Resources in the IRP

2014 IRP Stakeholders

September 12, 2013

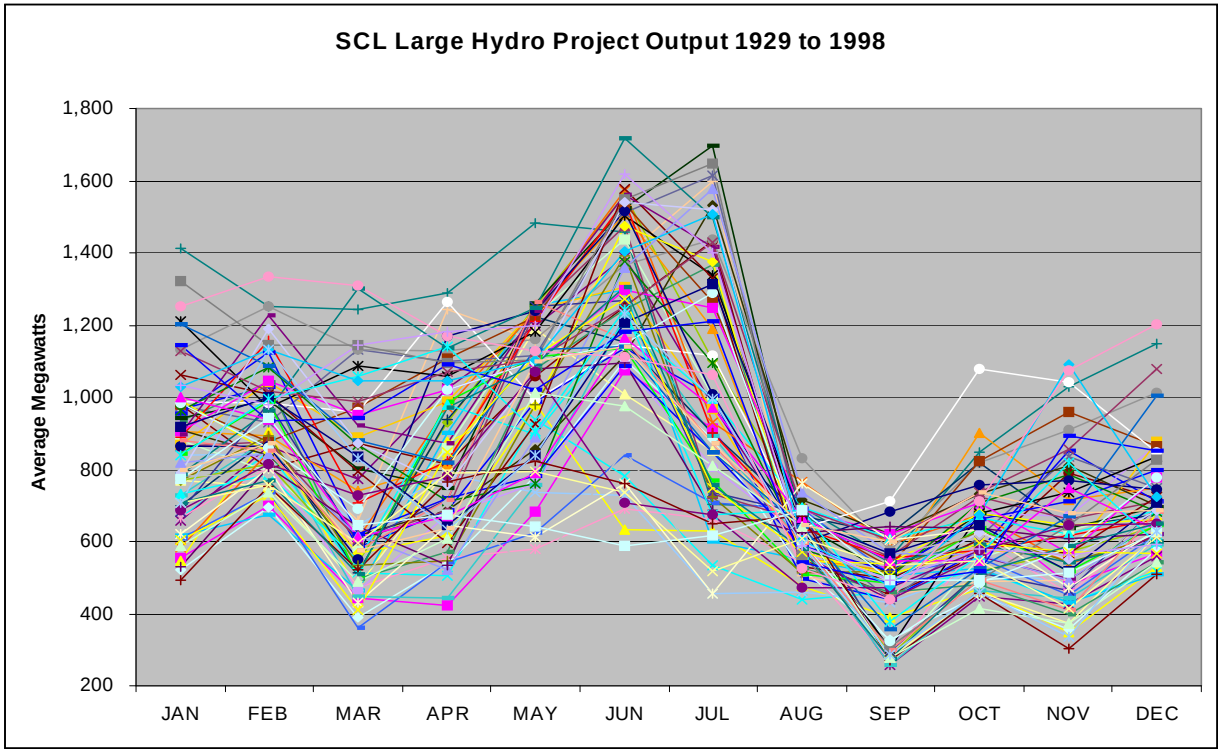
Resources in the IRP: Agenda

- Introduction
- Generation Resources
- Fuel Prices
- Conservation Potential Assessment
- Adjourn

Generation Resources

Generation Resources: City Light

- SCL's Existing Supply Portfolio is Heavily Dependent on Hydro
  - Advantages: Low cost, Considerable Experience
  - Disadvantages: Seasonal and Annual Variability in Precipitation



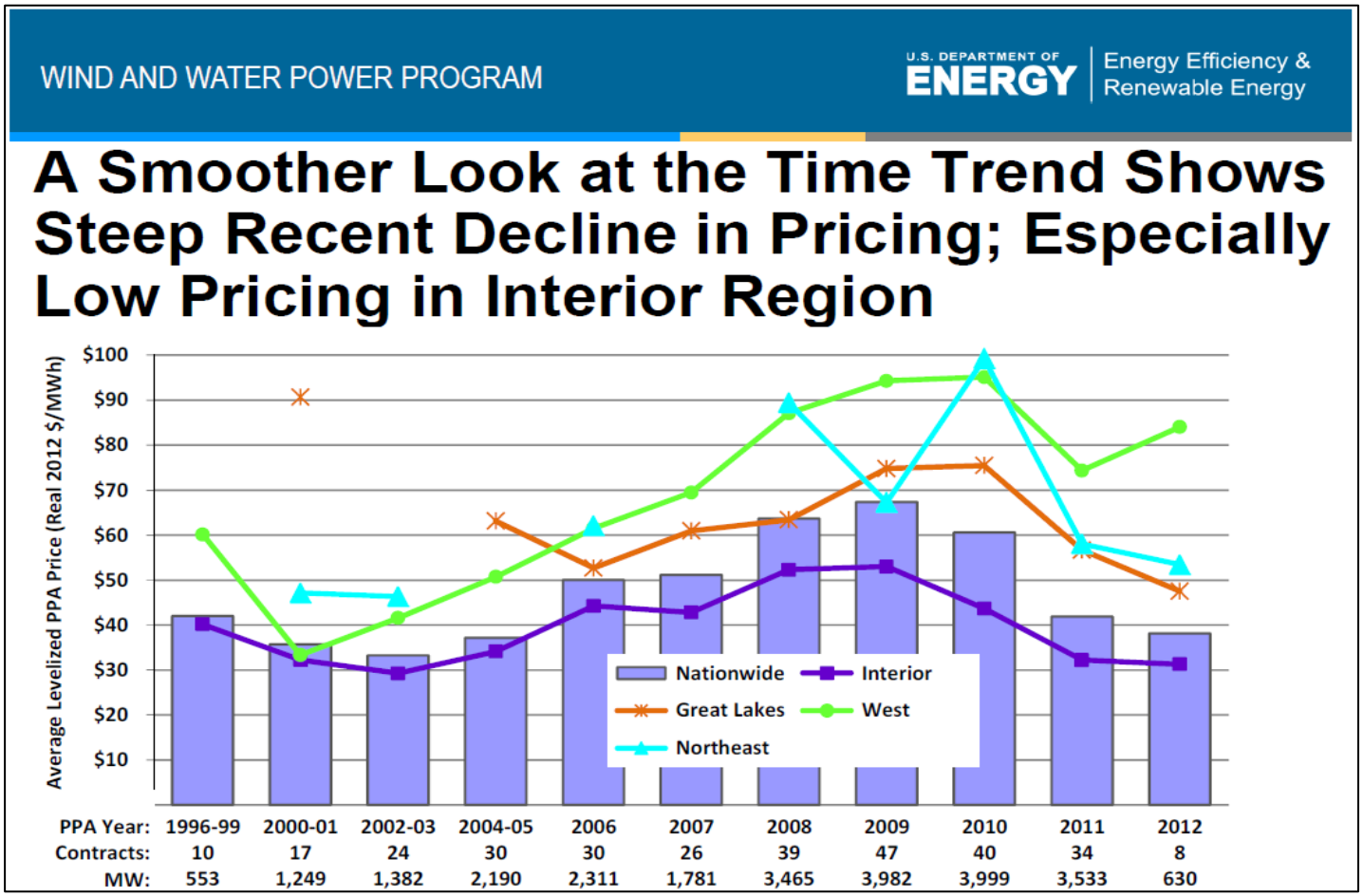
Generation Resources: Choices Available to Utilities

