Generation Options for Idaho's Energy Plan

Arne Olson
Energy & Environmental Economics, Inc. (E3)

Presented to:

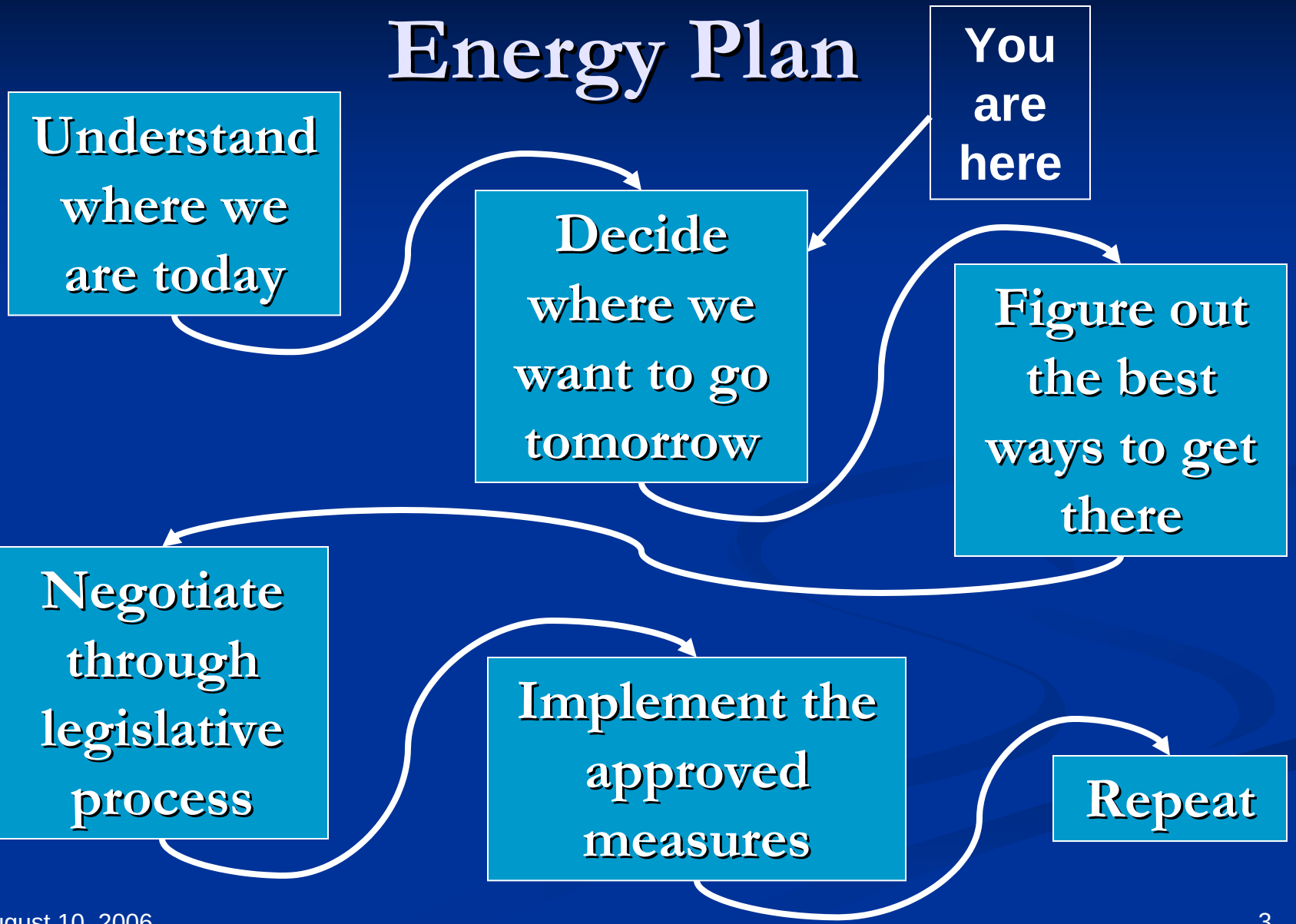
Subcommittee on Generation Resources
Boise, Idaho
August 10, 2006

353 Sacramento Street, Suite 1700
San Francisco, CA 94111
Telephone: (415) 391-5100
http://www.ethree.com

Goals for The Morning Session

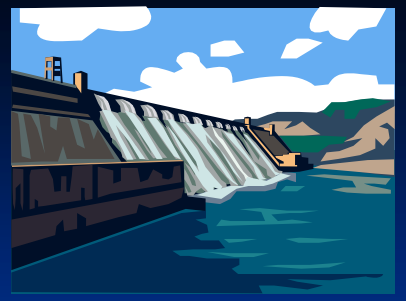
- Get a good understanding of the important attributes of various resource types and how they line up with the Committee's draft Policy Objectives
- Understand the "base case": what resources are likely to be developed in Idaho or on behalf of Idaho ratepayers in the absence of Committee action
- Understand how the interests of energy suppliers and end-users align with those of Idaho citizens
- See what goals others in similar positions have come up with

Roadmap for Developing the Energy Plan

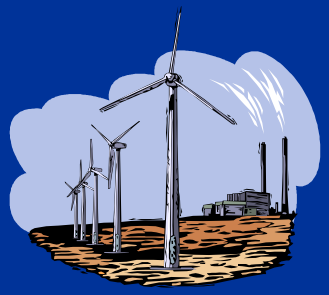


Facts about Energy in Idaho

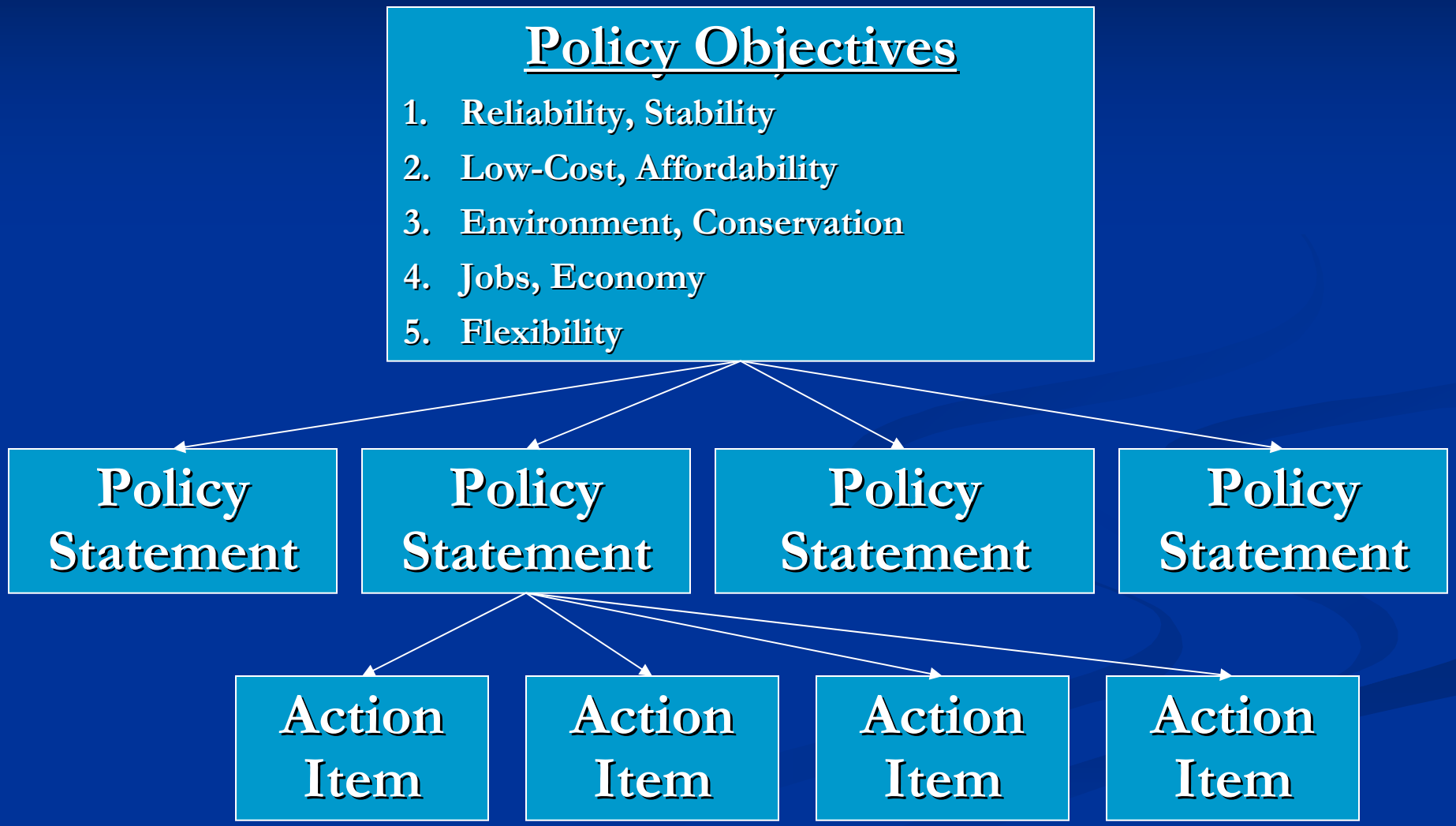
- Affordable, reliable energy is a necessity for public health and safety and for the functioning of a modern economy
- Despite low electricity and natural gas rates, energy is a larger burden for households in Idaho than in most other states due to higher consumption
- 100% of Idaho's petroleum and natural gas and approximately 50% of its electricity comes from outside the state
- Idaho investor-owned utilities remain vertically integrated and under full regulation of the Idaho PUC



