Visions of the Future NW Electricity Supply: Clean, Adequate and Reliable

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Themes

- Hard and Soft energy paths
- The Uniqueness of the Northwest Power System
- The Power Council and Power Plans
- Is a carbon free electricity system possible?
- Towards the Seventh Northwest Power Plan

Contemporary
Hard and Soft Energy Path Visions

Almost fifty years ago Amory Lovins in his celebrated article in Foreign Affairs laid out two paths to the future: The Hard and Soft energy paths. Those two options are still alive: we have foreclosed neither. Here are some contemporary renderings of what these two visions might look like.

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Hard and Soft Paths

- Hard:

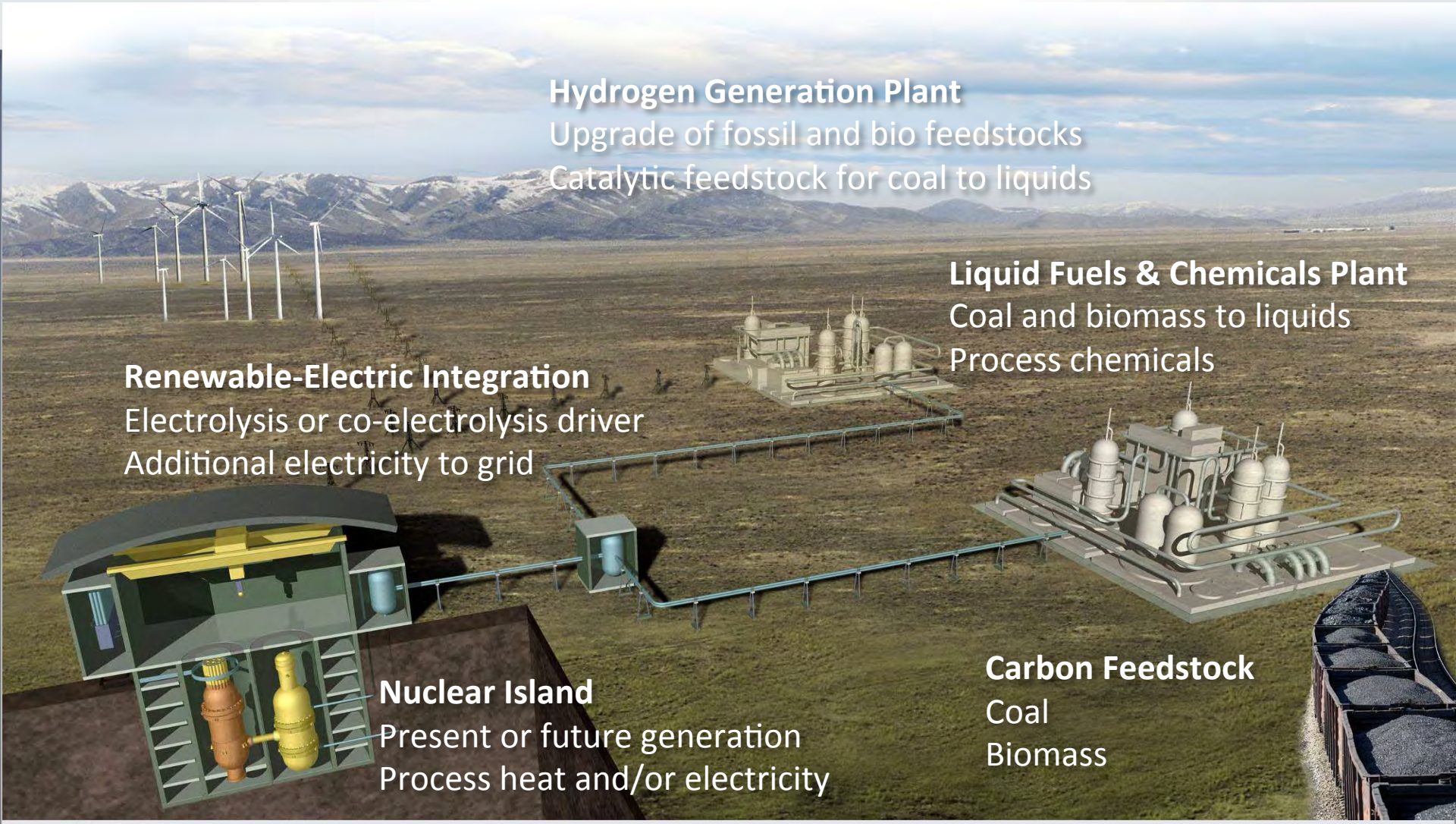
  Increasing production and consumption from large scale, central-station coal and nuclear generation

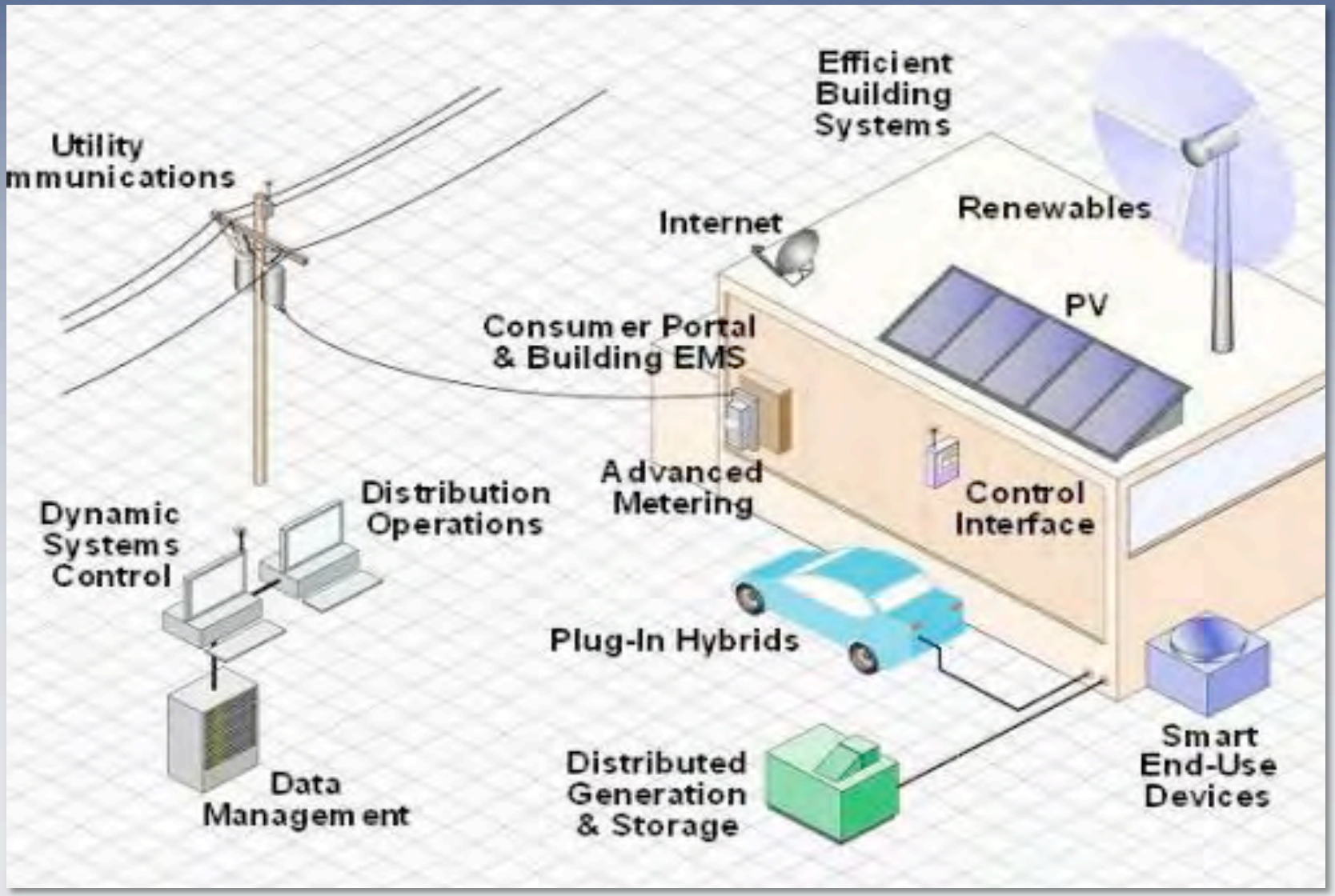
- Soft:

  Decreasing consumption because of huge improvements in efficiency with generation shifting to small scale, distributed resources, mostly from renewables such as solar and wind.

Strategic Energy Islands

(From an Idaho National Lab presentation)





An oft-used smart grid picture illustrating the integration of distributed renewables and end-uses

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Uniqueness of the NW

Because of its large hydropower base, the Pacific NW electricity system is unlike any other in the rest of the US:

- Low carbon
- Large Federal (BPA) role
- Lots of Public Power utilities (majority in Washington)
- A regional power planning agency-NWPCC

These factors may help to make a soft-energy path possible.

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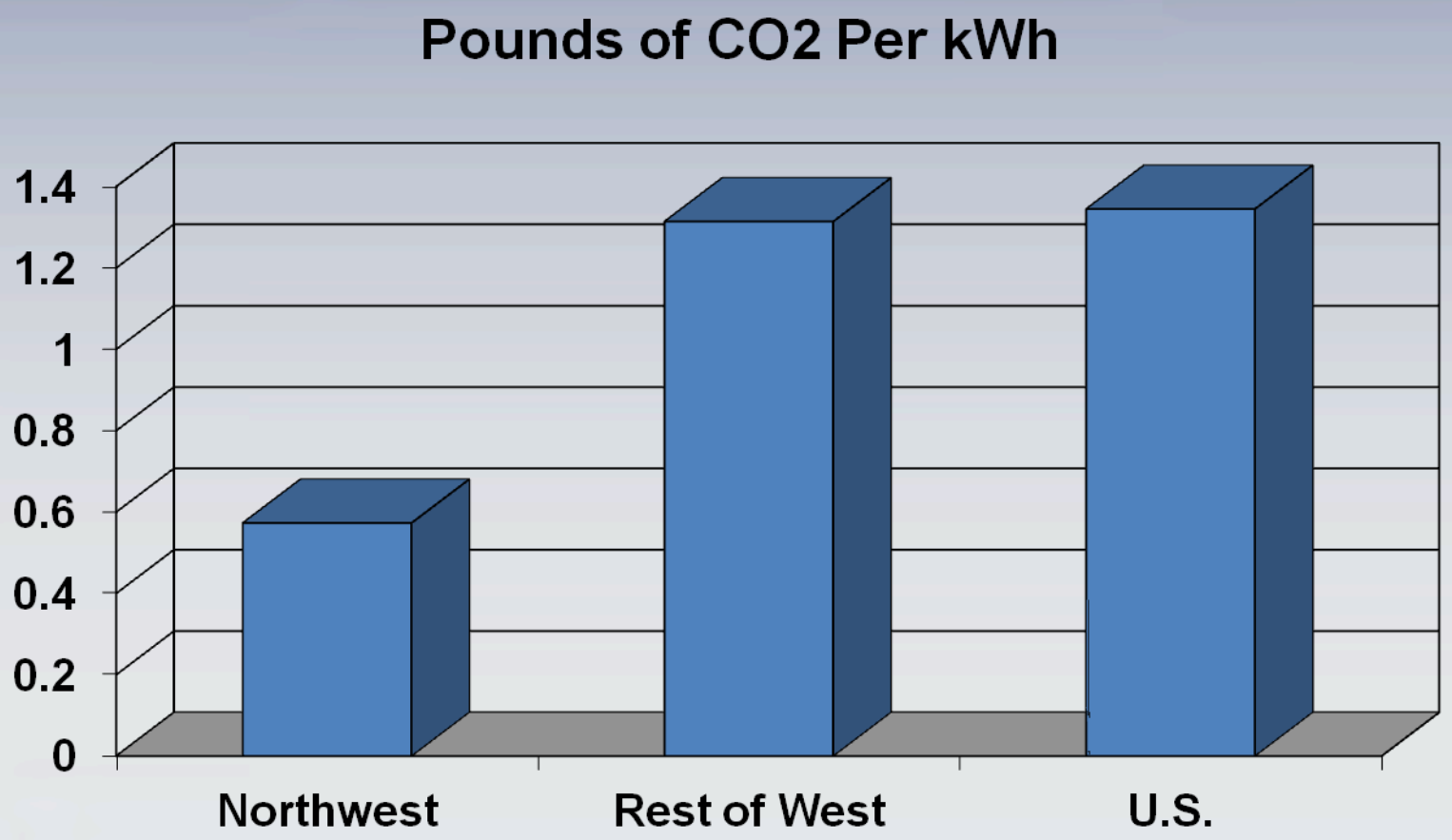
The Northwest Power System is Clean, Low Carbon…



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- Northwest Power Act of 1980 (Public Law 96-501)
- Interstate Compact
  - Four states, each Governor appoints two members
- A unique agency charged by Congress to:
  - Develop a Northwest Power Plan
  - Develop a fish and wildlife program
  - Provide for public outreach and accountability

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Northwest Power System

- Firm output from federal resources is enough to serve about one-third of the region's loads
- Bonneville sells wholesale power to over 120 publicly-owned utilities
- Bonneville built and operates the region's backbone transmission system
- The Northwest has a long-standing history of cooperation and collaboration
- Solutions are developed in the NW to meet regional needs
- Costs and rates are among the lowest in the United States