- Geothermal
  - Baseload
  - Limited by underground heat sources; technically challenging
- Landfill Gas
  - Baseload
  - Limited to landfills; most potential utilized
- Biomass
  - Baseload
  - Fuel competes with other markets; can be expensive
- Solar
  - Variable
  - Comparatively high cost and lower capacity factors in PNW
- Wind
  - Variable
  - Low capacity values and growing integration costs
- Natural Gas
  - Baseload or Peaking (Flexible)
  - CO2 emissions; lingering fuel price stability concerns

Generation Resources: Cost Comparisons

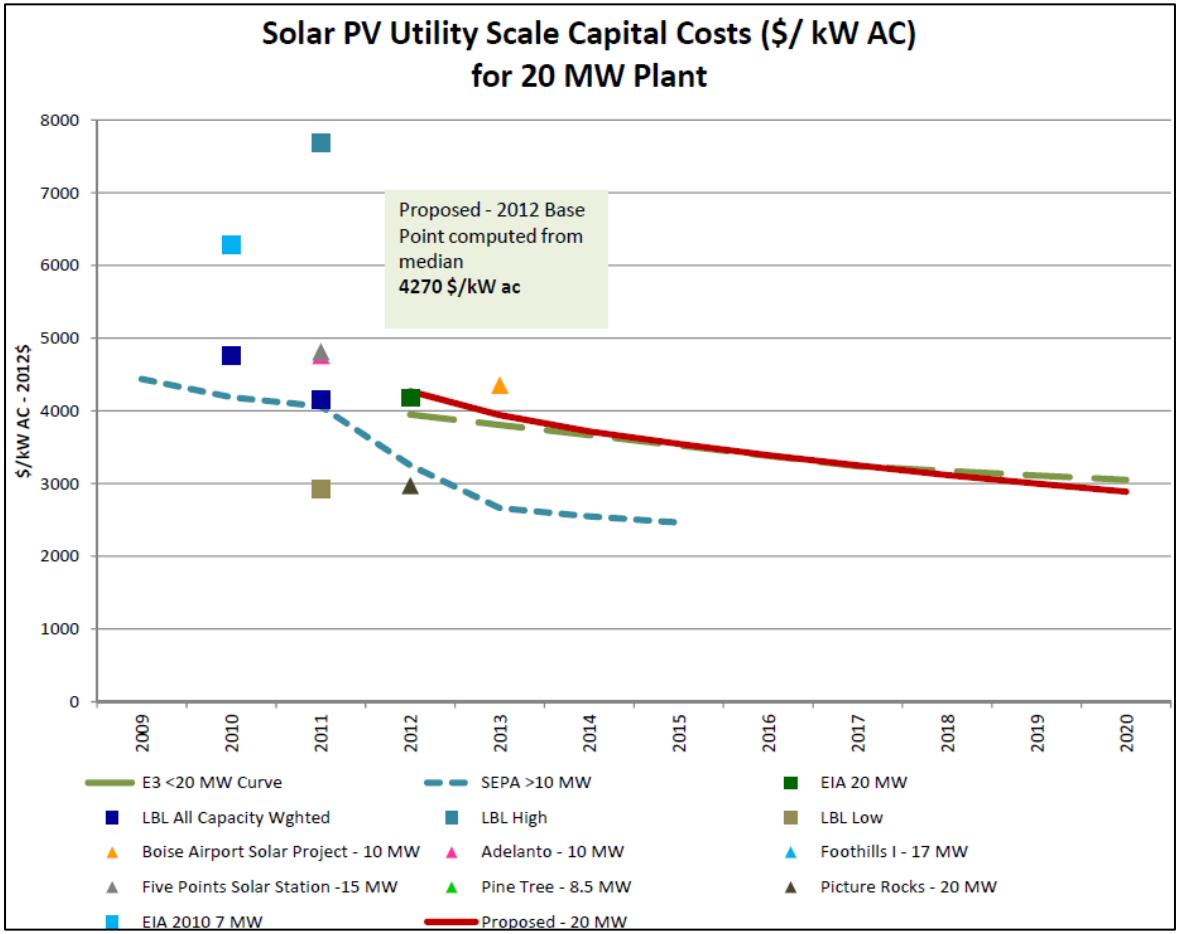
	Capacity Type		Initial Capital			
		Low ($/kW)	Med ($/kW)	High ($/kW)	Capacity Factor	Illustrative Levelized Cost ($/MWh)
Wind	Variable	$1,800	$2,200	$2,500	30-35%	$60-90
Biomass	Baseload	$3,500	$4,000	$8,000	75-85%	$90-130
Geothermal	Baseload	$4,000	$6,600	$9,000	80-90%	$85-110
Landfill Gas	Baseload	$2,300	$2,500	$4,000	80-90%	$55-100
Central PV	Variable	$2,000	$2,700	$3,500	up to 24%	$85-150
Eastern Oregon, 20 MW						
Combustion Turbine Natural Gas (before fuel, offsets)	Dispatchable, flexible		$900		1-25%	$100-1,000
Heat rate			10,000			
Combined Cycle Natural Gas (before fuel, offsets)	Dispatchable, baseload	$900	$1,300	$1,500	20-60%	$60-120
Heat rate		7,100	6,700	6,800		
Prices assuming resource is on-line in 2018, current dollars						
Illustrative cost is without government incentives or delivery.						

