better determine level of DSM and renewable resources
- IRP approval

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Utility Specific RFI's

- Independent Monitor (IM)
- ACC, stakeholder and IM comment prior to issuing solicitation
- Gather information on variety of technologies
- Results and IM review made available to ACC Staff and consultant
- Context for resource costs, market-readiness, and performance characteristics

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Collaborative Stakeholder Process

- Commission led workshop(s)
- Opportunity for stakeholder dialogue
- Utility and stakeholder presentations
- Discussion of potential scenario development

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Integration of T&D and Smart Grid Planning

- Relationship between BTA and IRP processes
- Smart grid investments key to overall system reliability
- IRP could serve as vehicle for more holistic view

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Utilize IRP to Better Determine Renewable and DSM Levels, Types and Timing

- Renewables important part of overall resource mix
- Use DSM to help address evolving customer load shape
- Emphasize programs that address seasonal peaks
- Expand opportunities to count cost-effective energy savings toward meeting EE Standard

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Acknowledgement vs Approval of IRP's

- "Approval" would provide Commission better opportunity to provide policy direction
- Provides utilities with increased certainty prior to making investment decisions
- Flexibility needed since circumstances and related plans change

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APS and RUCO Agreement

- Conduct all-source RFP by Dec 31, 2016
- Peaking capacity prior to 2021 (beyond Ocotillo project) and explore energy storage potential
- Energy storage totaling 10 MWh to be in service by Dec 31, 2018

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Current Request For Proposal (RFP)

- Independent monitor (IM) hired
- RFP issued January 30th
- Significant interest from various parties and technologies
- Responses due March 18th
- Final selection anticipated in May
- Report from IM due at completion of negotiations

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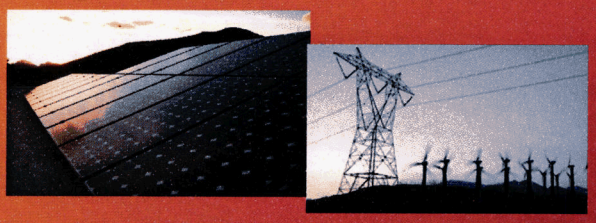


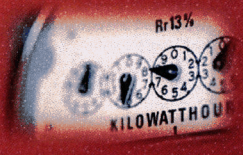
Realizing Ratepayer Savings through Improved Planning and Procurement

Lon Huber

Residential Utility Consumer Office (RUCO)

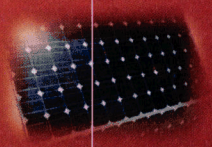
Background

- Multi-Party Filing on December 5th 2014 in IRP docket
  - In response to Staff's request for feedback during the November IRP workshop and their identified limitations of the current resource planning process (Staff Report, starting on page 101)
- Comments are provided in the context of changing a utility industry



Areas For Improvement

1. Planning Assumptions and Process
2. Disconnect between Resource Procurement and Resource Planning
3. Insufficient Data and Analysis
4. Absence of Independent Analysis
5. Procurement methods



Solutions

- Five step route that adds to and reinforces the current process
- Starts with the Commission hiring a consultant team to conduct an independent **analysis** of utility resource needs and provide a critical review of the IRPs and three year action plans
- Ends with acknowledging IRP, approving action plan, and if need be, an independently reviewed RFP

Solutions - Step One

Step One: ***Define Key Assumptions, Resource Options, etc***

- Stakeholder workshops on the front end would be conducted by the Commission to help determine key assumptions, (e.g., future fuel prices, load growth rates, discount rates, etc.)
- In preparation, the consultant team would also obtain reliable information on such topics as:
  - Cost and availability of various resources
  - Resource operating characteristics
- If certain additional information is needed, an RFI could also be issued by the utilities

Solutions - Step Two

Step Two: ***Obtain Data and Conduct Analyses to Provide Guidance to Utilities***

- The Commission's Consultant would gather and analyze data to recommend additional scenarios and portfolios in the IRP plans for utilities to analyze. The consultant would:
  - Recommend multiple sensitivity analyses that combine scenarios for fuel, water, federal regulations, etc.
  - Cost projections of new and emerging technologies
  - Offer standardized way to compare resources
  - Request key statistics

Solutions - Step Three

Step 3: Develop IRP and Near Term Action Plan

- Utilities should address integration of generation with transmission and distribution planning in the IRP
- Consideration of operational changes, such as joining the Energy Imbalance Market that will provide system benefits
- To the extent possible, the Consultant and utilities should take a statewide perspective
- The Consultant would then review and analyze the plans

Solutions - Step Four

Step 4: Review Near Term Action Plan and Specify Details of the Resource Needs

- If near-term resource needs were identified the Independent Consultant would evaluate and verify these needs. This *would not* establish prudency for rate making purposes
- Specific parameters of the needs for the purposes of resource procurement would be established
- The Commission would *approve* the Action Plan and *acknowledge* a long-term IRP with a selected portfolio

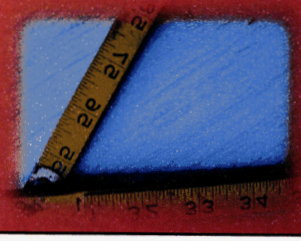
Solutions - Step Five

Step 5: Conduct Competitive Resource Procurement

- The Commission, its Consultant, and stakeholders would be provided an opportunity to review and comment on the RFP prior to its release
- All-resources and business models would be eligible
- This RFP process would include an Independent Monitor as specified in existing policy (A.A.C. R14-2-706).
- Additionally an independent evaluation of bids would also be conducted

Going Forward

- Provide direction and guidance in 2014 IRPs for 2016
- Look at procurement polices to cover the interim period – use Ocotillo settlement as guide
- Explore creating a valuation model for new technologies



Concluding Points

The proposed process reforms:

- Formalize stakeholder input and Commission analysis
- Provide actionable information
- Improve coordination - just when AZ needs it the most
- Reduce probability of stranded cost and poor investment choices

Thank You