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



February 4, 2020

**MEMORANDUM**

**TO:** **Council Members**

**FROM:** **Ben Kujala**

**SUBJECT:** **Briefing on the Analytical Process for the 2021 Power Plan**

## BACKGROUND:

Presenter: Ben Kujala

Summary: From May to September of 2019 staff gave multiple presentations to the Power Committee on the various anticipated analytical processes needed to develop the plan. This summarizes those presentation for a start-to-finish view of the analytics that support the plan.

Workplan: A. Develop the 2021 Power Plan

Background:

Related Power Committee presentations:

May 2019:

- Forecast prices for natural gas and other fuels
- Forecast regional transportation fuel consumption
- Develop generating resource reference plants
- Develop demand response supply curves

June 2019:

- Develop energy efficiency supply curves and develop methodology for identifying cost effective energy efficiency measures

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- Forecast load outside the Northwest
- Forecast electricity prices
- Forecast energy use with price effects, forecast energy use with frozen efficiency, and forecast electricity sales

July 2019:

- Establish global financial and economic assumptions
- Forecast the consumption of natural gas
- Develop MCS and surcharge methodology
- Establish existing system parameters and interpret state policies

August 2019:

- Method for determining quantifiable environmental costs and benefits
- Estimate system adequacy requirements
- Analyze resource strategies

September 2019:

- Develop cost-effective methods for providing reserves

More Info:

# The Analytical Process for the Power Plan

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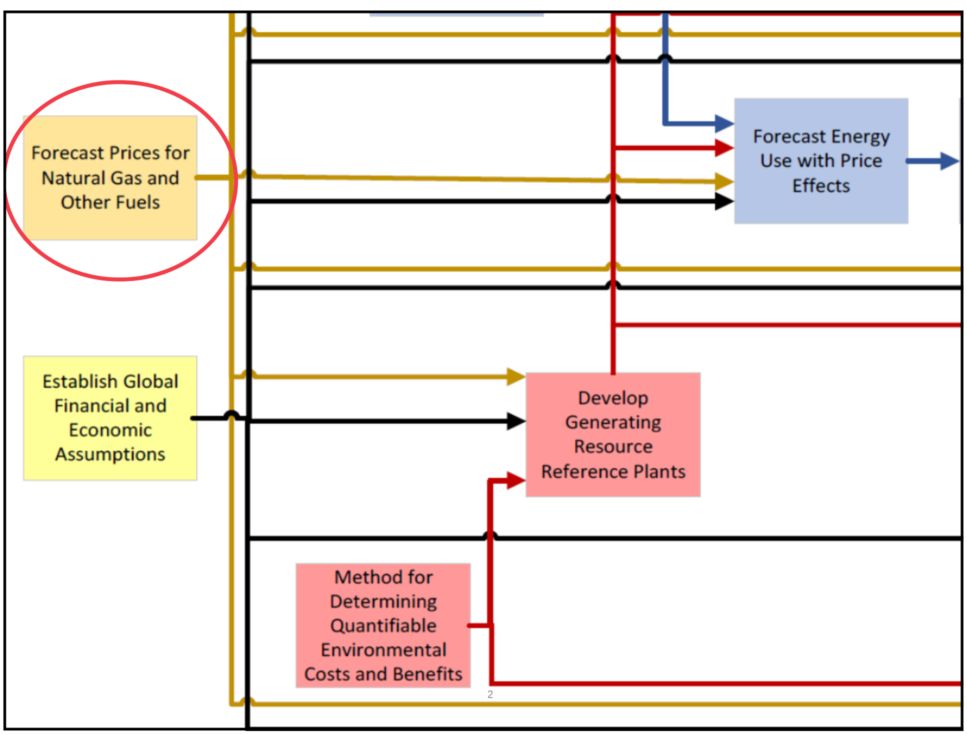


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# What do we forecast?