Generation Resources: Wind Prices



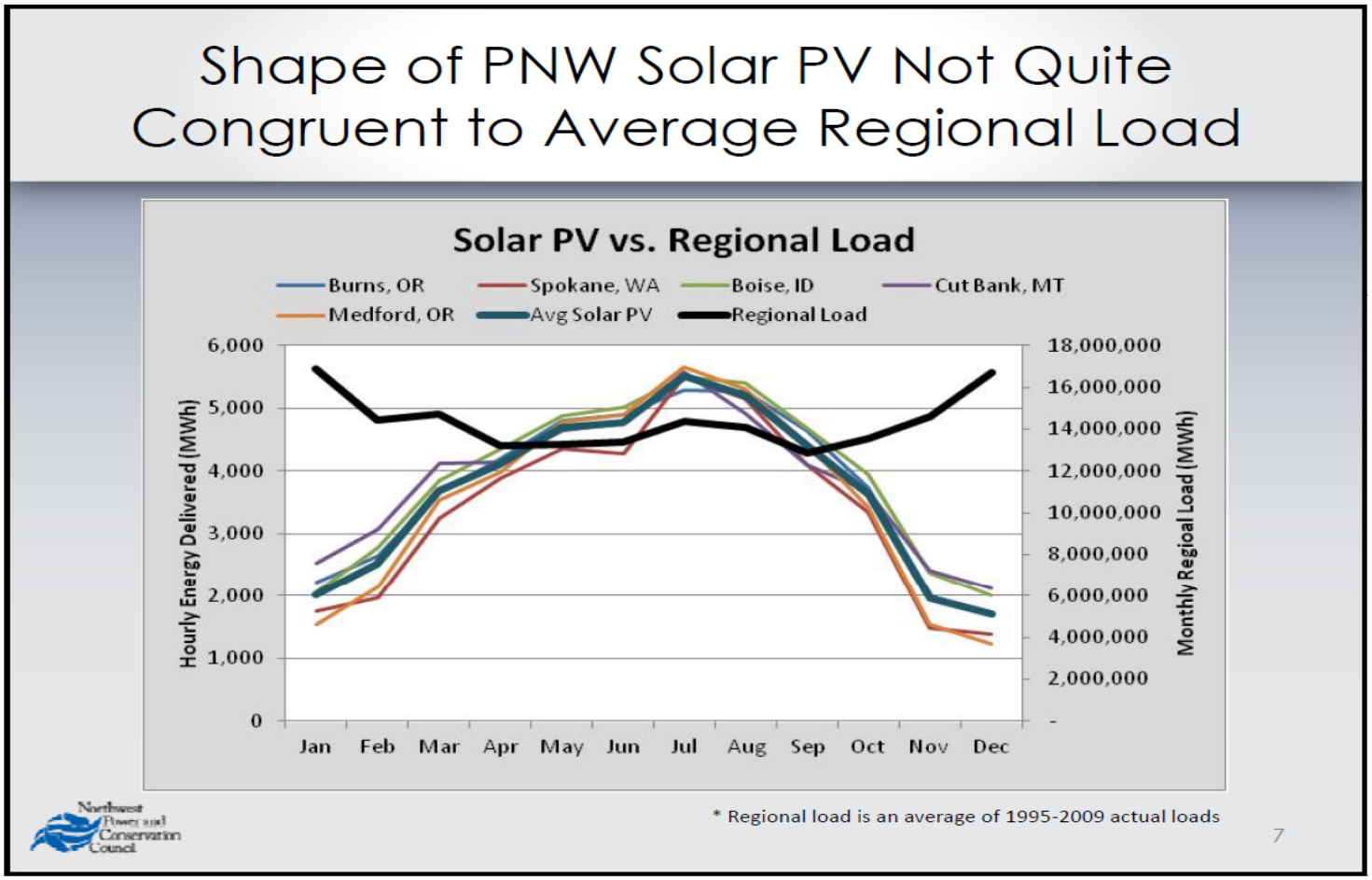
Source: Lawrence Berkeley Labs, Wiser *et al*., August 2013