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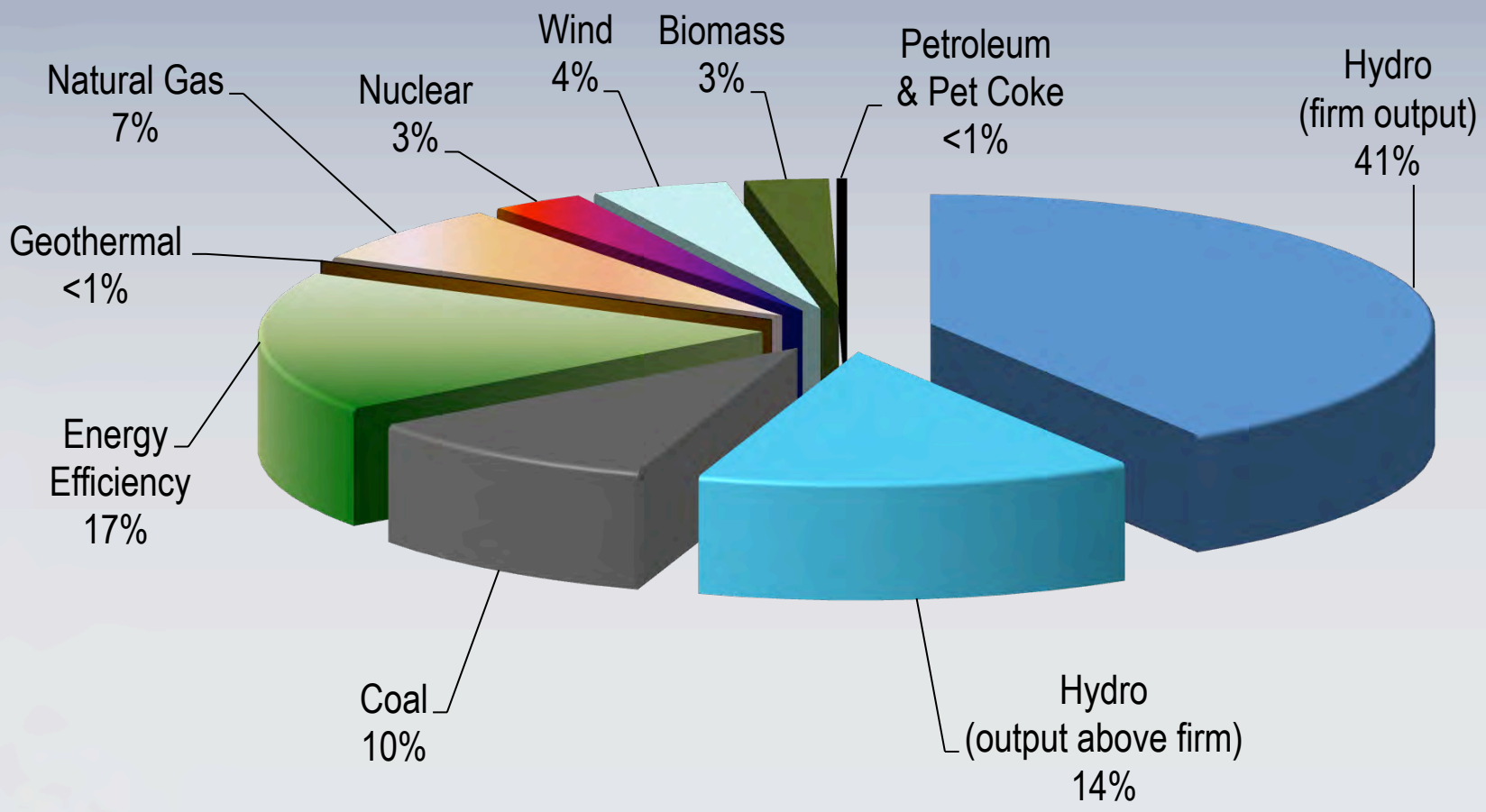
Northwest Power System
Energy Resources in an Average Hydro Year



Expected resource generation and efficiency savings based on simulated operation

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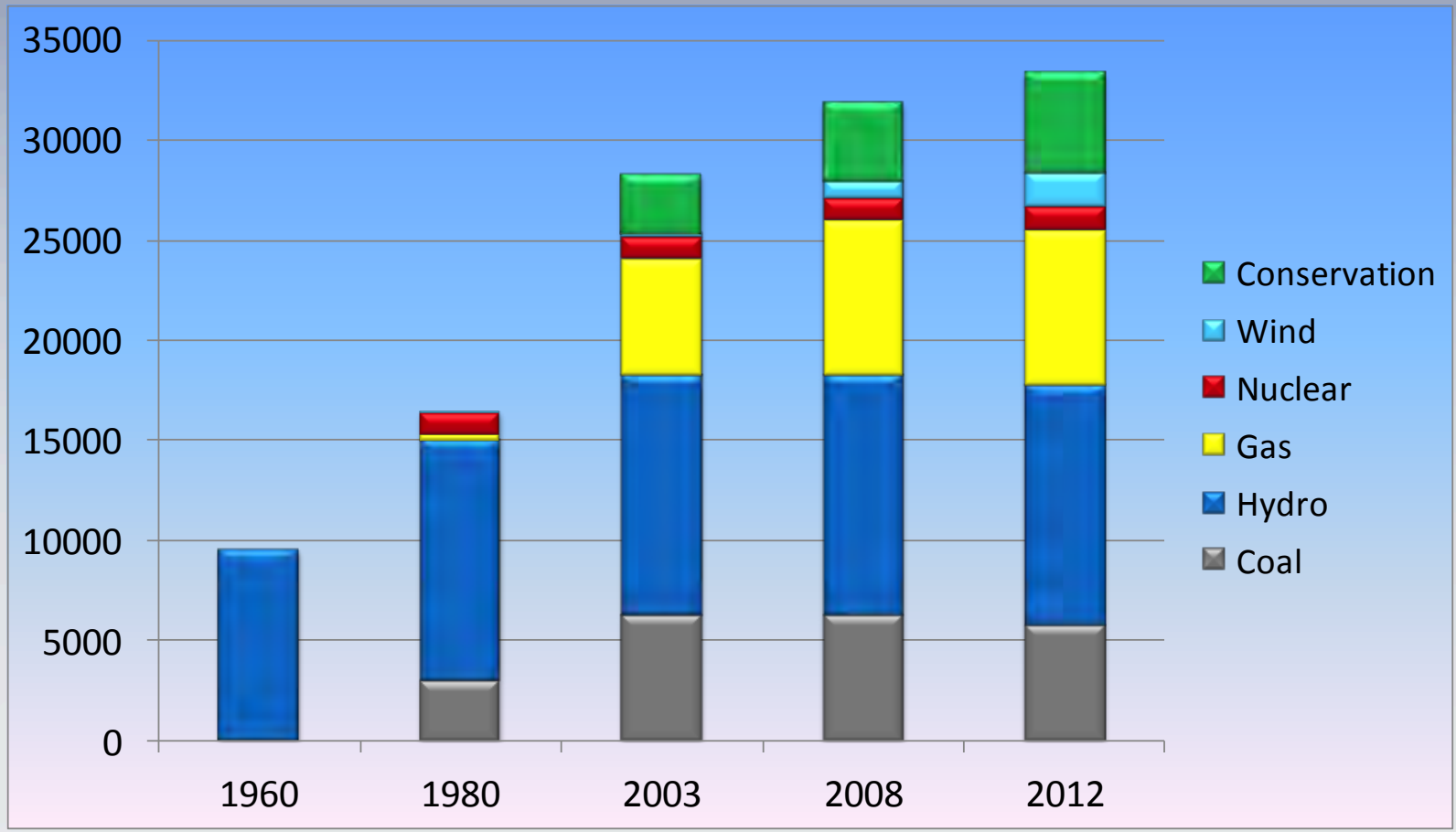
Change in Generating Resources Available to Pacific Northwest Utilities Over Time (MWa)



* Includes resources owned by or under contract to Pacific Northwest utilities, excluding PacifiCorp East wind projects in Wyoming. Does not include resources located in the Pacific Northwest with contracts to utilities outside of the Pacific Northwest.