Draft Policy Objectives

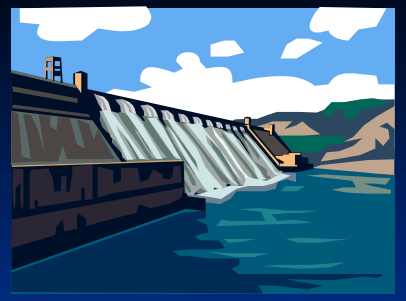


Proposed Structure of Plan Findings

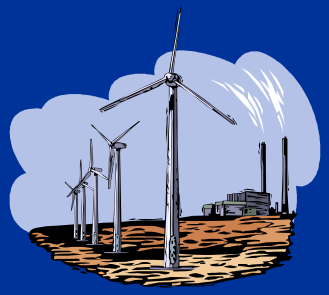


Draft Policy Objectives

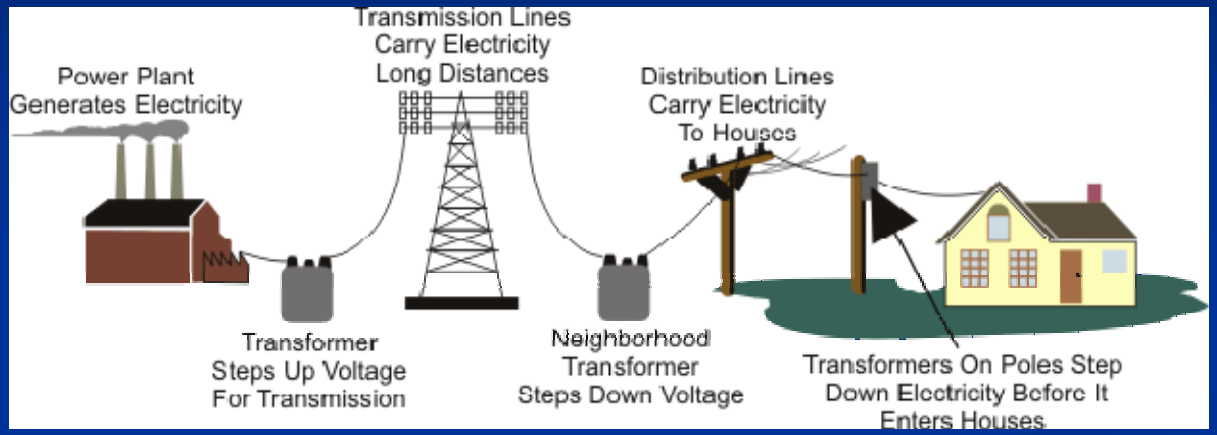
1. Ensure a secure, reliable and stable energy system for the citizens and businesses of Idaho
2. Maintain Idaho's low-cost energy supply and ensure access to affordable energy for all Idahoans
3. Protect Idaho's public health, safety and natural environment and conserve Idaho's natural resources
4. Promote sustainable economic growth, job creation and rural economic development through investments in Idaho's energy infrastructure
5. Provide the means for Idaho's energy policy to adapt to changing circumstances



Discussion of Resource Types



The Electric Grid



- **Generation:** Can be owned by utility or by independent power producer (IPP)
- **Transmission:** Generally owned by utility, regulated by the Federal Energy Regulatory Commission
- **Distribution:** Owned by utility, regulated by the states

Who Acquires Generating Resources in Idaho?

- Investor-owned utilities acquire resources, via ownership or contract, to meet growing load
- Municipals and cooperatives will have to start acquiring resources beginning in 2012
  - "Allocation" of federal power from BPA will be fixed instead of growing to match loads
- End-use customers can acquire "behind-the-meter" generation
  - Industrial cogeneration through PURPA
  - Net metering of solar photovoltaic systems

State Regulation of Electric and Gas Utilities

- "Regulatory compact" took shape in the 1920s and 1930s
  - Utility has the obligation to serve to all customers
  - Utility has the opportunity to earn a fair return on prudent investments
- Utilities earn profits by investing in facilities for which they receive a regulated rate of return
- PUC sets rates to recover utility's cost of service plus return on prudent investments
  - Evidentiary hearings with multiple participants

Economic Incentives of Utilities under State Regulation

- Because return is based on investment, utilities will have the incentive to grow the rate base by making *capital investments*
- All else being equal, utilities will prefer a *self-build* option over an IPP contract, even if the IPP contract is more cost-effective
- Because their rate of return is regulated, utilities have the incentive to *minimize risk*
- Utilities have little incentive to encourage conservation, because lower sales means less revenue

Utility Resource Planning

- Resource plans evaluate "portfolios" of resources according to three general criteria:
  - Reliability (i.e., resource adequacy)
  - Cost
  - Risk
- Individual resources are evaluated for how they contribute to the three portfolio goals
- "Integrated Resource Planning" (IRP) considers conservation/energy efficiency as resource
- Investor-owned utilities file IRPs with the PUC

Important Characteristics of Resource Options

- **Utilities always consider:**
  - Cost
  - Operations (baseload vs. peaker vs. intermittent)
  - Fuel price variability
- **Utilities sometimes consider:**
  - Environmental impact (separate from cost or risk)
  - Effect of conservation on utility revenues
- **Utilities generally don't consider:**
  - Economic development, local jobs, tax base

Relative Cost of Resource Options

Resource Type	Gas Combined Cycle	Pulverized Coal Steam	Coal Gasification	Nuclear	Wind	Geothermal	Run-of-River Hydro	Solar/Ocean Wave/Tidal	Energy Efficiency
Cost	Depends on Gas Prices	Low	Medium	High	Medium	Site-specific	Site-specific	High	Measure-specific

- Gas-fired resources are cheap to build but expensive to operate
- Coal, nuclear & renewables are generally expensive to build but cheap to operate
- Gas was resource of choice from late '80s to early '00s
- Higher gas prices have sparked renewed interest in coal, renewables and even nuclear

Operations

Resource Type	Gas Combined Cycle	Pulverized Coal Steam	Coal Gasification	Nuclear	Wind	Geothermal	Run-of-River Hydro	Solar/Ocean Wave/Tidal	Energy Efficiency
Operations	Flexible	Baseload	Baseload	Baseload	Intermittent	Baseload	Intermittent	Intermittent	Measure-specific

- Gas-fired resources are flexible and can be used for peaking
- Coal, nuclear, & geothermal operate as baseload (24x7) resources
- Intermittent resources (wind, solar, run-of-river hydro) generate energy only when the resource is available
  - Wind fluctuates from day-to-day and hour-to-hour
  - Requires additional capacity to be built and maintained in "ready" condition in case wind stops blowing
  - "Integration" of wind costs $5-15/MWh

Fuel Price Variability

Resource Type	Gas Combined Cycle	Pulverized Coal Steam	Coal Gasification	Nuclear	Wind	Geothermal	Run-of-River Hydro	Solar/Ocean Wave/Tidal	Energy Efficiency
Fuel Price Variability	High	Medium	Medium	Low	Low	Low	Low	Low	Low