Generation Resources: Solar PV Cost Trends



Source: NPCC, Solar Cost, June 2013

Generation Resources: Solar Output and Regional Load



Source: NPCC June 2013

Generation Resources: Natural Gas

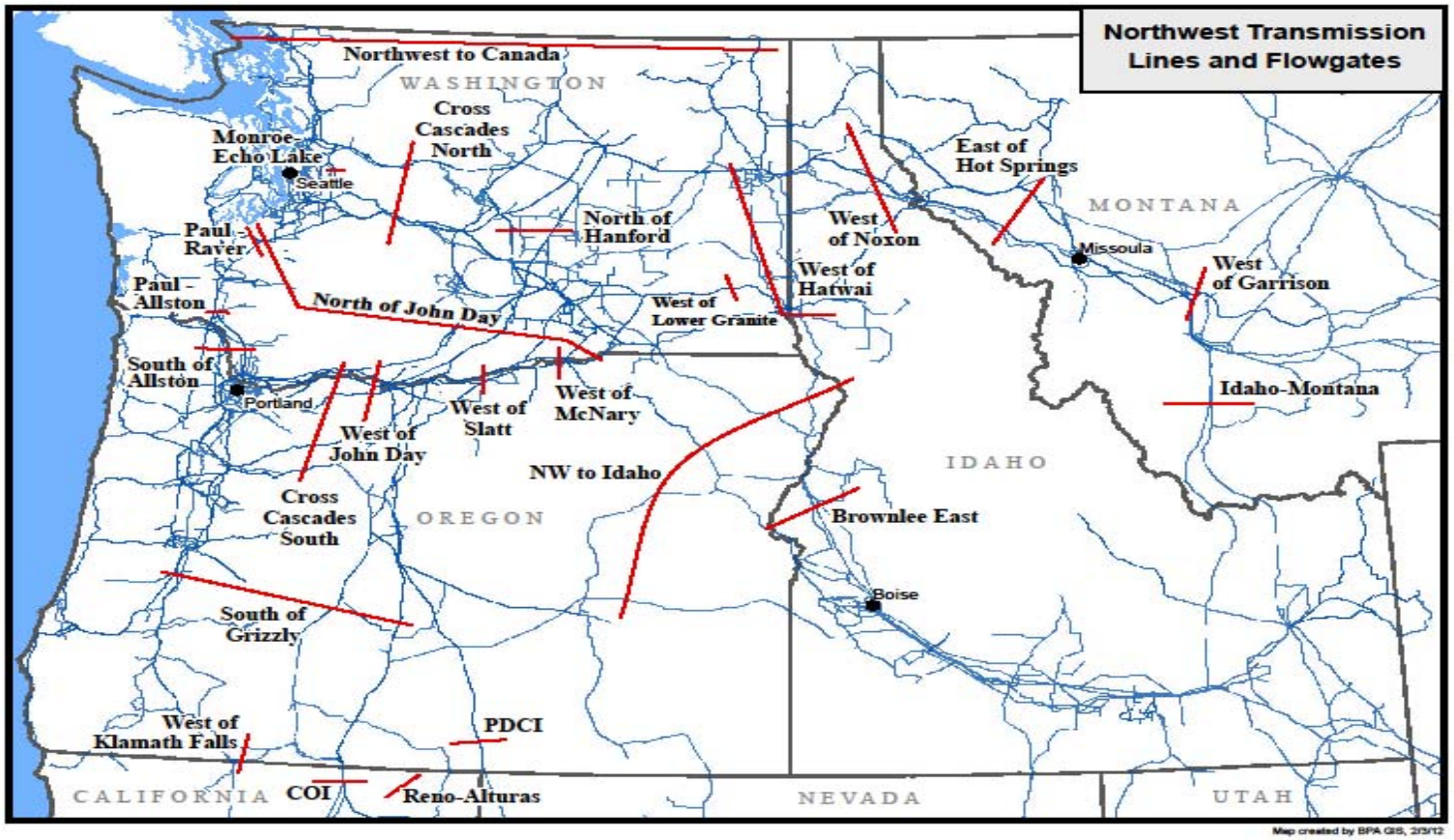
- Natural Gas: Four plants in siting process in Oregon
- Tradeoffs: forecast of regional load growth resulting in less demand compared to planned coal retirements increasing demand
- Power Plant Characteristics:
  - Combustion Turbines
    - Idaho Power commissioned Langley Gulch plant in 2012
    - May be quick start and dispatchable
    - High heat rate
  - Combined-cycle Turbines
    - Port Westward outside Portland
    - Efficient operations (heat rate 6,900) if run as baseload
    - Cycling plant reduces efficiency