- Monthly natural gas prices inside and outside the Northwest
- High, medium, and low forecasts give a range of prices
- Other fuel prices including coal, oil, gasoline, and Renewable Natural Gas

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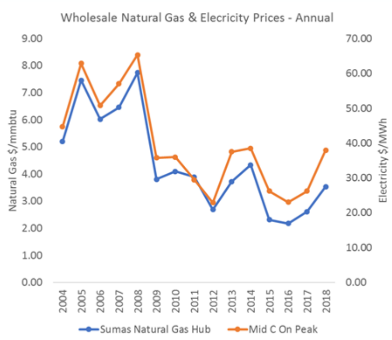
# Why is natural gas price important?

- Natural gas price often informs the price of electricity – gas-fired power plants consume around 30% of regional gas and provide around 12% of the electricity
- Gas-fired power plants provide support service to the electric grid – which requires fuel

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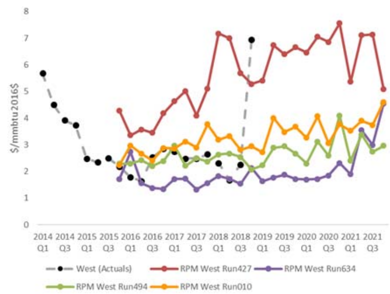
# What about price volatility?




- The price spike from the BC pipeline rupture can be seen in Q4 2018
- The Regional Portfolio Model introduces volatility to our forecasts - the price spike was within the range considered in the Seventh Plan

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# How do we prepare a fuel price forecast?

1. Survey Natural Gas Advisory Committee (NGAC) members and compile the results anonymously
2. Collect other public forecasts, like EIA and CEC
3. Using these sources, develop a proposed Henry Hub forecast to start discussion at the committee
4. Derive more finely tuned forecasts for western hubs, including regional hubs

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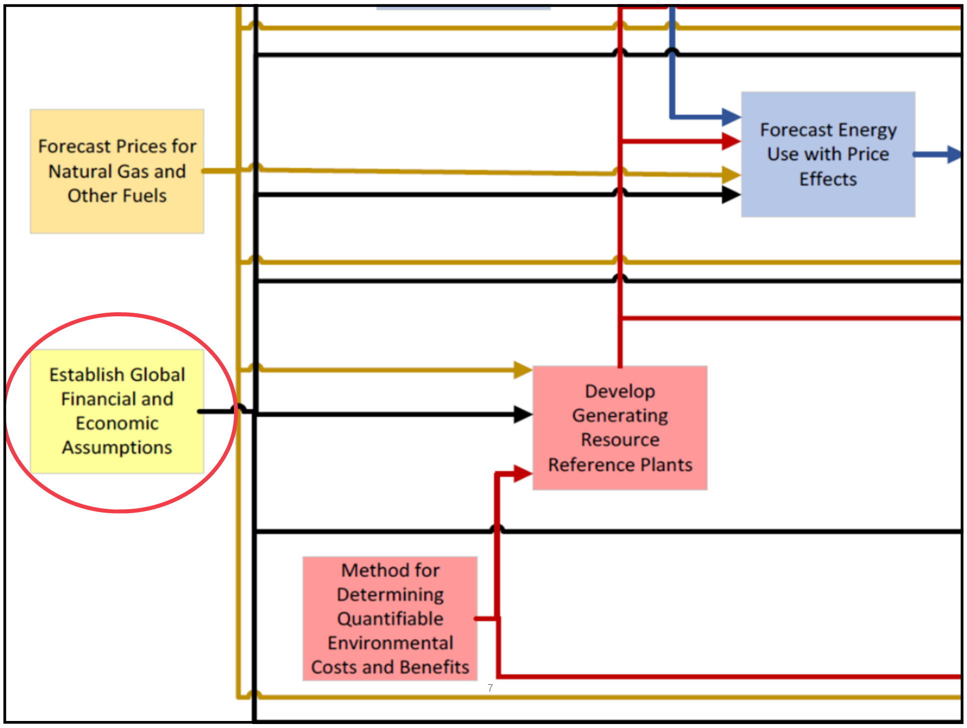


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## What are global, financial, and economic assumptions?