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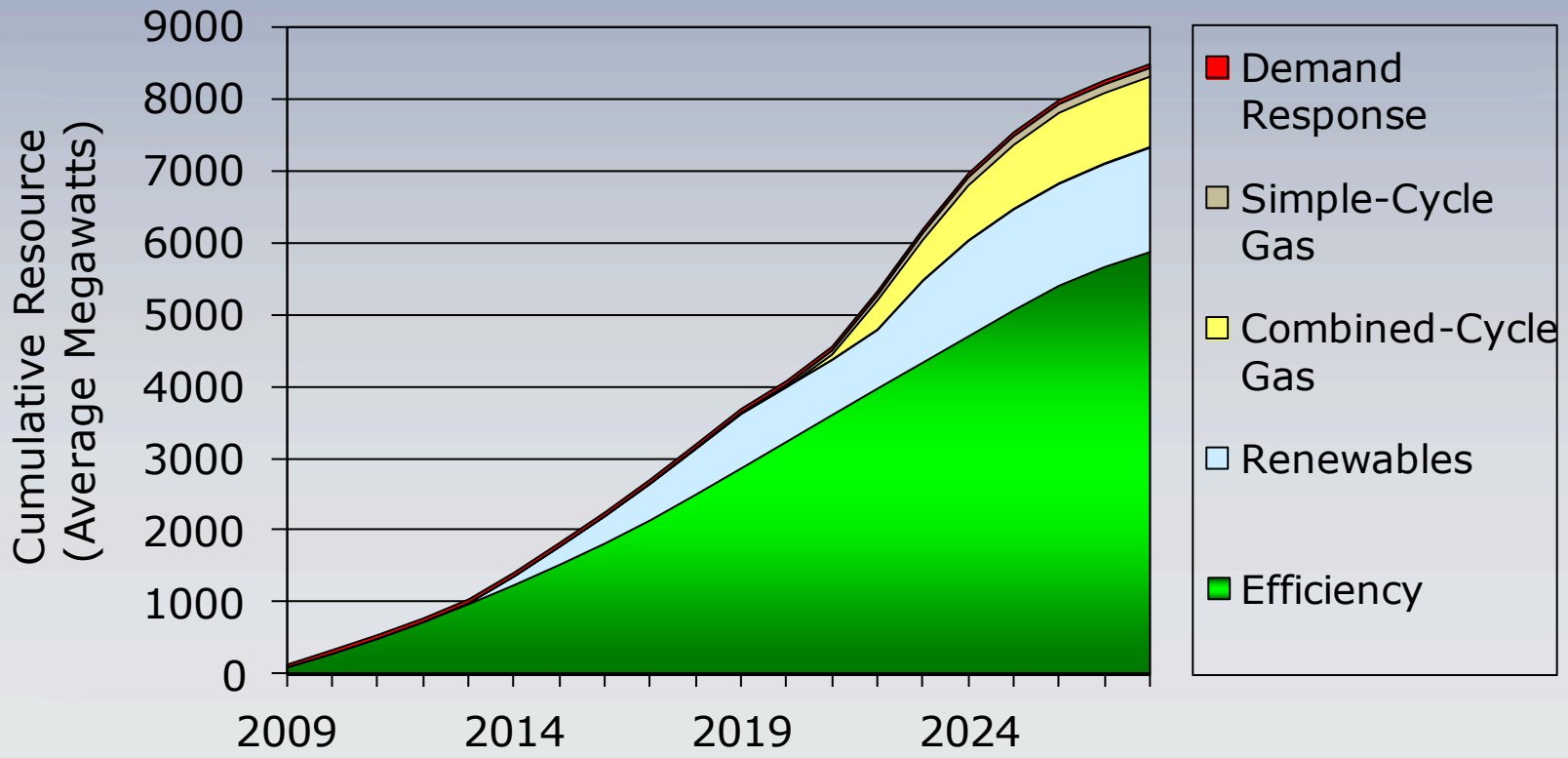
Northwest Power Plans

- Long-term regional power plan (20 year horizon)
- Updated every five years
- Electricity demand and price forecasts
- Identifies least-cost, least-risk resources among all of the resources and technologies that are available
- Northwest Power Act designates energy efficiency as the top priority resource to meet future load growth and gives it a 10% cost advantage over other resources
- Bonneville actions must be consistent with the plan

Sixth Northwest Power Plan (2010)

- Resource strategy:
  - Meet 85 percent of growth in demand with energy efficiency
  - Integrate renewable resources the utilities are adding to meet state renewable portfolio standards
  - Take steps to be ready to add natural gas-fired generation when needs emerge
- Five year Action plan (selected items):
  - Acquire 1,100 – 1,400 average megawatts of energy efficiency during 2010-2014
  - Improve system flexibility by increasing supply of flexible resources and reducing electricity demand overall.
  - Assess and ensure resource adequacy

Planned Resource Additions in the Sixth Power Plan



Expected value build out; actual build out depends on future conditions.

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Looking Towards the Seventh Northwest Power Plan (2015)

Council will focus on these issues:

- Regional needs for energy, peaking capacity, and system flexibility; strategies to help meet those needs
- Renewable resources development and integration; impacts on the regional hydro system
- Customer demand response, including its potential as a source of peaking capacity and system flexibility
- Incorporating intra-regional transmission constraints in regional power system planning