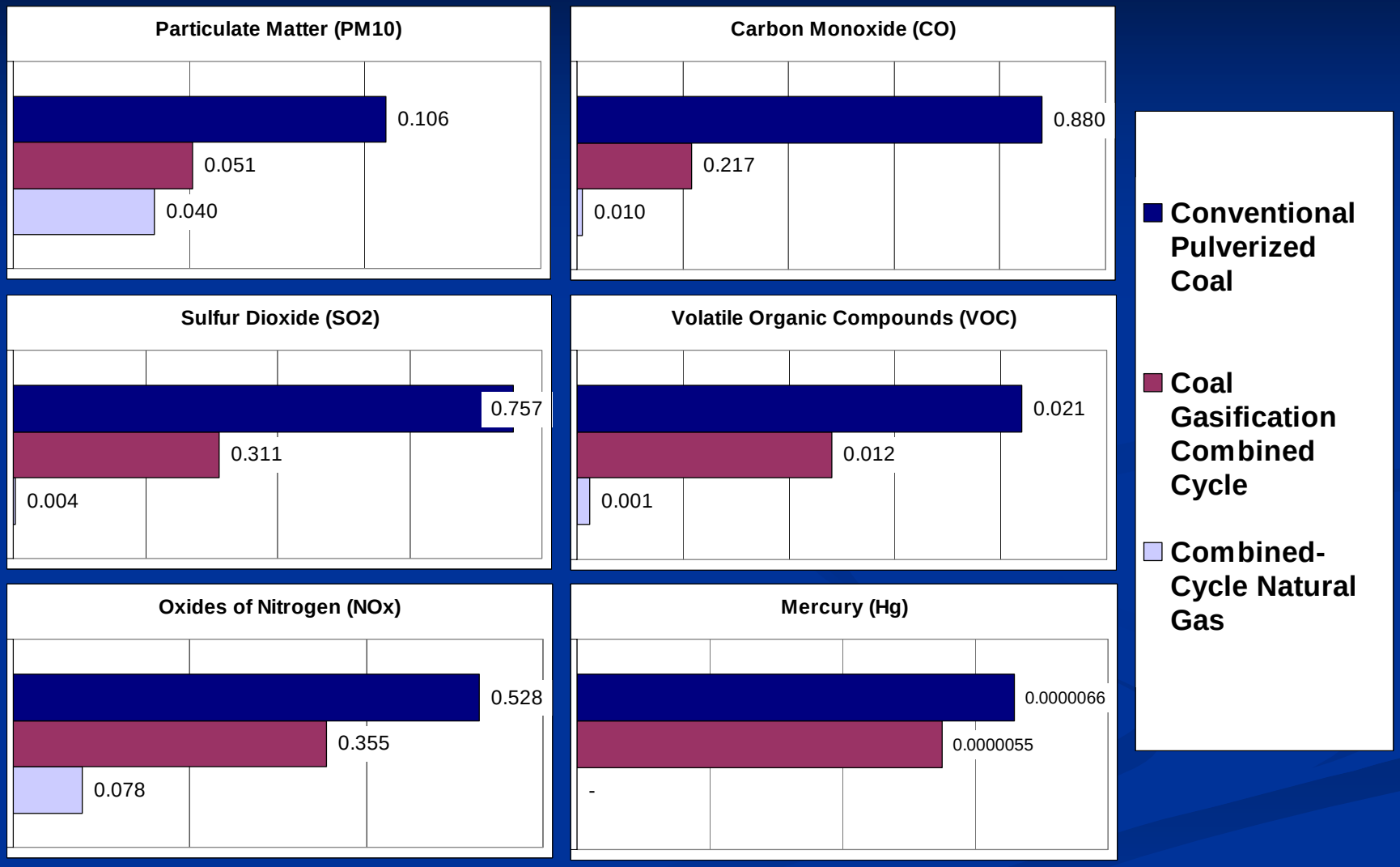
- Gas prices are highly volatile, and 80% of cost is variable
- Coal is less volatile than gas, and 80% of cost is fixed
- Conservation, nuclear and renewables have no fuel price volatility
- A diversified resource portfolio is less variable than relying heavily on one resource

Environmental Impact

Resource Type	Gas Combined Cycle	Pulverized Coal Steam	Coal Gasification	Nuclear	Wind	Geothermal	Run-of-River Hydro	Solar/Ocean Wave/Tidal	Energy Efficiency
Environmental Impact	Medium	High	Medium	High	Low	Medium	Low	Low	Low or Net Positive

- Even modern conventional coal facilities have much higher emissions of "criteria" pollutants than gas
- Coal gasification eliminates some of the emissions, but still does not match gas
- Impacts of renewables are very site-specific
- Efficiency/Conservation can be net positive

Estimated Emissions Rates of New Generating Technologies in lbs. per MWh



Another Source of New Generator Emissions Rates

Comparison of the Major Coal Combustion Technologies with Natural Gas Technology											
Fuel	Combustion Technology	SO2		NOx		PM 10		CO		Hg	
		lbs/mmbtu	lbs/MWh	lbs/mmbtu	lbs/MWh	lbs/mmbtu	lbs/MWh	lbs/mmbtu	lbs/MWh	lbs/mmbtu	lbs/MWh
Coal	Pulverized Coal Supercritical Boiler (1) (Wet FGR/SCR/LNB/DSI/FF)	0.15	1.53	0.08	0.82	0.0180	0.18	0.11	1.12	2.39E-06	2.43E-05
Coal	Integrated Gasification Combined Cycle (2) (diluent air)	0.17	1.15	0.13	0.85	0.0130	0.09	0.06	0.38	1.94E-06	1.31E-05
Coal/Coke	Circulating Fluidized Bed Boiler (3) (SNCR;Limestone inj; FF)	0.15	1.39	0.09	0.84	0.0110	0.10	0.13	1.17	1.09E-05	1.01E-04
Natural Gas	Natural Gas-Combined Cycle (4) (SCR/LNB/catox)	0.0019	0.02	0.0094	0.11	0.0119	0.14	0.0066	0.08		

* lbs/mmbtu = pounds of emissions/million btu heat input
* lbs/MWh = pounds of emissions/megawatt-hour generated

* Wet FGD = Wet Flue Gas Desulfurization (SO2 control)
* SCR = Selective Catalytic Reduction (NOx Control)
* LNB = Low NOx burners
* DSI = Dry Sorbent Injection (SO2 control)
* FF = Fabric Filter (PM control)

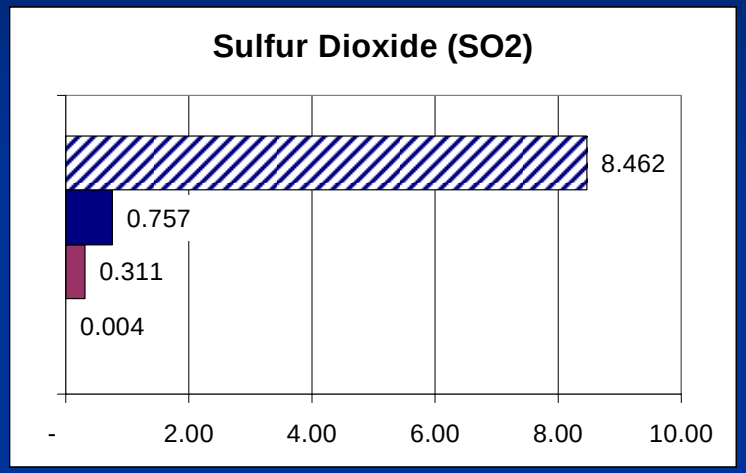
* Diluent Air = NOx control
* SNCR = Selective Non-catalytic Reduction (NOx control)
* Limestone Injection = SO2 control
* Catox = Catalytic Oxidation (CO control)

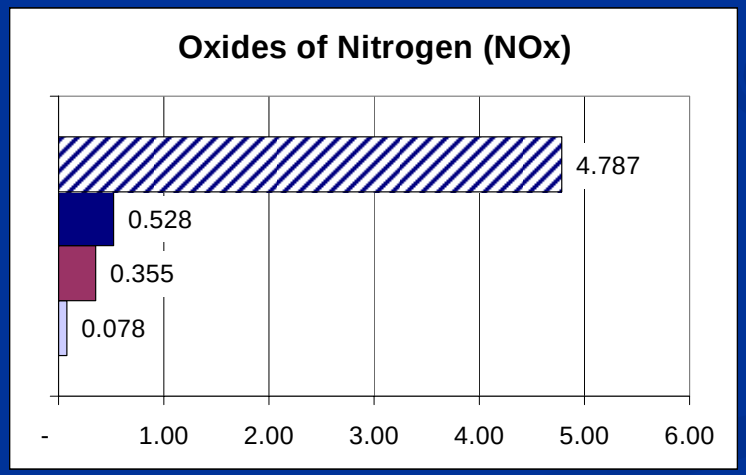
(1) 600 MW unit burning bituminous coal with a heat input of 6,114 mmbtu/hr. Information from Longwood Power, LLC Permit No. R14-0024 for Longview Power Station, Longview, West Virginia.
(2) 260 MW unit with a heat input of 1,755 mmbtu/hr using synethic gas. Information from Tampa Electric Company Permit No. 1050233 for Polk County Power Station, Polk County, Florida.
(3) 298 MW unit burning bituminous coal and coke with a heat input of 2,764 mmbtu/hr. Information from JEA Permit No. 0310045-011-AV for Northside Generating Station, Duval County, Florida.
(4) 160 MW unit with a heat input of 2,132 mmbtu/hr using natural gas. Information from CPV Permit No. 81382, Cunningham Creek Facility, Fluvanna County, Virginia.

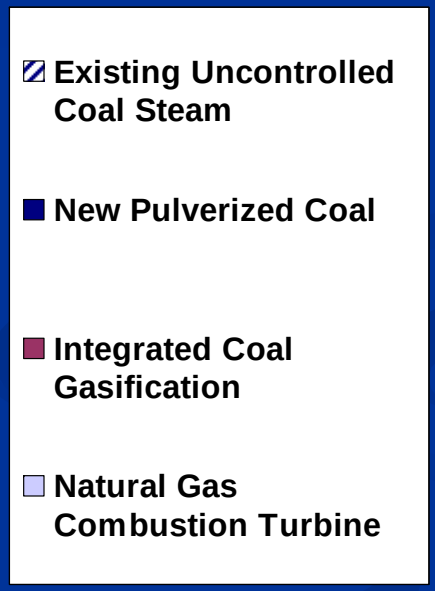
This information is intended as a guide to assist industries, utilities, and government agencies in assessing potential control options. Achievable control efficiency is site-specific and will depend on the type of fuel burned, design of the process, and type of control equipment used. It may not be feasible to meet the high removal efficiencies noted with some of these technologies in all plants. It should be recognized that the information provided is based on PERMIT LIMITS and does not necessarily represent the full capability of the technology. In particular, IGCC emissions may be lower with state-of the art technology.