Generation Resources: Transmission

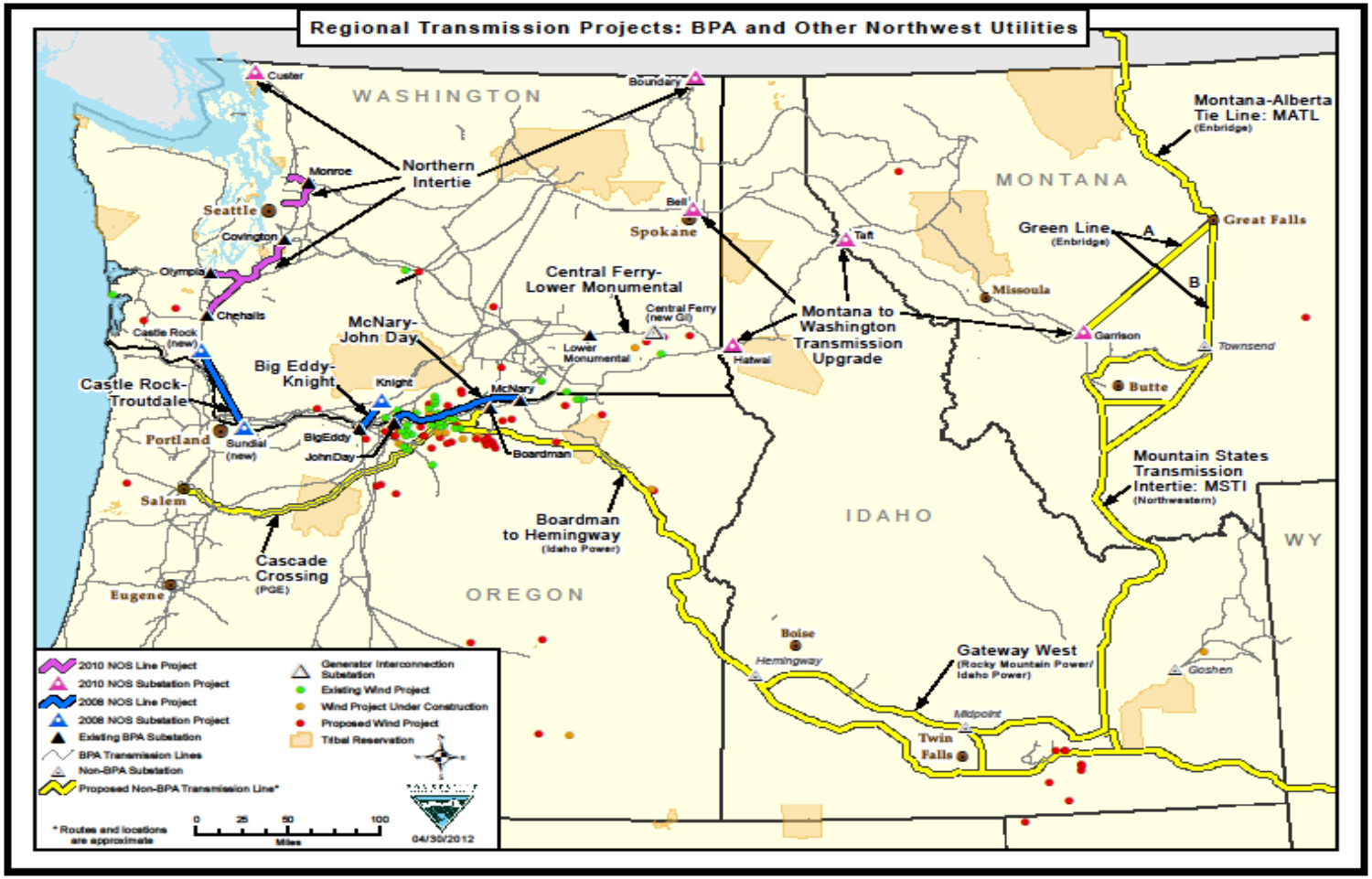
- Regional Transmission
  - Many constraints (see map, next page)
  - Some planned improvements
- SCL Can Deliver Power Today
- Future Load Growth and New Resources Will be more Difficult (Expensive) to Serve