- Parameters coordinated between processes and models
- Centrally documented in building models and preparing analyses
- Revisited and considered for scenario analysis, as needed

Examples:
- Discount Rate
- Inflation Rate
- Forecast Period
- T&D Deferral
- Real $ Base Year

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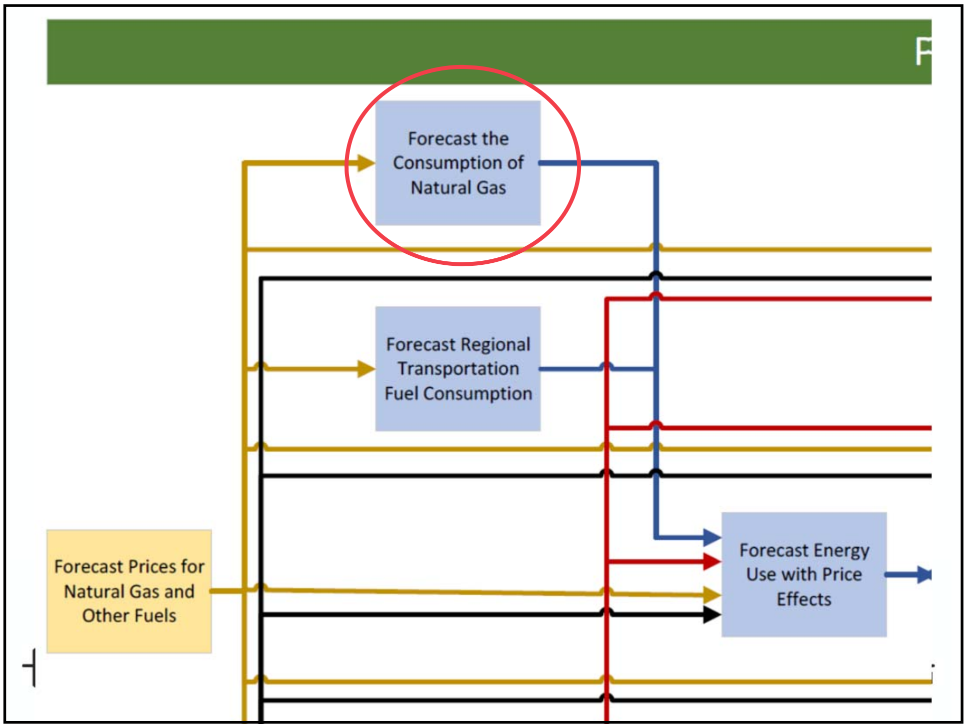


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# What is a forecast of the consumption of natural gas?

- The forecast of the consumption of natural gas is a forecast of the volume of natural gas used in the region including
  - Residential use
  - Commercial use
  - Industrial use
  - Transportation

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# Why forecast natural gas use?

- Integrates with a more holistic look at regional energy use in our load forecasting model
- Highlights regional greenhouse gas emissions and the impacts of strategies to reduce emissions on the electric sector

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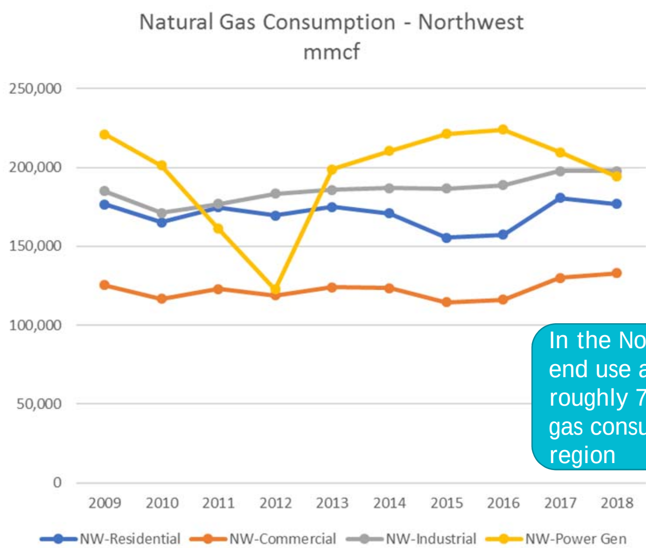