Source: Virginia DEQ (http://www.deq.virginia.gov/air/sab/comparison1008.pdf)

Emissions Rates of Uncontrolled vs. New Generators in lbs./MWh







Climate Change/Carbon Regulation in Utility IRPs

- **Low Cases ($ per ton CO2)**
  - ***Avista:** **none***
  - Idaho Power: none
  - PacifiCorp: none
- **Medium Cases ($ per ton CO2)**
  - Avista: $7-15
  - ***Idaho Power:** **$12***
  - ***PacifiCorp:** **$8***
- **High Cases ($ per ton CO2)**
  - Avista: $22-60
  - Idaho Power: $49
  - PacifiCorp: $40

**** = Base Case***

- "The company believes that some form of GHG emissions regulation will occur at some point in the future." – *Avista*
- "It is likely that carbon dioxide emissions will be regulated within the thirty-year timeframe addressed in the 2004 IRP." – *Idaho Power*
- "The global scientific community has offered compelling evidence of the effect of man-made greenhouse gas emissions on future climate conditions. It is therefore prudent to recognize … the potential for costs associated with …climate change policy." – *PacifiCorp*

Economic Development

Resource Type	Gas Combined Cycle	Pulverized Coal Steam	Coal Gasification	Nuclear	Wind	Geothermal	Run-of-River Hydro	Solar/Ocean Wave/Tidal	Energy Efficiency
Economic Development	Small	Large	Large	Large	Medium	Medium	Small	Large	Large

- Coal and nuclear facilities are large local employers
- Local renewables can have a positive impact on rural communities
- Wind, hydro and gas facilities operate without substantial labor requirements
- Conservation creates dispersed labor force & increases income through lower bills

Characteristics of Different Resource Types

Resource Type	Gas Combined Cycle	Pulverized Coal Steam	Coal Gasification	Nuclear	Wind	Geothermal	Run-of-River Hydro	Solar/Ocean Wave/Tidal	Energy Efficiency
Cost	Depends on Gas Prices	Low	Medium	High	Medium	Site-specific	Site-specific	High	Measure-specific
Operations	Flexible	Baseload	Baseload	Baseload	Intermittent	Baseload	Intermittent	Intermittent	Measure-specific
Fuel Price Variability	High	Medium	Medium	Low	Low	Low	Low	Low	Low
Environmental Impact	Medium	High	Medium	High	Low	Medium	Low	Low	Low or Net Positive
Economic Development	Small	Large	Large	Large	Medium	Medium	Small	Large	Large

Effect of Conservation on Utility Revenues and Rates

- Conservation reduces some utility costs because less energy must be generated, but many costs are fixed
- Conservation reduces sales, meaning fixed costs must be allocated over a smaller sales base
- This dynamic creates different incentives for different players

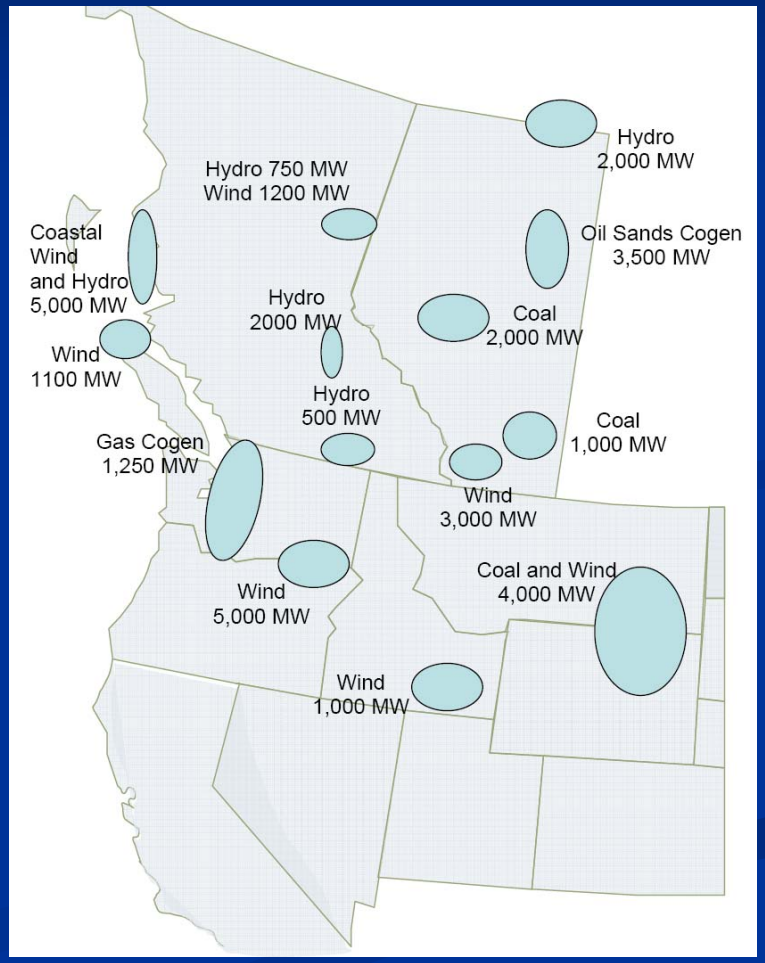
From the perspective of utility shareholders, conservation reduces sales and revenues

From the perspective of utility ratepayers, conservation increases rates

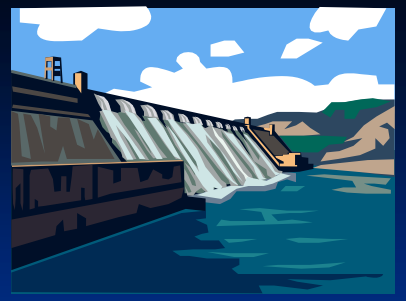
From the perspective of Idaho citizens, cost-effective conservation reduces average energy bills

Remote Resources in the West

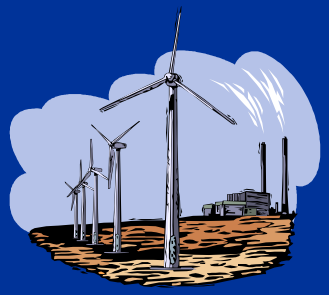
- There are a variety of resources located in remote areas that would require new transmission
- A number of plans have been developed to build transmission to exploit these resources, but no commitments
- Tricky to get all the interests lined up to build long-distance transmission
- Regional efforts are ongoing