Gov. Inslee on the 7th NW Power Plan

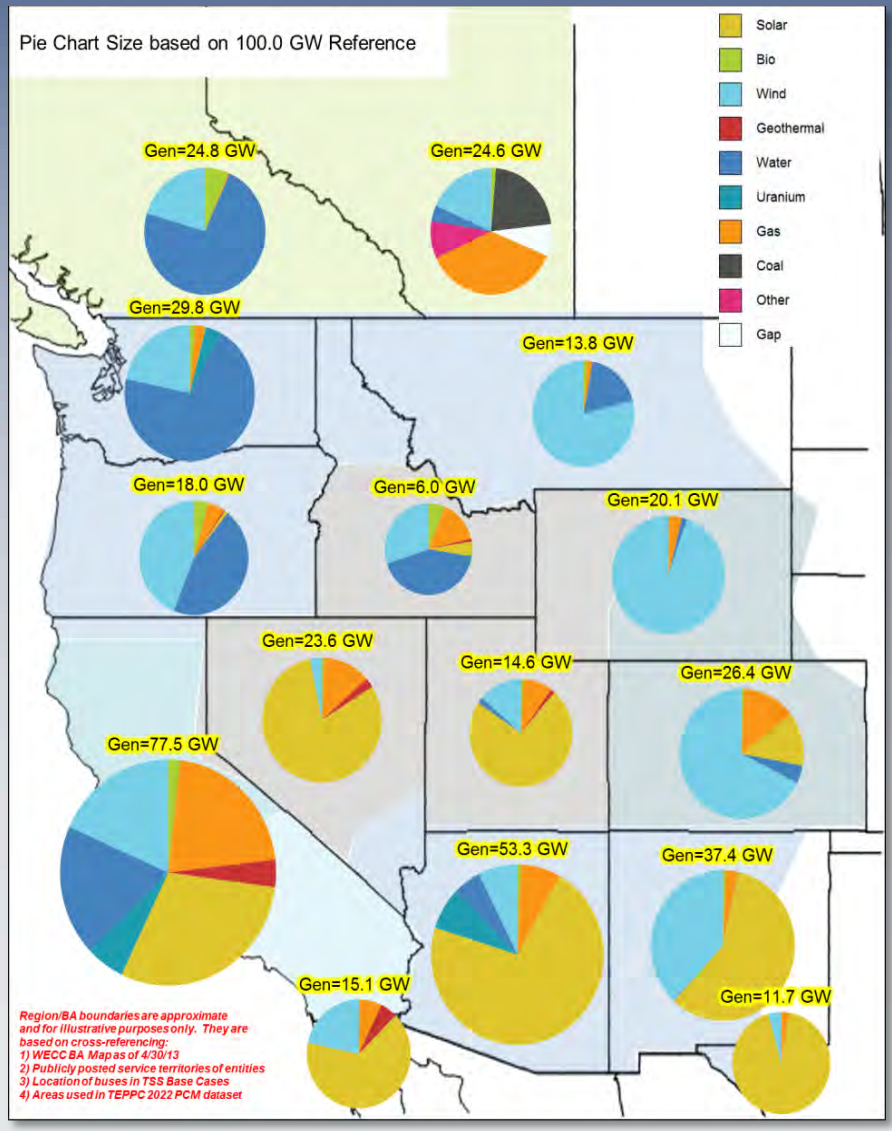
On July 9, Gov. Jay Inslee of Washington addressed the Power Council and said the following:

> I ask that the Seventh Power Plan fully address how the Northwest will reduce the carbon pollution for our electricity further, faster, in the most effective, efficient way possible. The plan should facilitate and accelerate the transition from coal power and ***identify the steepest reasonable glide path for making this final transition***... As a 20-year plan, it should ***lay out a clear and date-certain path*** to an electrical system that is ***100-percent carbon-free and renewable*** through preserving and enhancing our hydropower base, accelerating energy efficiency, and deploying all renewable sources effectively and in an integrated manner across the region and the West. And as a start we will look for ***a date certain for completion of Washington state being coal-free in electricity.*** And that would be a great start.

A Carbon free Electricity System?

- A mix of generation resources that might fulfill Gov. Inslee's request can be found in the 2013 Transmission Plan now being wrapped up by the Western Electricity Coordinating Council (WECC).

- Funded under an stimulus grant from USDOE, this plan used scenario analysis to develop four possible generation scenarios for 2032 in order to forecast possible transmission expansions. Let's look at Scenario 2: Low Carbon, Clean Energy, High Economic Growth.



WECC 2013 Transmission Plans: Scenario 2: Total 2032 Generation Capacity

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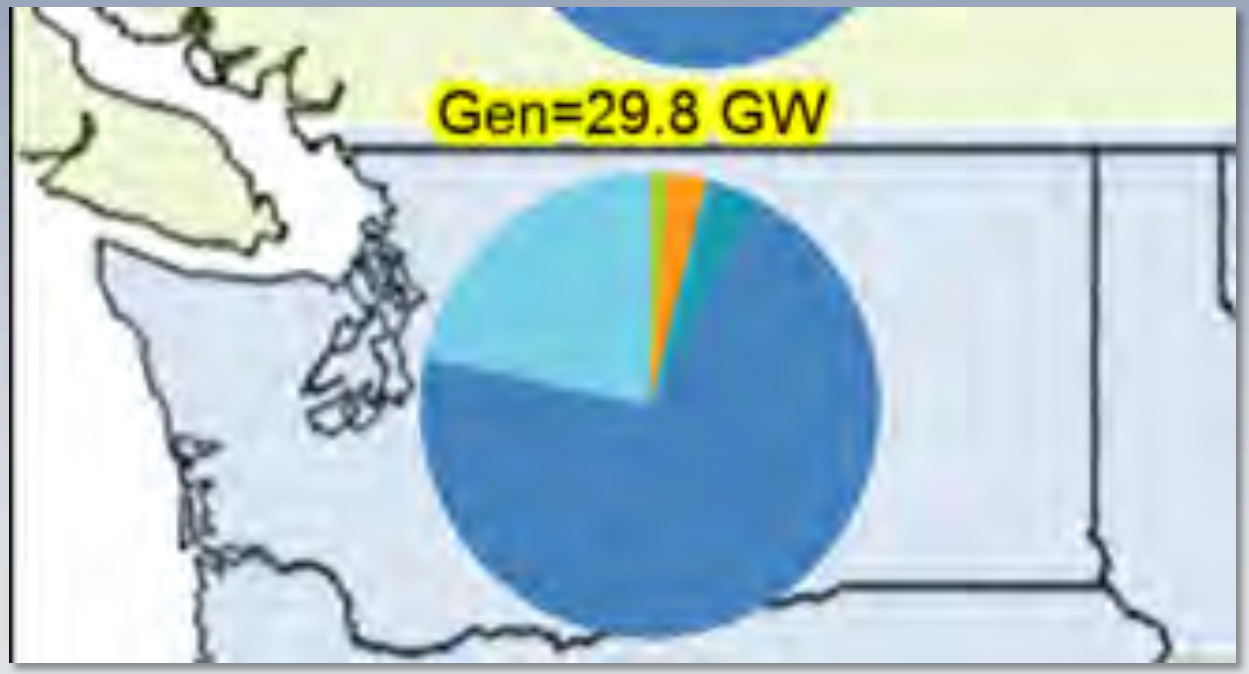