In the Northwest, end use accounts for roughly 70% of the gas consumed in region

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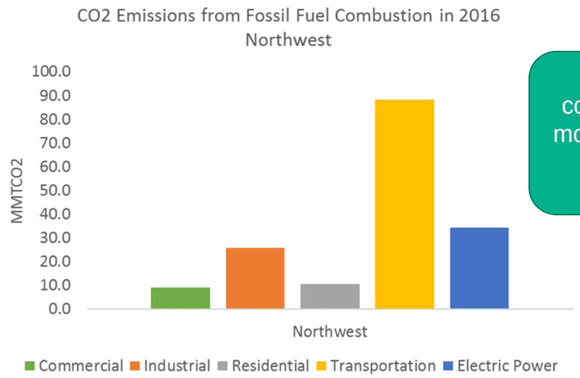
Residential, Commercial, and Industrial sectors accounted for 27% of the Northwest CO2 emissions from fossil fuel in 2016




A forecast of gas consumption allows a more complete picture of greenhouse gas emissions

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# How do we forecast natural gas use?

1. Collect data on history gas usage and associate it with each end-use (such as space heating) and historic temperatures
2. Factor in historic efficiency, fuel prices, and temperatures to estimate price-effect and non-price-effect variables
3. Forecast energy requirements based on expected economic conditions and anticipated temperatures

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## Key Inputs

- Historic natural gas consumption
- Device efficiency, units, square feet, and market shares for gas
- Heating degree days
- Natural gas retail price
- Economic growth drivers
- Potential blend and cost of renewable natural gas

## Key Outputs

- Monthly, annual and peak natural gas load by state, sector and end use
- Natural gas market shares
- Greenhouse gas emissions related to combustion

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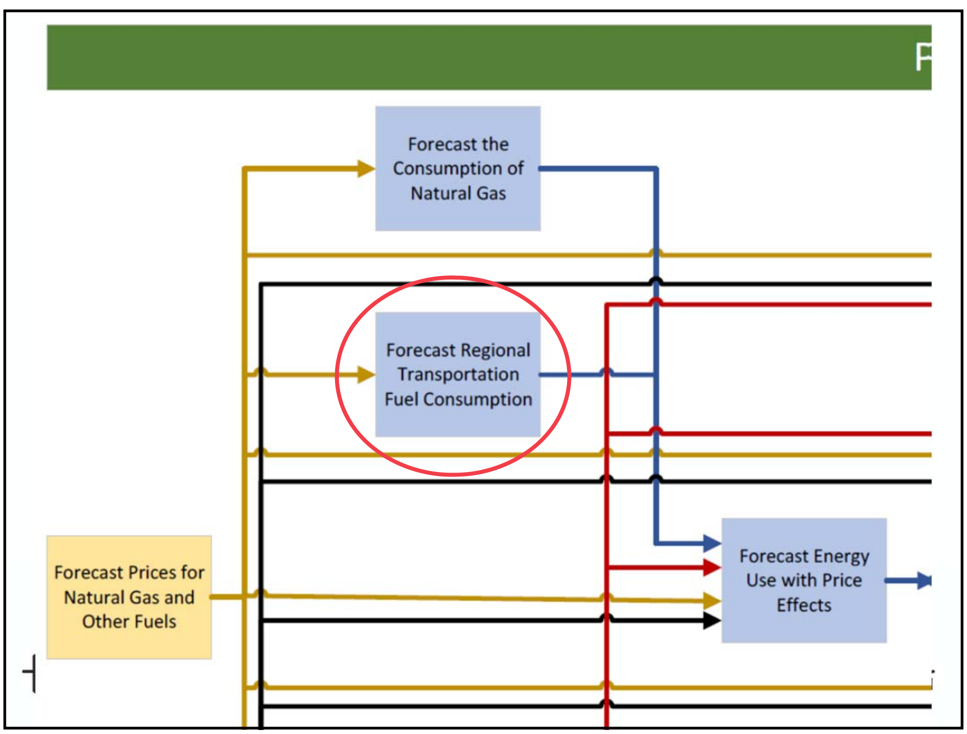