Source: Northwest Power Pool



"Base Case" from Utility IRPs

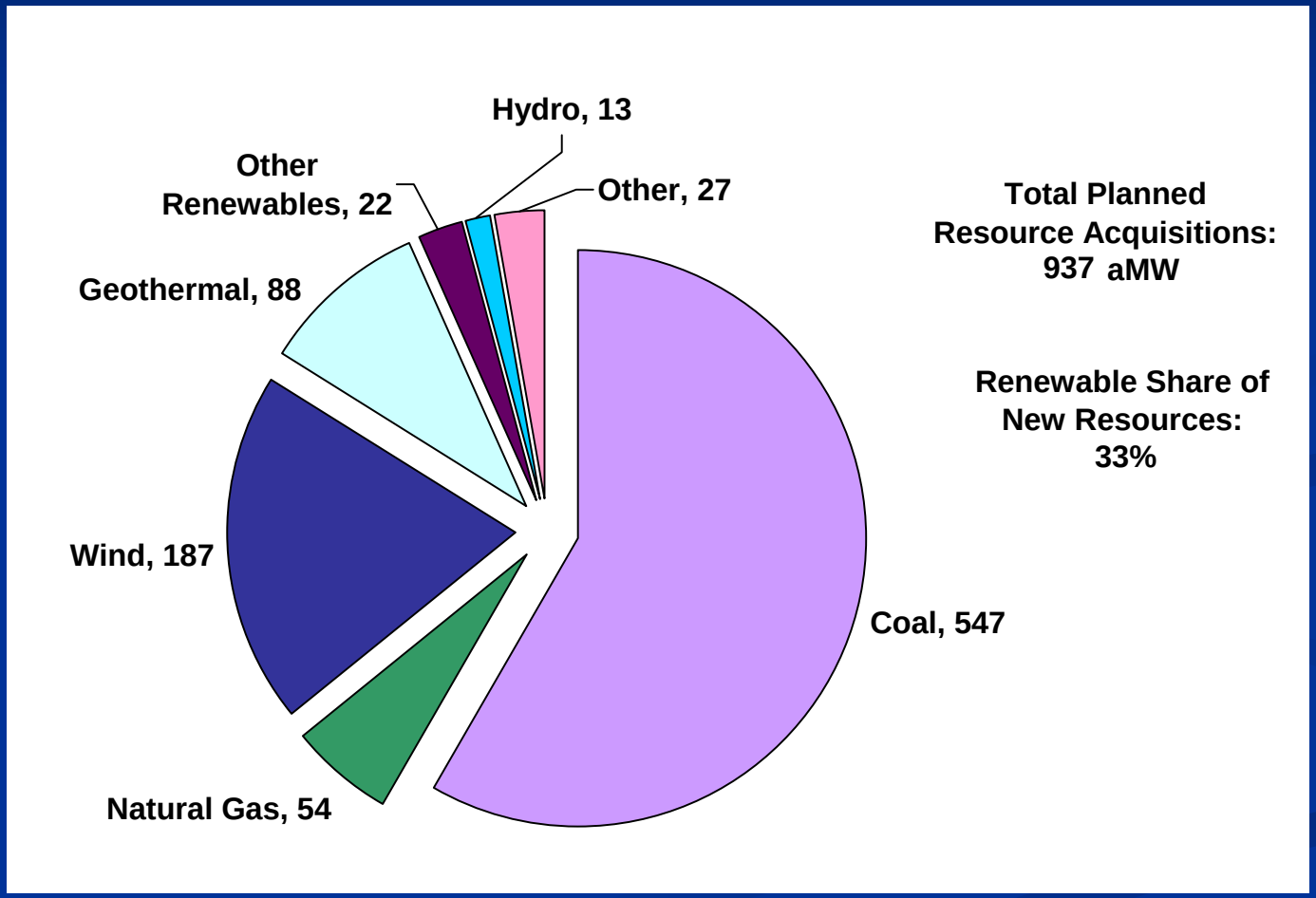


Idaho Resource Needs over the Next Ten Years

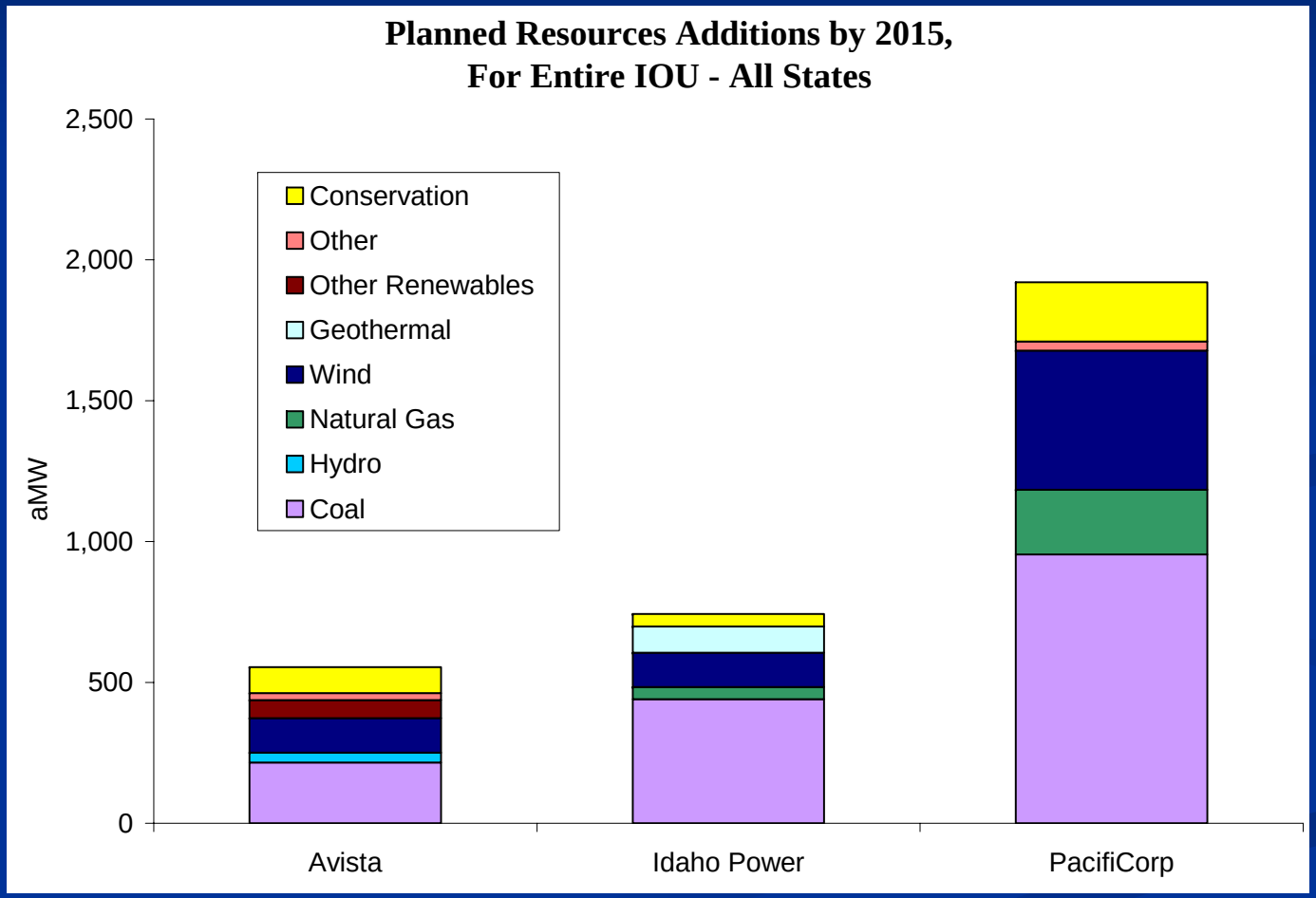
- Idaho load is growing relatively rapidly, particularly peak demand in southern Idaho
- Idaho IOU loads are expected to grow by approximately ***630 aMW*** by 2015 and ***1,182 aMW*** by 2025
- Idaho IOUs plan to acquire approximately ***937 aMW*** of new resources on behalf of Idaho customers by 2015

Fuel Type	Resources Added by 2015
Loads	
Load Growth	630
Conservation	79
Net Load Growth	551
Resources	
Coal	547
Hydro	13
Natural Gas	54
Petroleum	0
Nuclear	0
Wind	187
Biomass	0
Waste	0
Landfill Gas	0
Solar	0
Geothermal	88
Other Renewables	22
Other	27
Total Resources	937

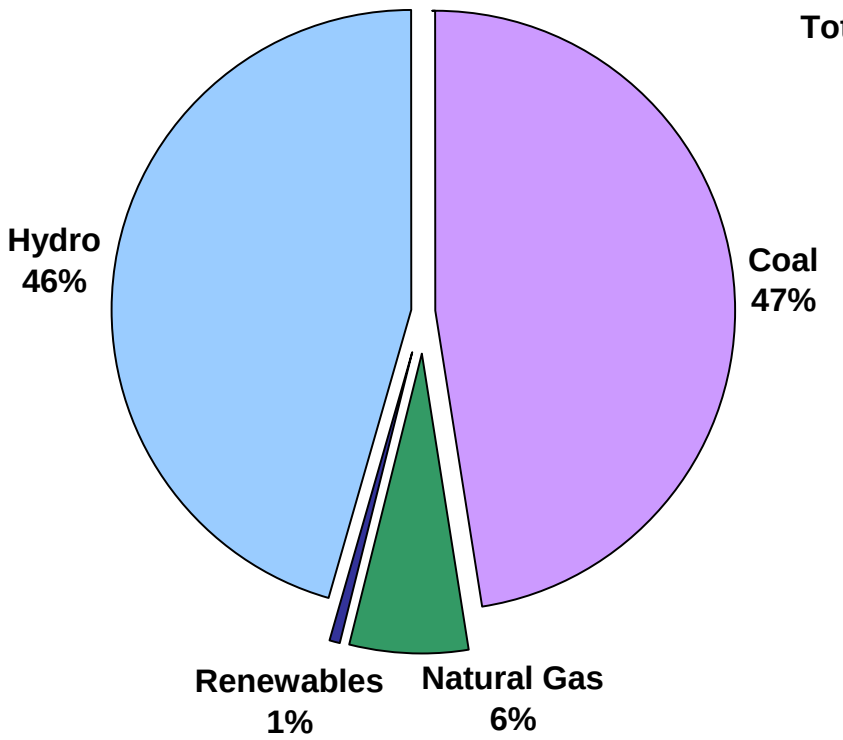
Planned Resource Investments on Behalf of Idaho Customers by 2015