WECC 2013 Scenario 2: Focus on Washington

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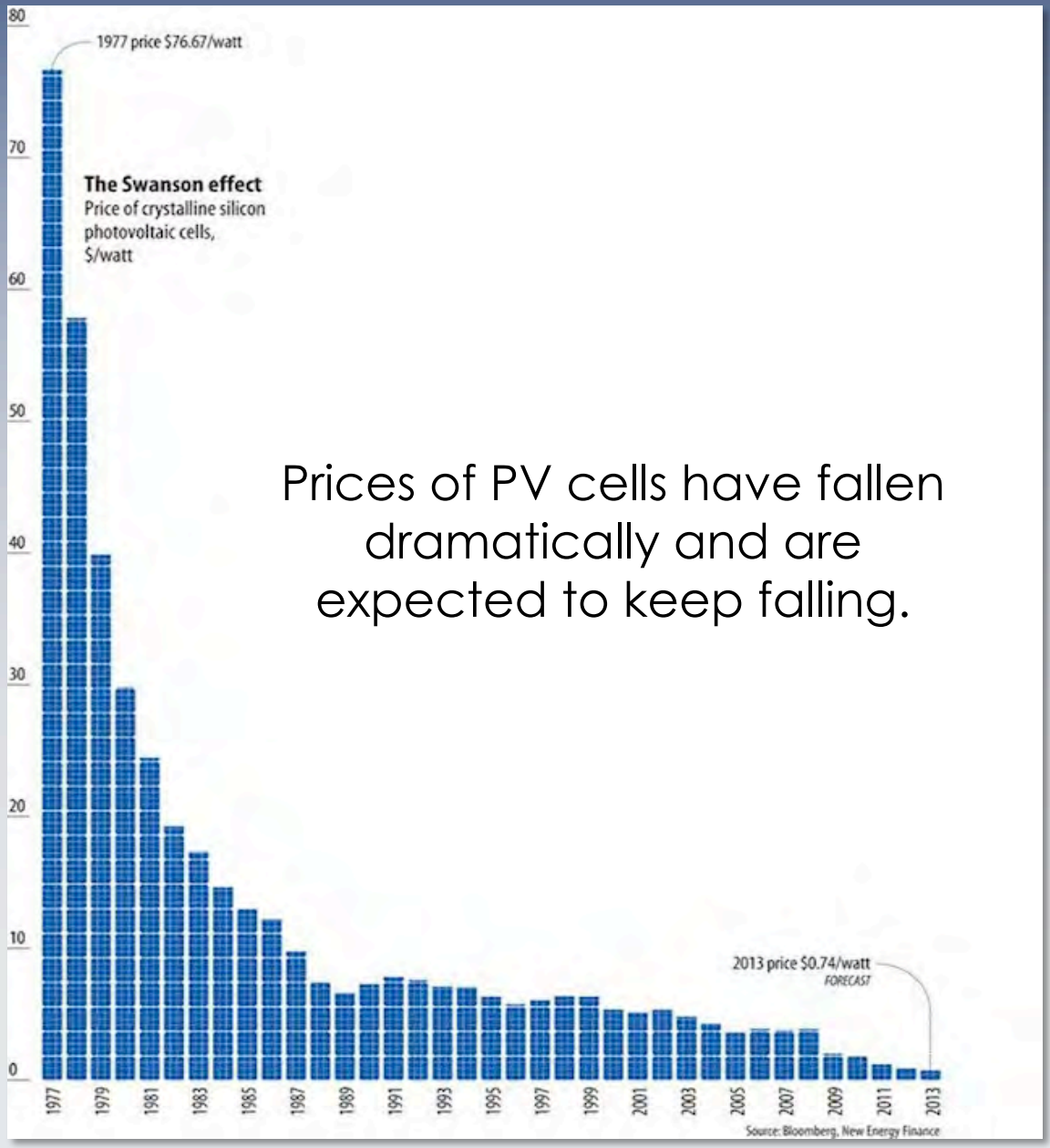
Scenario 2 Assumptions

- High Carbon Cost/price (policy driven)—forces out coal, limits natural gas
- Solar costs continue to fall rapidly
- Wind costs continue to decline
- Renewable integration issues are solvable– storage, smart grid, creative market solutions
- Natural gas generation to fill gaps
- More hydro is available in Washington
- Load growth is small due to conservation and efficiency.
- Adequate transmission is available

None of this is unrealistic; much is already underway



Prices of PV cells have fallen dramatically and are expected to keep falling.

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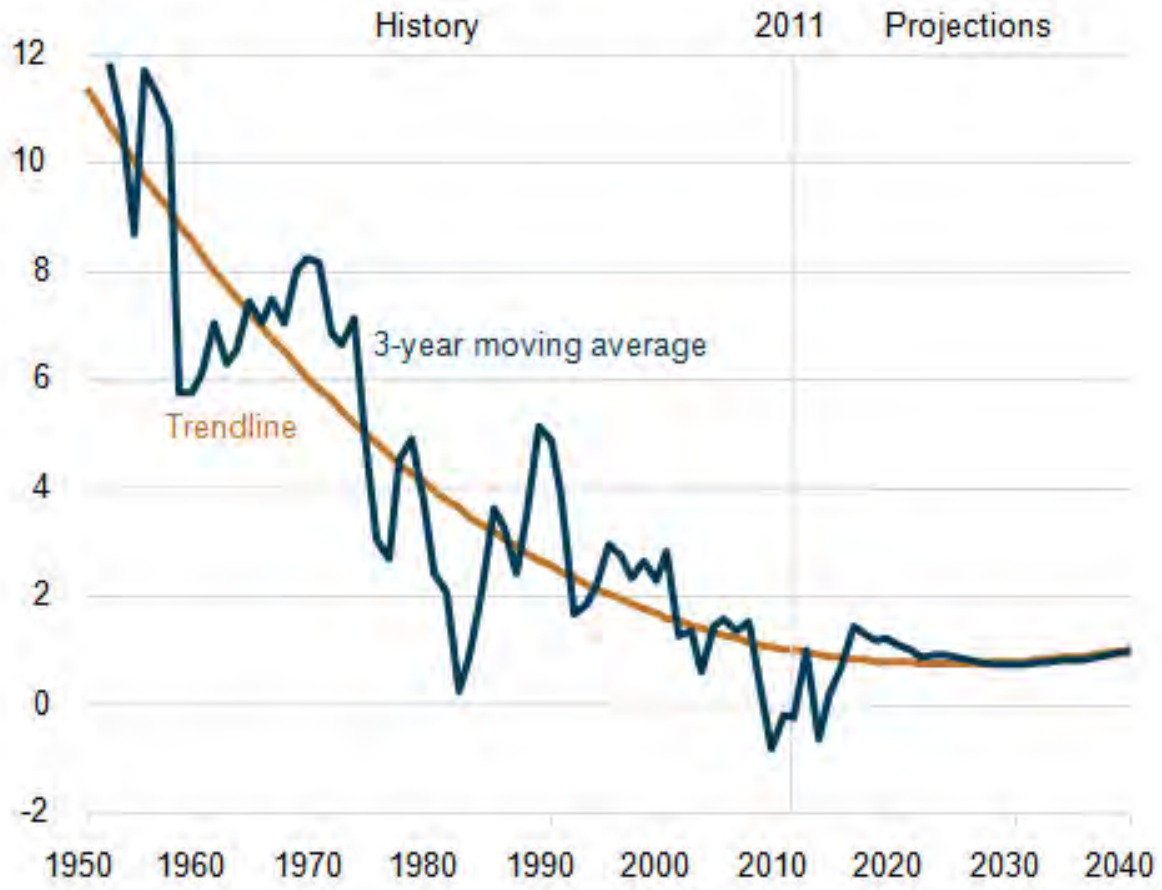
Figure 75. U.S. electricity demand growth, 1950-2040 (percent, 3-year moving average)



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"Smart Grid" applications are already being deployed

- Outage detection on distribution systems
- Sub-station automation
- Transmission operations monitored by synchrophasers
- Automatic reading of meters and compiling of data about time of day usage
- And remote control of end-uses for demand-response is almost ready for prime time

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BPA has recently evaluated multiple technologies for both reducing and increasing load, including:

- Commercial and public building load control
- Residential and commercial space heating energy storage
- Water heating energy storage and load control
- Industrial process load control and energy storage
- Large farm water management system load control and storage
- Small-scale battery energy storage
- Load increase using aquifer recharge opportunities

Is a very low carbon future for the Pacific NW possible?