Generation Resources: Existing Transmission

BPA's Transmission Grid and Regional Constraints



Generation Resources: Planned Transmission

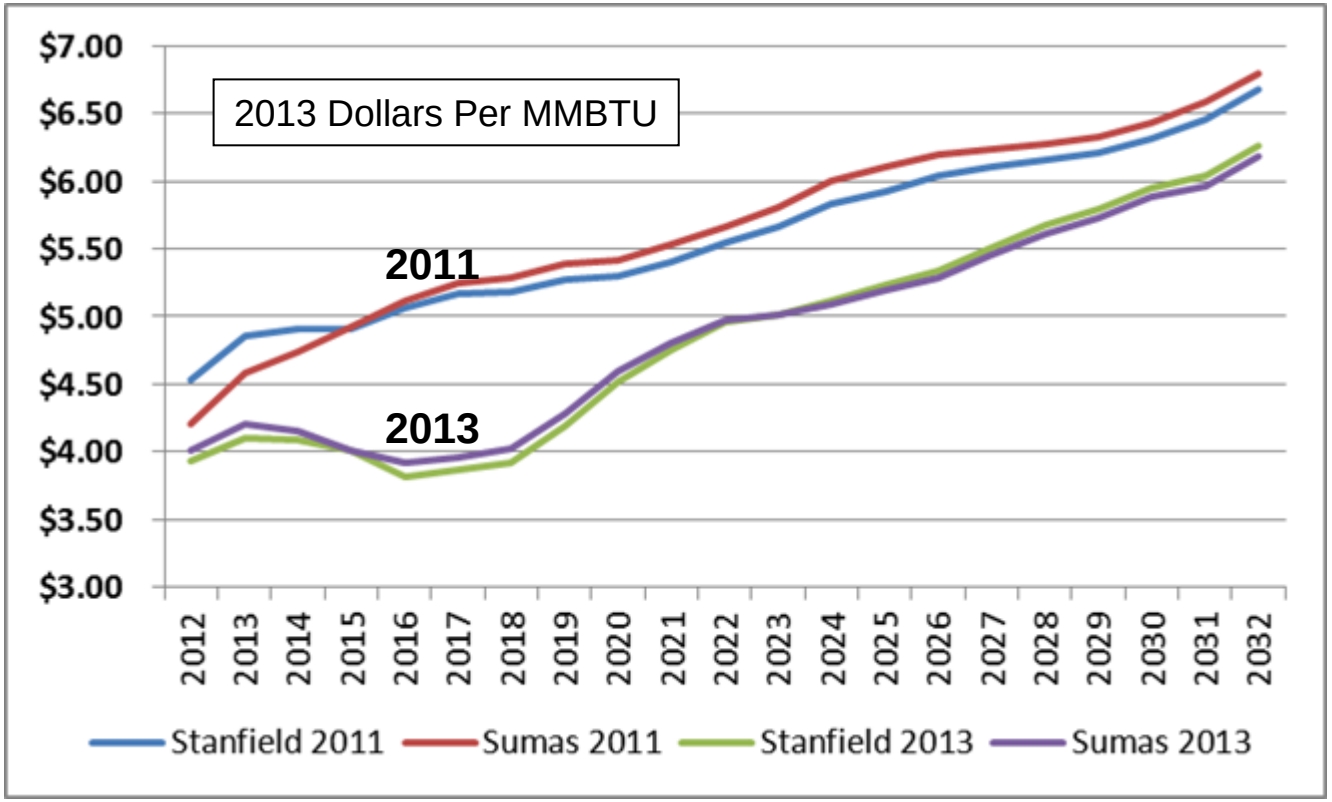


Generation Resources: Regional Issues

- Regional Electrical Energy Changes
  - Coal Retirements
    - Centralia, Boardman have announced changes
    - Others possible
  - Changes to Canadian Return Treaty
    - BPA and Mid-C utilities provide free energy to British Columbia to compensate BC for constructing 3 dams in upper Columbia
    - Earliest possible change is Fall 2024
    - Could result in 200-400 aMW power staying in region (regional load approximately 27,000 aMW)
  - Will an Energy Imbalance Market Emerge?

Pacific Northwest Fuel Prices

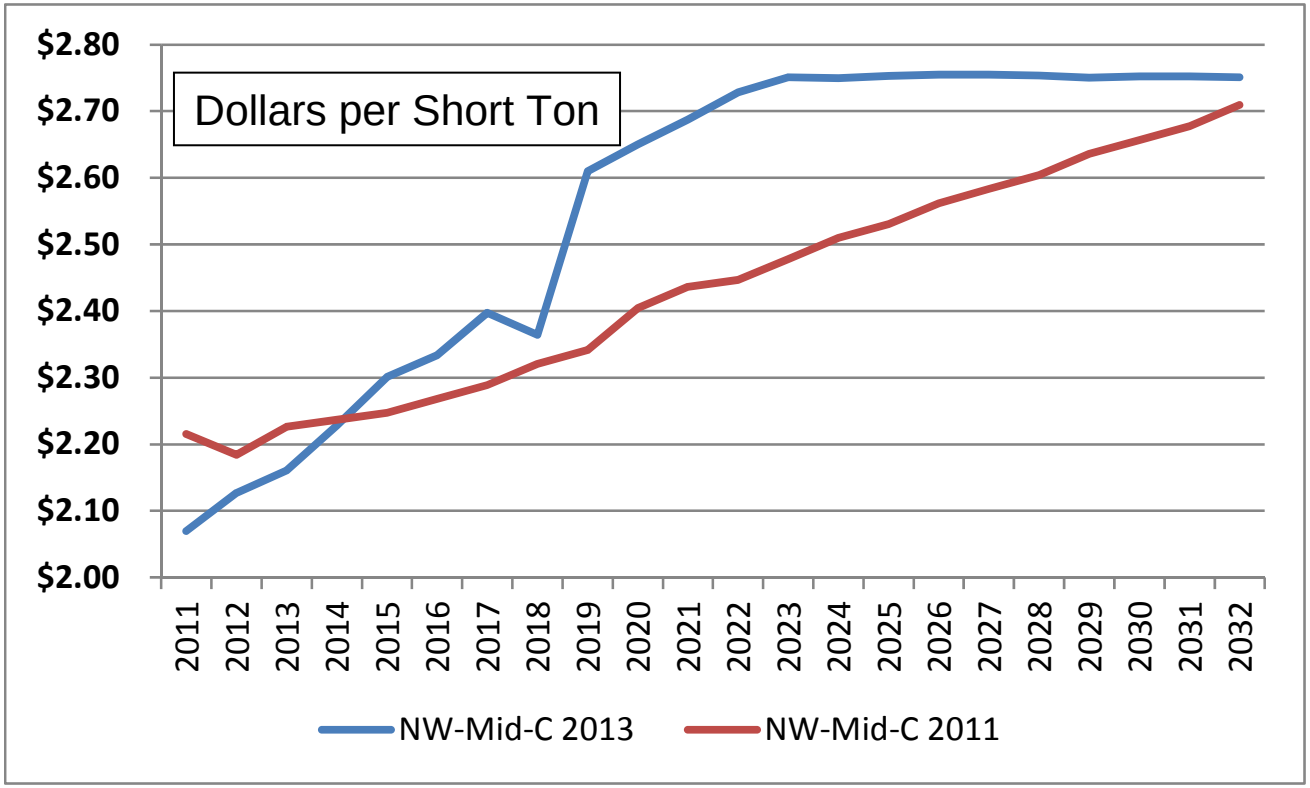
Fuel Prices: Ventyx Natural Gas Price Outlook Declined From 2011 to 2013



Fuel Prices: Shale Gas Drives Ongoing Decline in Natural Gas Price Outlook

- Shale Gas Supplies Exceeded Expectations
  - A mild winter in 2012 pushed gas storage to the highest on record and Henry Hub prices fell to $2 per MMBTU
  - A large backlog of drilled (but not yet producing) wells suggests continued low prices
- The 2012 IRP Outlook Foresaw Increased Gas Demand, But Overestimated Shale Gas Production Costs
  - Production costs have fallen significantly since 2008 and are estimated at $4 per MMBTU or less
  - Much shale gas production is a joint product with producing higher value oil and natural gas liquids
    - Production of “wet gas” is driving natural gas pricing and supplies

Fuel Prices: Ventyx Coal Price Outlook Increased 2011 to 2013



Fuel Prices: Mid-C Coal Price Outlook Lifted By Growing PRB Market Share

- Shrinking Coal Supplies
  - Nationally, more than 150 coal mines have been idled
    - Central Appalachian supplies most reduced
- Uncertain Regulatory Landscape for Coal Emissions Helps Low-Sulfur PRB Coal
  - Use of blended or 100% PRB coal reduces emissions for many plants
- PRB Coal Remains Lower Cost than Natural Gas
- Export Market Stability
  - Non-OECD countries (India, Asia) continue to be a strong market for coal