Planned Resource and Conservation Investments in All States by 2015

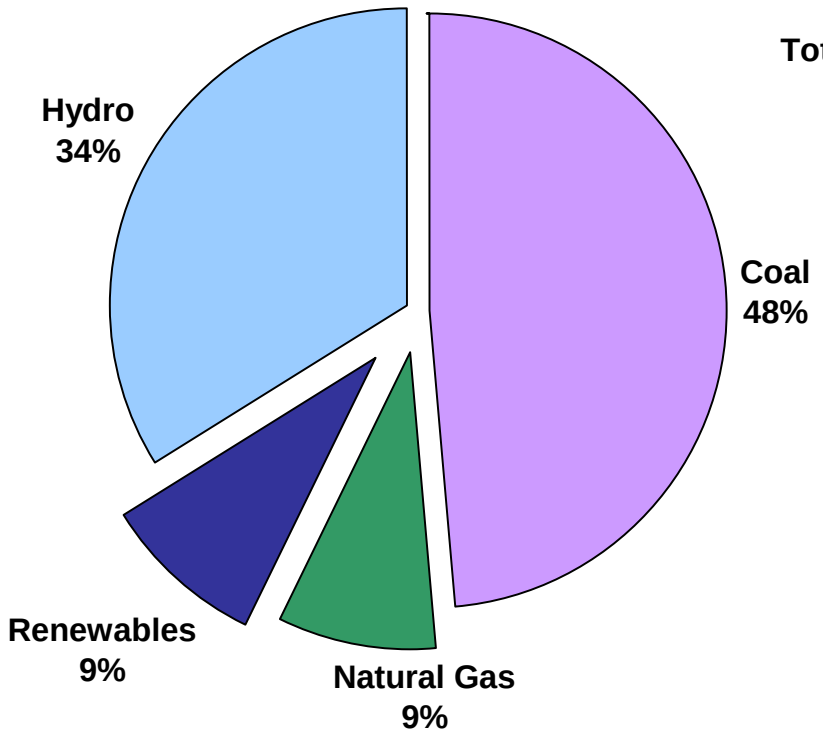


2005 Idaho Electricity Fuel Mix



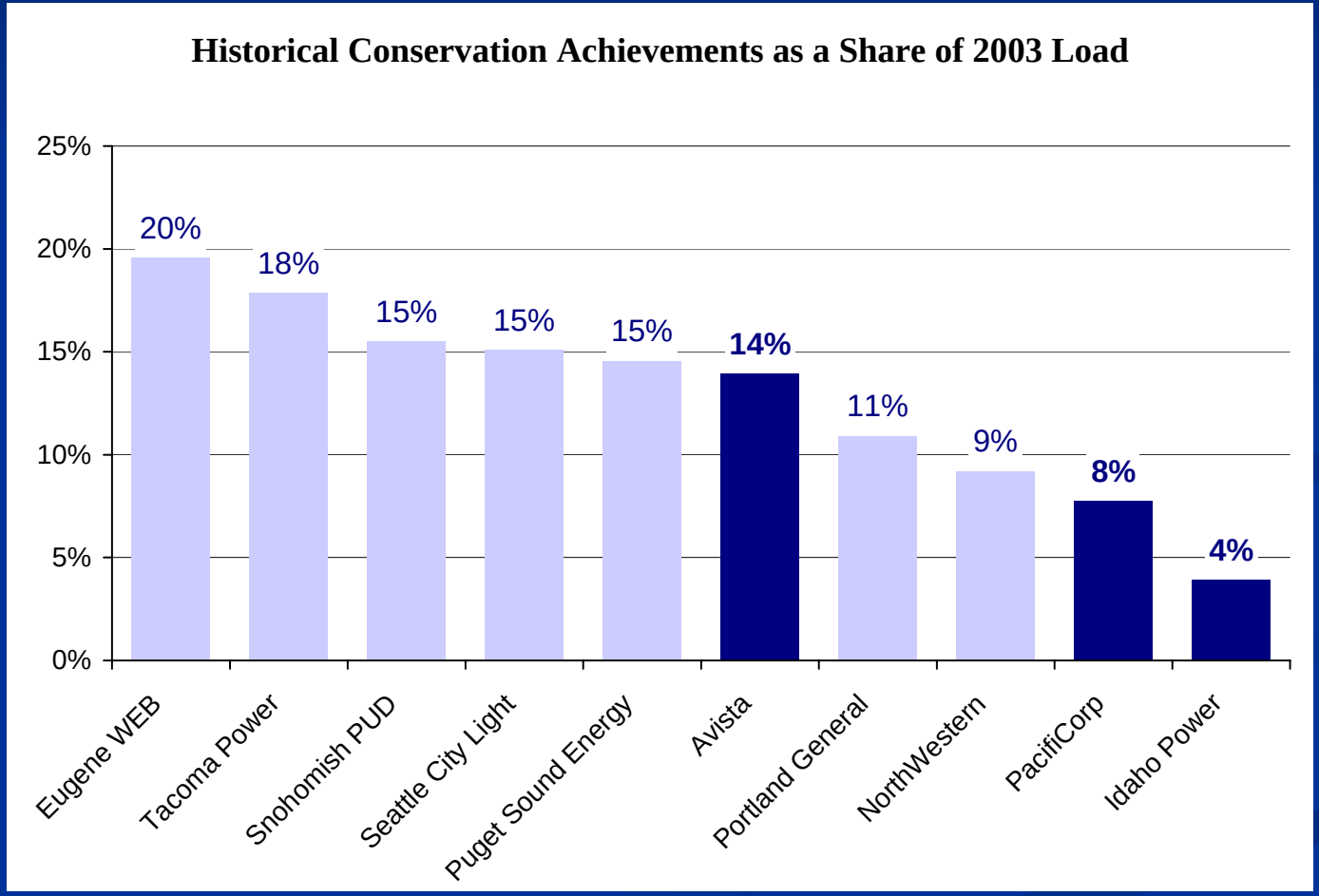
Note: Fuel mix shown above includes 432 aMW from Purchases/Contracts, which have been allocated based on the system fuel mix.

2015 Idaho Electricity Fuel Mix

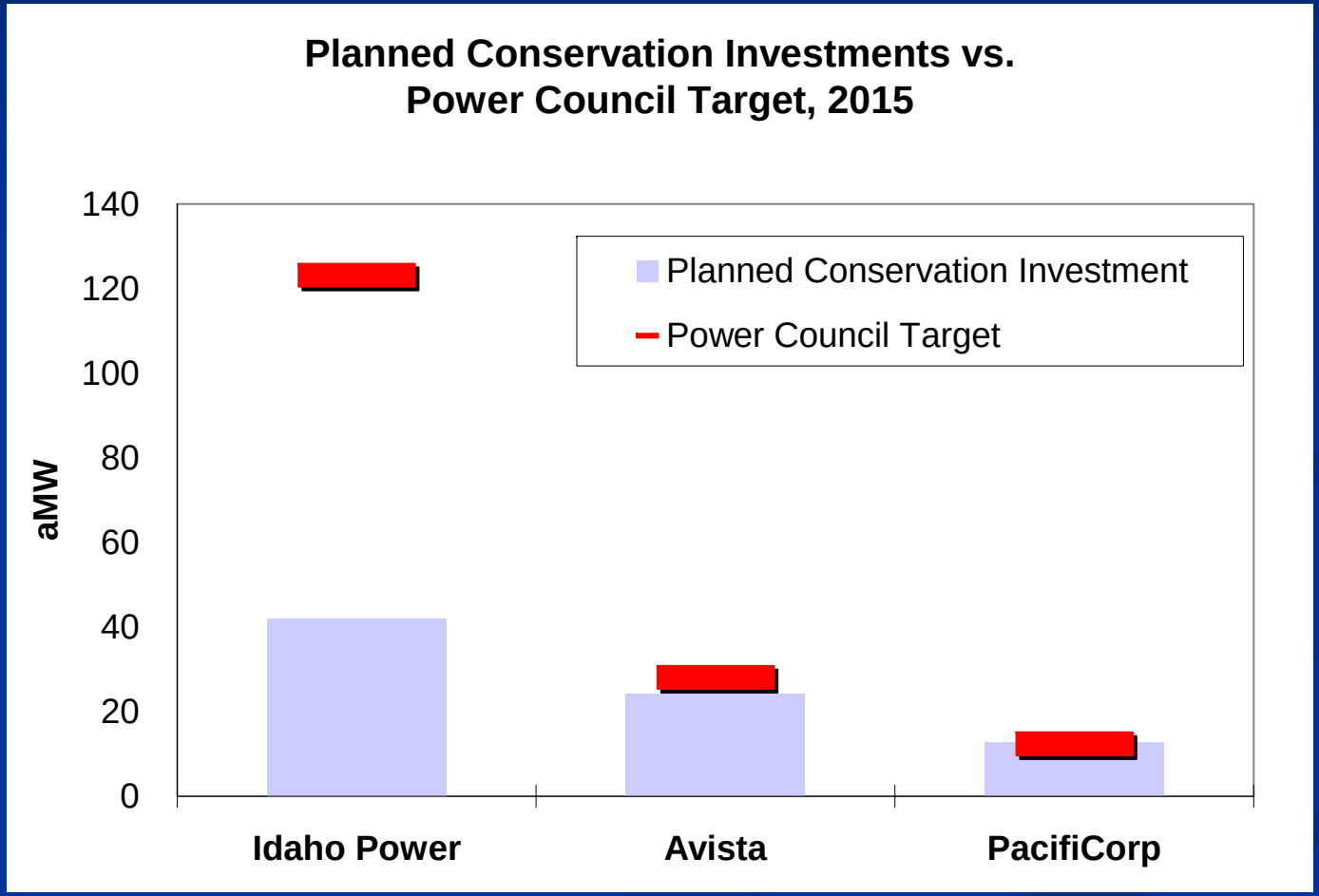


Note: Fuel mix shown above includes 211 aMW from Purchases/Contracts, which have been allocated based on the system fuel mix.