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# What is the forecast of regional transportation fuel consumption?

- Full fuel & technology forecast estimate the future market share of electric vehicles
- Includes fuel consumption, electricity load, vehicle unit sales, and forecast vehicle stock

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# Why forecast regional transportation fuel consumption?

- Integrates with a more holistic look at regional energy use in our load forecasting model
- Provides context for forecast of electric vehicles, including impacts to
  - Consumer cost
  - Greenhouse gas emissions
  - Electric load and impacts on the regional peak electricity use
- Highlights regional greenhouse gas emissions and the impacts of strategies to reduce emissions on the electric sector

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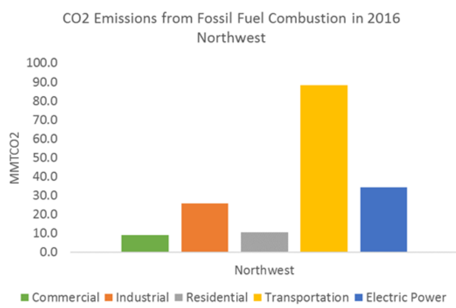
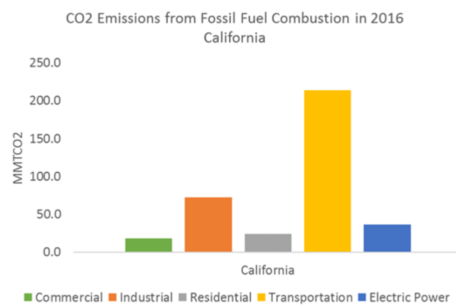
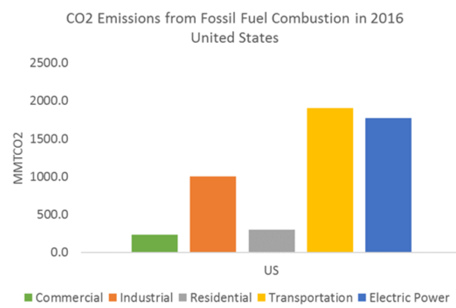



The transportation sector stands out as a significant CO2 emitter in the Northwest – and the West Coast in general

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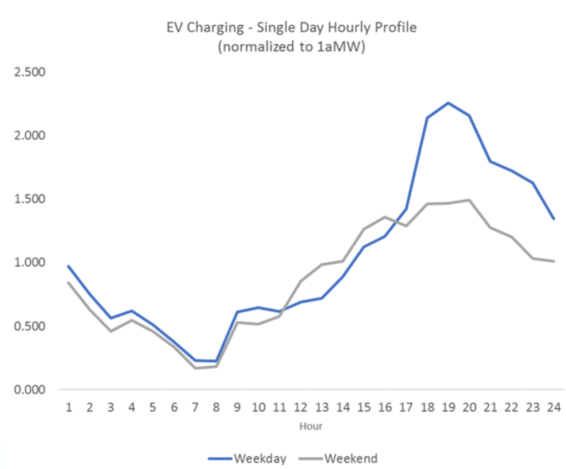
Electric Vehicle Charging Profiles - Overall




Estimate of Electric Vehicle Charging Profiles

- 70% home
- 20% home + workplace
- 10% public (retail shopping, grocery shopping...)