Yes, if:

- All of the assumptions for Scenario 2 are realized.
- The costs are manageable
- There is sustained political commitment

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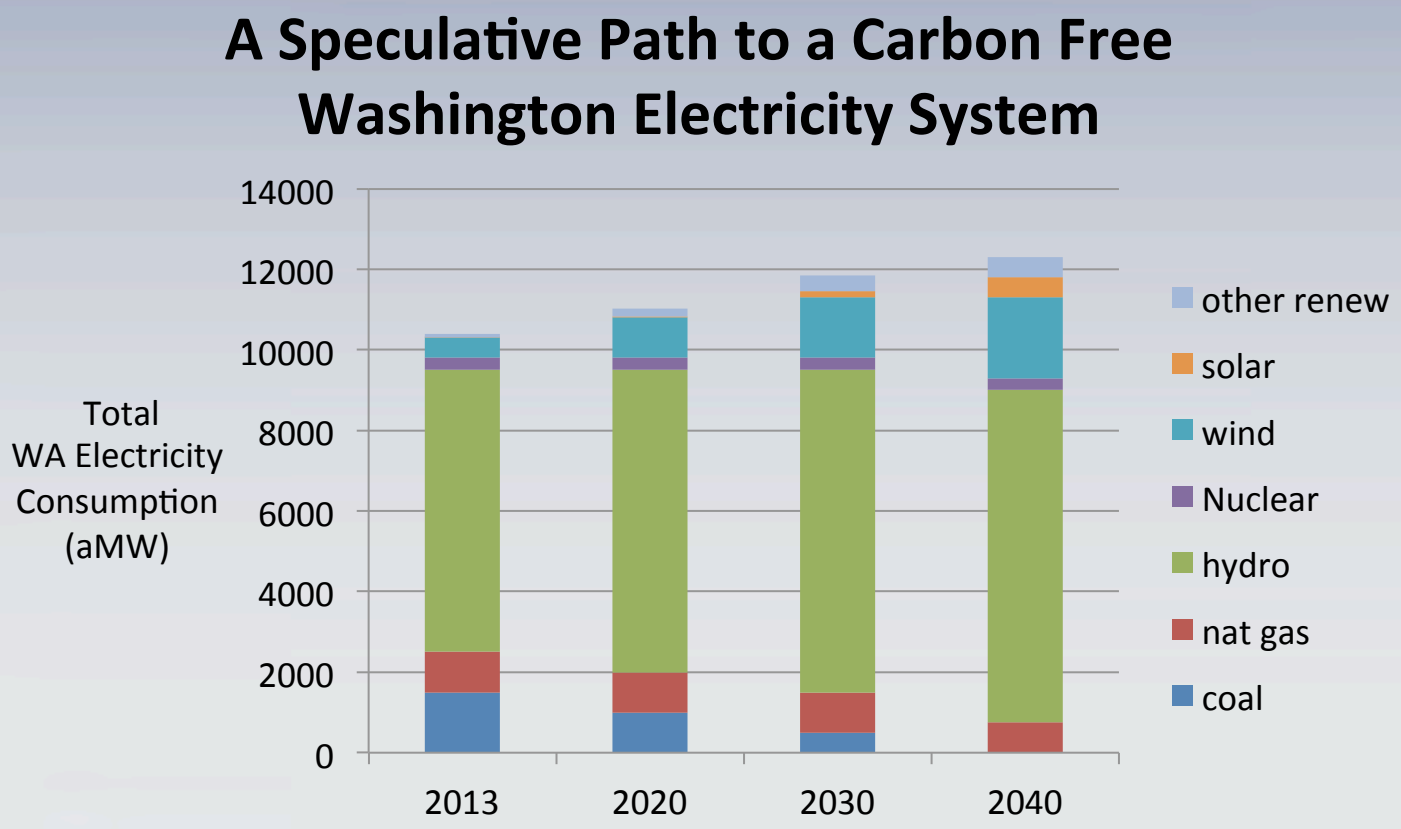
In Washington it might look something like this



Source: Howard Schwartz Extrapolations from WA Fuel Mix Reports, Dept. of Commerce

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The Seventh Power Plan

- Due in 2015
- Will look at many possible futures, such as Governor Inslee's, and see which ones best meet the test of an
  - "Adequate
  - Efficient
  - Economic
  - Reliable

  Power system," as stated in the NW Power Act.

Adequate and Reliable

- Is there enough generation available?
- Is it flexible enough to be on-line when needed?
- Can much larger amounts of intermittent renewables be integrated into the grid?
- Is it dependable– not subject to unplanned outages?

Efficient and Economic

- Conservation is the preferred resource under the Act.
- Conservation is the cheapest resource available, but cannot meet all load growth.
- How the cost of renewables are compared to the cost of coal and gas (and possibly nuclear) will be an essential component of the analysis.