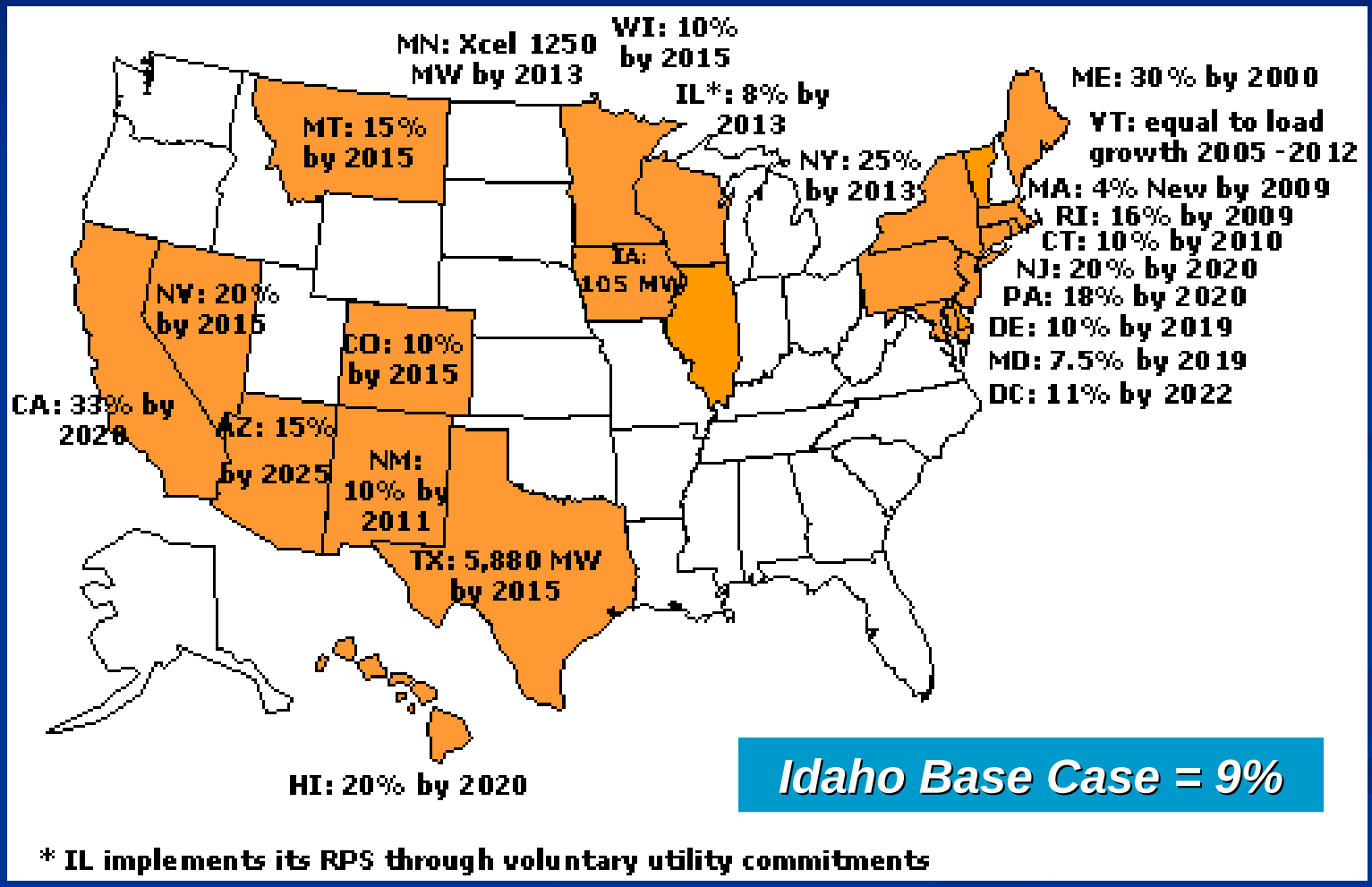
Historical Conservation Achievements of Northwest Utilities



Planned Conservation Investments of Idaho Utilities by 2015



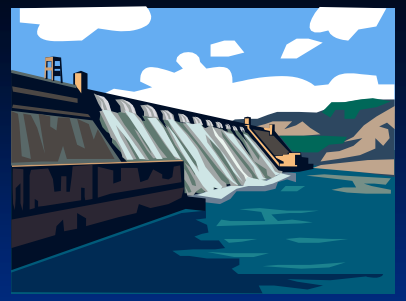
States with Renewables Portfolio Standards and Targets



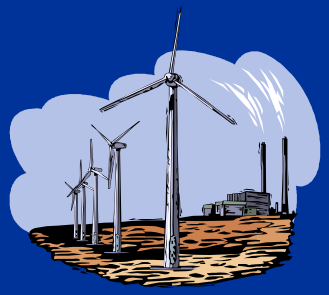
Source: Pew Climate Trust

Idaho Base Case Summary

- Idaho utilities plan to add 937 aMW of new resources by 2015 to meet 630 aMW of new load
- More than half of new resources would be coal-fired
- Conservation and new renewables would constitute 41% of new resources and 62% of new loads
- New renewables would constitute approximately 9% of Idaho's fuel mix in 2015



IPPs & PURPA



Independent Power Producers

- Independent power producers (IPPs) gained a foothold with passage of Public Utility Regulatory Policy Act (PURPA) in 1978
- Momentum accelerated after EPACT 92 and FERC Order 888 (1996)
- Today, IPPs generate around 35% of U.S. power
- Another possible source of supply for Idaho utilities

Merchant vs. Utility Facilities

Utility Facilities

- Developed under state regulation in conjunction with obligation to serve
- PUC reviews prudency and sets returns
- Risks and returns shared among utility shareholders and ratepayers

Merchant Facilities

- No obligations other than those spelled out in contract
- Physical output is consumed locally, but economic benefits accrue to contractual owner
- Risks and returns borne by merchant shareholders