Fuel Prices: Summary

- Fuel Prices Directly Affect SCL Conservation and Generation Economics
  - Market prices affect SCL revenues for surplus power sales
  - Recent market prices sometimes lower than average utility programmatic conservation costs
- Coal Likely Still Important to Western Power Supply in Next IRP
  - Western coal plants typically use low cost PRB coal
  - PRB coal prices are increasing, but capped by natural gas prices
  - Continuing coal operations lead to lower PNW electric prices
- Lower Natural Gas Price Outlook Expected for Next IRP
  - Oil and natural gas liquids production, plus abundant shale gas supplies are expected to keep natural gas prices low for at least a decade

Conservation Resources: Conservation Potential Assessment

Seattle City Light
2013 Conservation Potential Assessment

IRP Stakeholder Meeting – CPA Results Summary

September 12, 2013, 4:00pm-6:00pm

Outline

- Conservation Potential Assessment - Overview
- Analysis approach
- High-level market characterization
- Conservation savings potential results
- Avoided cost sensitivity
- I-937 Compliance

Conservation Potential Assessment - Overview

Objectives:

- Meet I-937 requirements
- Establish cost-effective conservation targets
- Support IRP development
- Quantify amount, timing, and cost of conservation resources
- Not intended to design programs

Study approach

Study results

Synthesize
Develop supply curves
Sensitivity analysis

Achievable potential

Establish Customer Acceptance
SCL programs Other studies
Market acceptance/ramp rates

Technical and economic potential

Screen Measures and Options
Measure descriptions SCL program data
Avoided costs NWPCC/RTF workbooks

End-use forecast by segment

Project the Baseline
Prototypes and energy analysis (***BEST***) SCL forecast data
Codes and standards RTF data Secondary data

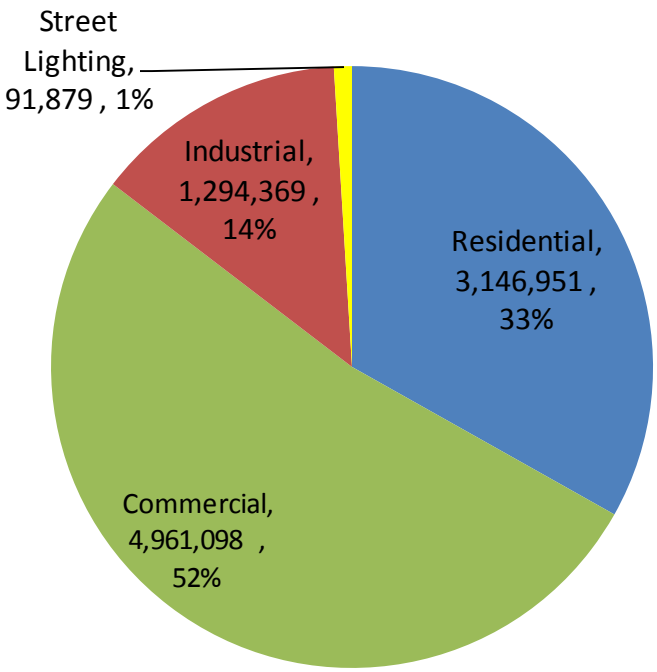
Base-year energy use by segment

Characterize the Market
SCL billing data SCL program data ***Energy Market Profiles***
RBSA, RCCS, and other surveys Secondary data Previous study results

Study objectives

Market segmentation by sector, 2012

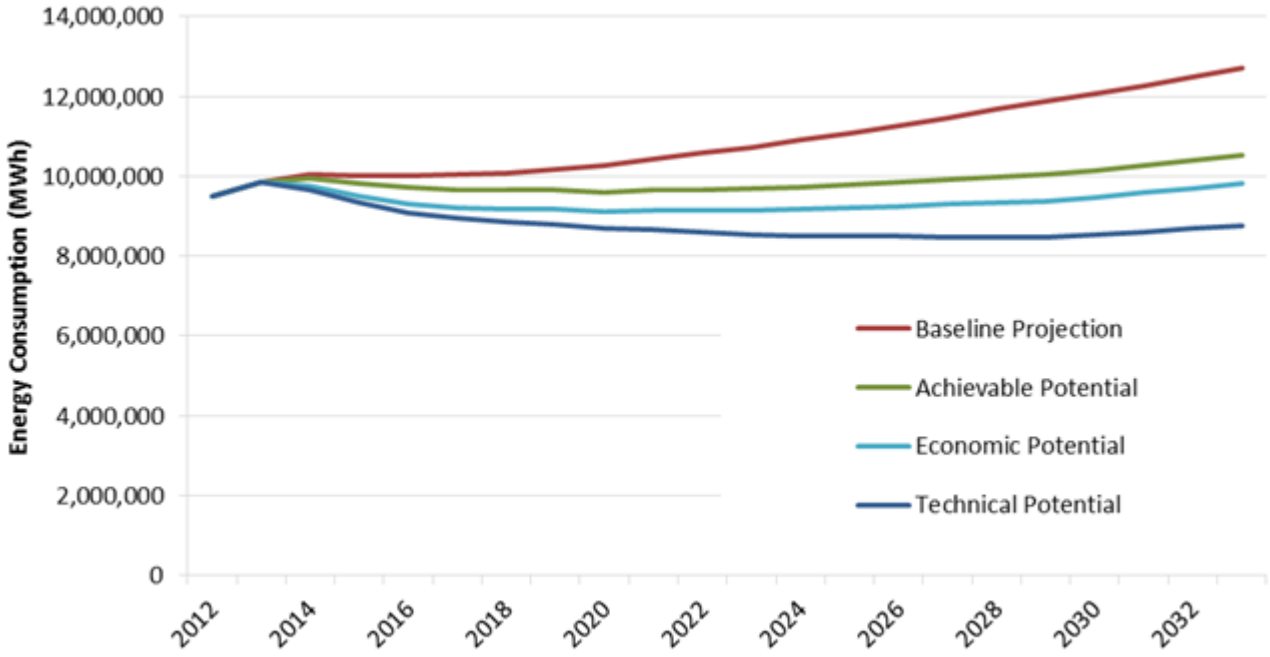
Sector	Number of meters (customers)	2012 Electricity sales (MWh)
Residential	362,524	3,146,951
Commercial	40,084	6,255,467
Industrial		
Street Lighting	3,301	91,879
Total	405,927	9,494,297