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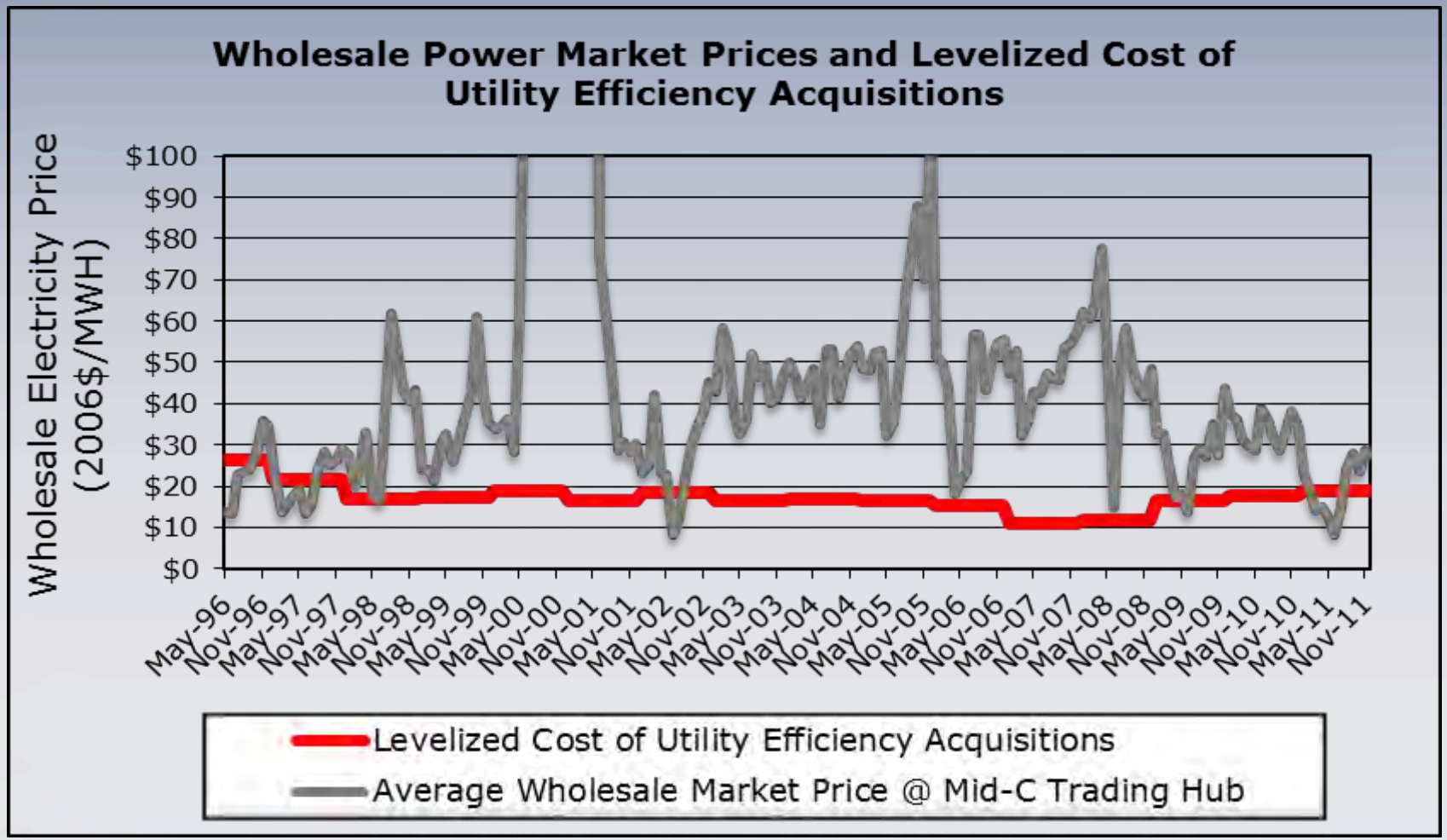
Conservation is cheap and mitigates risk



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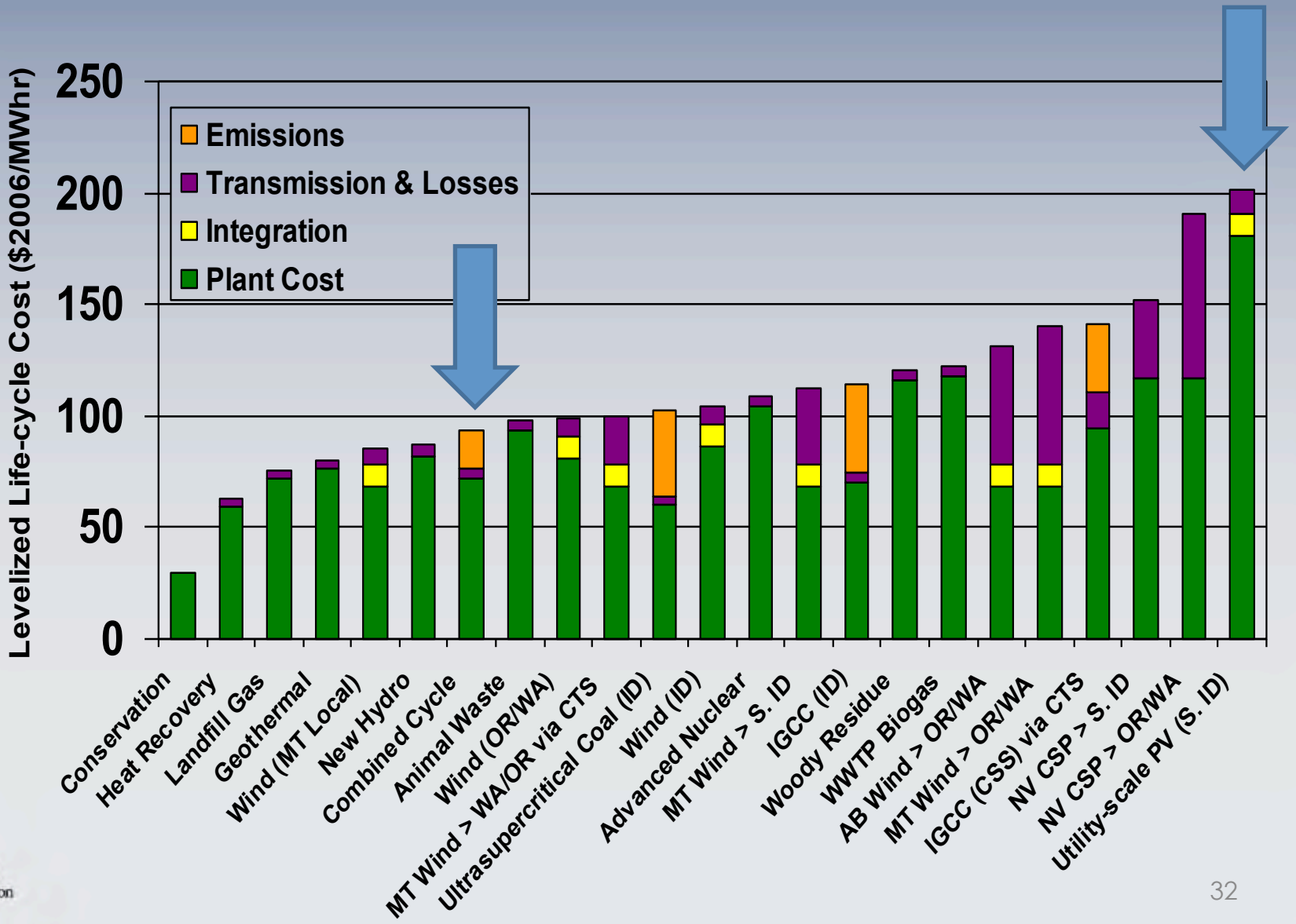
Resource Costs Comparison
(6th Power Plan)



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Concluding Thoughts

The large hydro base of NW electricity generation makes it possible to seriously consider an almost carbon free electricity system.

Whether the rest of the resource mix can also be carbon-free and renewable will depend on the technological developments and economic trends that I have discussed and the political decisions that are made.

The 7th Power Plan will help guide the discussion.

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