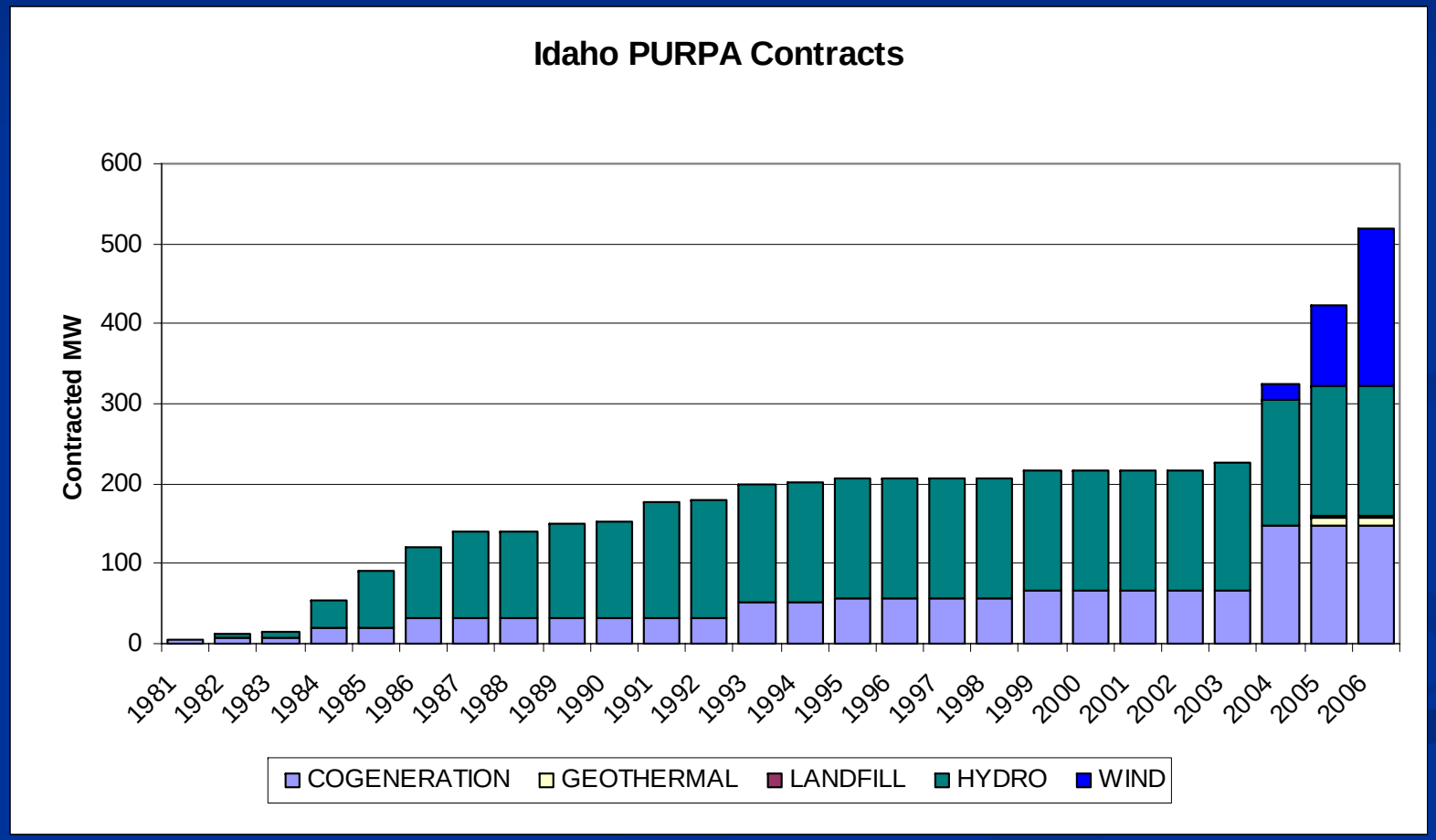
PURPA and QFs

- PURPA passed by Congress in 1978 to:
  - Lessen dependence on foreign gas and oil
  - Alleviate inflation
  - Improve the balance of payments
  - Preserve nation's nonrenewable resources
- Utilities must buy power from Qualifying Facilities (QFs) at their "avoided costs"
- QFs include cogeneration and small renewables
- Rates, terms, and conditions set by state commissions

PURPA In Idaho

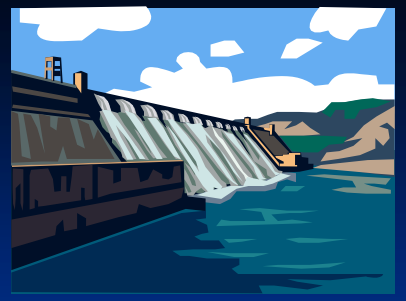
- Idaho was one of the first states to adopt PURPA and has been one of the most QF-friendly
- Rates, terms, and conditions for QF's have changed several times over the past 25 years
- The fuel types of QFs have varied over the past 25 years
- Current PURPA rates around $60/MWh
- Utilities would prefer to acquire renewables through IRPs rather than PURPA

Cumulative PURPA Contracts by Resource Type

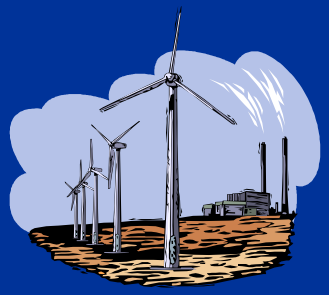


Small-Scale Renewables

- Solar and wind power can be developed at the residential scale
- Cost-effective in remote applications that would otherwise require costly line extensions
- Increased demand for small-scale renewables, particularly solar, is expected to eventually result in cost decreases
- Many states have promoted small-scale renewables through net metering and/or tax credits



Priorities from Other Relevant Sources



Northwest Power Act

- PACIFIC NORTHWEST ELECTRIC POWER PLANNING AND CONSERVATION ACT 16 U.S.C. §§ 839-839h, December 5, 1980.
- Established Northwest Power and Conservation Council
- Directs the Council to adopt a regional energy conservation and electric power plan
- Directs the Council to adopt a program to protect, mitigate and enhance fish and wildlife on the Columbia River and its tributaries

Northwest Power Act: Purposes

- Assure the Pacific Northwest of an adequate, efficient, economical and reliable power supply;
- Provide for the participation and consultation of the Pacific Northwest states, local governments, consumers, customers, users of the Colombia River System (including federal and state fish and wildlife agencies and Indian tribes), and the public;
- Ensure development of regional plans and programs related to energy conservation; renewable and other resources;
- Protect, mitigate, and enhance fish and wildlife resources;
- Facilitate the planning of the region's power system;
- Provide environmental quality.

http://www.nwcouncil.org/LIBRARY/poweract/summary.htm

Northwest Power Act: Resource Priorities

- Priority shall be given: first, to conservation; second, to renewable resources; third, to generating resources utilizing waste heat or generating resources of high fuel conversion efficiency; and fourth, to all other resources. [Northwest Power Act, §4(e)(1), 94 Stat. 2705.]

1982 Idaho Energy Plan

- High priority on conservation, renewables, and high fuel efficiency generation before others. High priority to hydroelectric projects.
  - Carefully consider impacts on agriculture
  - Favor conversion to natural gas heating
  - Review and update curtailment plans
  - Consider coal and nuclear
  - Promote cogeneration and wood fuel
  - Encourage development of municipal solid waste power
  - Identify potential for wind development
- Promote petroleum and gas conservation, exploration
- Encourage and support local governments in their efforts to promote energy awareness, efficiency and resource development.

Western Governors' Clean and Diversified Energy Initiative

- June 2004 resolution with the objective of:
  - "…identifying ways to increase the contribution of renewable energy, energy efficiency, and clean energy technologies within the context of the overall energy needs of the West."
- Four broad goals:
  - Additional development of 30,000 MW of clean energy by 2015;
  - A 20% increase in energy efficiency by 2020;
  - An ability to meet the transmission needs of the West for the next 25 years; and
  - Better position the Western energy system to respond to new environmental challenges.

Western Governors' Clean and Diversified Energy Initiative

- Specific recommendations for transmission, wind, advanced coal, energy efficiency, solar, biomass, geothermal
- Not mandatory or binding on any state
- Some of the recommendations already being implemented by regional organizations in which Idaho parties are participating

Idaho Share of 30,000 MW goal:	***1,085 MW***
Current plans of Idaho IOUs:	***~700 MW***

Washington: 2003 Energy Strategy Update

- **Guiding Principle #1:** Encourage all load-serving entities to adopt and implement integrated resource plans.
- **Guiding Principle #2:** Encourage the development of a balanced, cost-effective and environmentally sound resource portfolio that includes conservation, renewables, and least-cost conventional resources.
- **Guiding Principle #3:** Protect the benefits to Washington consumers from the Federal Columbia River Power and Transmission System (FCRPS).
- **Guiding Principle #6:** Foster a predictable and stable investment climate to facilitate adequate and efficient access to capital markets for independent power producers, federal agencies and Washington's public and private energy industry.
- **Guiding Principle #7:** Promote Washington State as a leader in clean energy technologies by supporting and attracting companies that are active in developing, manufacturing and selling these technologies. In addition, lead by example with clean energy, energy efficiency, and sustainable practices in state and local government operations.

Oregon Energy Plan 2005-2007

Policy Priorities

- Maximize energy conservation and efficiency
- Support a stable energy supply for Oregon
- Support renewable energy development and technology companies in Oregon

Report from the Nevada Electric Energy Policy Committee (2001)

Recommendation 1 - Low Income Assistance

- This state shall implement energy affordability programs so that the acquisition of essential energy services does not place an undue economic burden on Nevada households

Recommendation 3 - Incentives to Construct and Retain

- Incent new generators to offer Nevada customers a portion of all electricity generated in the state.
- Incent potential plant builders to build in geographic areas that have more water and to transmit electricity to areas of less water.

Report from the Nevada Electric Energy Policy Committee (2001)

Recommendation 4 – Renewables

- The state of Nevada has great potential to utilize its wind, solar and geothermal renewable resources. We recommend the state of Nevada develop an overall policy to support renewables in this state.

Recommendation 6 - Long-term / Permanent Energy Policy Committee

- We recommend the Governor create a standing committee under the Executive branch to develop an energy policy including the status of the energy environment, competition, a long-term policy for renewables and conservation.

California Energy Action Plan I (2003)

I. Optimize Energy Conservation and Resource Efficiency

II. Accelerate the State's Goal for Renewable Generation

III. Ensure Reliable, Affordable Electricity Generation

V. Promote Customer and Utility Owned Distributed Generation

California Energy Action Plan II: Implementation Roadmap (2005)

- Endorses "Loading Order":
  - Energy efficiency and demand response are preferred means of meeting growing energy needs.
  - Next, rely on renewable sources of power and distributed generation, such as combined heat and power applications
  - To the extent that efficiency, demand response, renewable resources, and distributed generation are unable to satisfy needs, support clean and efficient fossil-fired generation.

Objectives of the 2003 North Carolina State Energy Plan

- Insure energy reliability for North Carolinians;
- Improve the public health and environmental quality of our state;
- Develop policies that promote wise land use;
- Implement strategies supportive of a sound North Carolina economy;
- Develop an achievable sustainable energy strategy for North Carolina; and
- Implement a strategy by which the state can lead by example.

North Carolina -- Action Items

- Support economic development of energy-related enterprises whose products are intended to increase energy efficiency or use renewable resources
- Create a greenhouse gas registry to track emissions of carbon dioxide and other greenhouse gases
- Evaluate a renewable portfolio standard (RPS) that complements the NC GreenPower program
- The General Assembly should require that all electric utilities in North Carolina provide generation disclosure of fuel mix percentages and emissions statistics
- State Energy Office should assess and propose incentives and regulatory or administrative measures for development of renewable electricity generation facilities