LoadMAP baseline and potential projections

Residential, Commercial, Industrial, and Street lighting

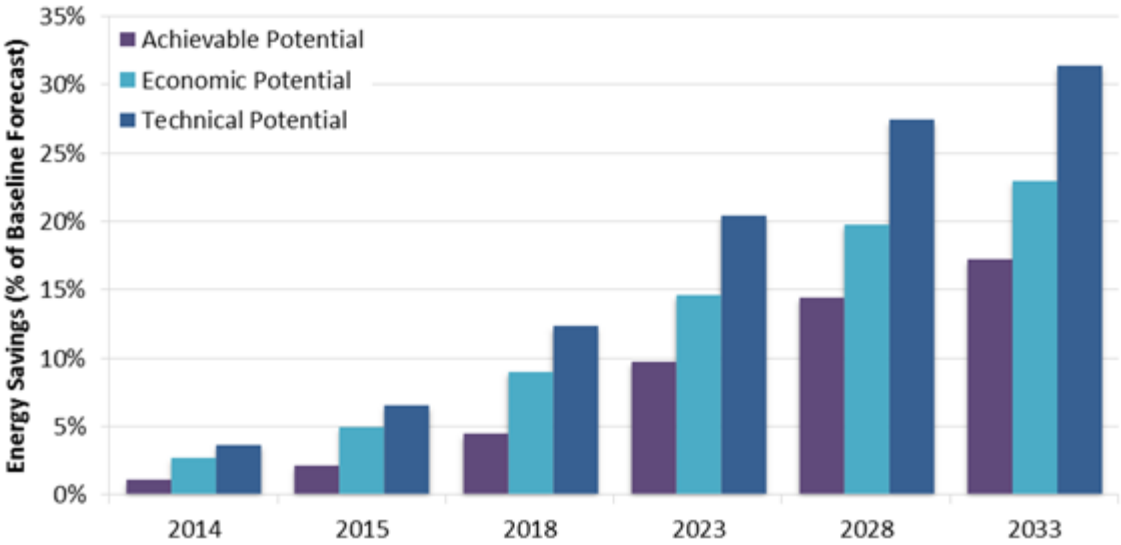
- **Baseline Projection** – Forecast of energy usage absent the effects of customer efficiency programs. Holds efficiency purchasing trends at current levels, but includes the effects of codes and standards.
- **Technical Potential** – Theoretical upper limit of savings potential, assumes all customers adopt the most efficient measures regardless of cost
- **Economic Potential** – Customers adopt all cost-effective measures that pass the TRC test with B/C >1.0
- **Achievable Potential** – Subset of economic potential that can be reasonably achieved given the realities of customer preference, market adoption, limited information and education, and program implementation barriers.



SCL all sectors conservation potential

For 2014 to 2023, ten-year achievable potential savings are 9.7% of the baseline forecast.

This is 118.4 aMW.



	2014	2015	2018	2023	2028	2033
Baseline Forecast (MWh)	10,049,821	10,005,208	10,085,063	10,728,599	11,667,344	12,706,161
Cumulative Savings (MWh)						
Achievable Potential	99,985	197,975	433,371	1,036,977	1,699,082	2,195,644
Economic Potential	285,794	504,001	911,503	1,574,823	2,342,961	2,893,157
Technical Potential	376,456	656,464	1,243,763	2,185,003	3,209,910	3,938,790
Cumulative Savings (aMW)						
Achievable Potential	11.4	22.6	49.5	118.4	194.0	250.6
Economic Potential	32.6	57.5	104.1	179.8	267.5	330.3
Technical Potential	43.0	74.9	142.0	249.4	366.4	449.6
Energy Savings (% of Baseline)						
Achievable Potential	1.0%	2.0%	4.3%	9.7%	14.6%	17.3%
Economic Potential	2.8%	5.0%	9.0%	14.7%	20.1%	22.8%
Technical Potential	3.7%	6.6%	12.3%	20.4%	27.5%	31.0%

ENERNOC

Avoided cost sensitivity

- Two avoided cost scenarios
- The I-937 Market Avoided Cost Method is used I-937 purposes
- The 2012 IRP Preferred Portfolio Method is used for SCL's IRP

Levelized cost over time horizon is approx 50% higher.

Results in approx 10% increase in ten-year savings potential (~130 aMW in 2023)

EnerNOC Consistency with Council Methodology

I-937 Compliance

- End-use model — bottom-up
  - Building characteristics, fuel and equipment saturations
  - Stock accounting based on measure life
  - Codes and standards that have been enacted are included in baseline
  - Lost- and non-lost opportunities treated differently
- Measures – comprehensive list
  - RTF measure workbooks
  - BPA data
  - EnerNOC databases, which draw upon same sources used by RTF
- Economic potential, total resource cost (TRC) test
  - Considers HVAC interactions, non-energy benefits
  - Avoided costs include 10% credit based on Conservation Act
- Achievable potential – ramp rates
  - Based on Sixth Plan ramps rates, but modified to reflect City Light program history

Thank You!

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