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## Key inputs

- Vehicle capital and maintenance costs
- Fuel prices
- Vehicle efficiency
- Emission factors
- Economic growth
- Charging profile
- Vehicle lifetime

## Key outputs

- Electricity Demand
- Contribution to electricity peak load
- Pollution
- Vehicle unit sales & stock

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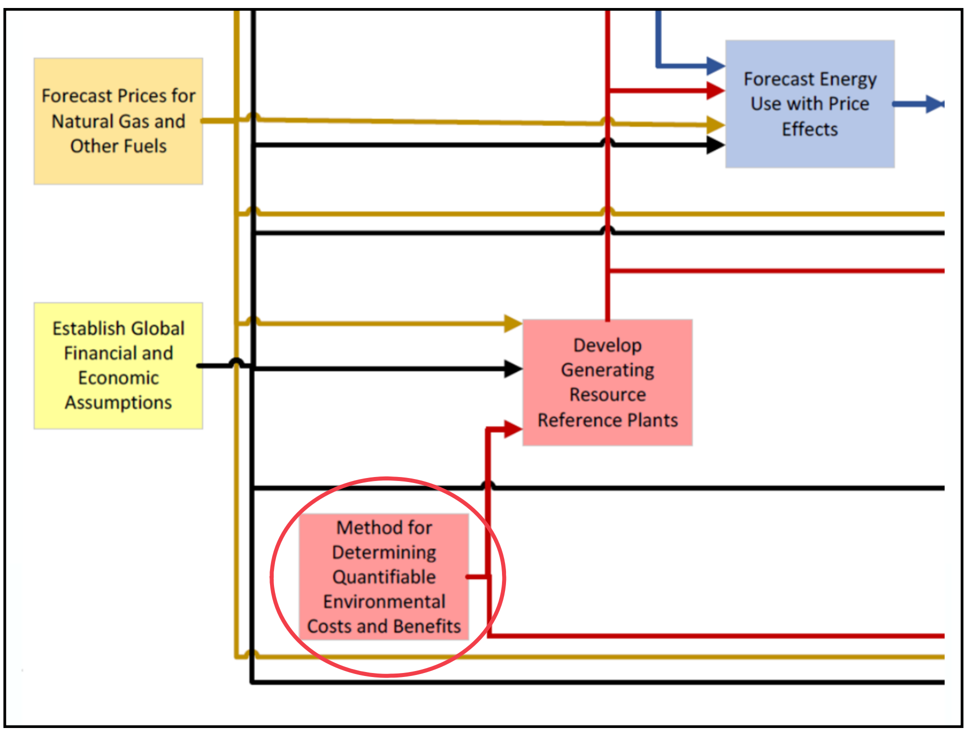


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# Why a method for determining environmental costs and benefits?

- In estimating the overall system cost of a particular **new** resource or measure, the Council must include **quantifiable environmental costs and benefits** directly attributed to the resource as determined by the environmental methodology
- The Northwest Power Act requires the Council (1) develop and (2) apply a "**methodology** for determining [the] quantifiable environmental costs and benefits" of electric generating and conservation resources §4(e)(3)(C)

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# What if it cannot be quantified?

- Environmental effects that cannot be quantified are still taken into considerations through the Act's due consideration provision
  - Section 4(e)(2) calls for implementing conservation measures and developing generating resources "with due consideration" for environmental quality, fish and wildlife, and compatibility with the existing system

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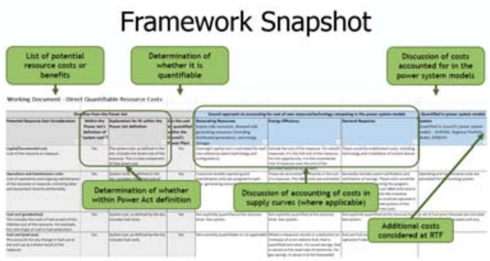
# Treatment of Quantifiable Resource Costs

- Framework to support consistent quantification of costs and benefits – including environmental

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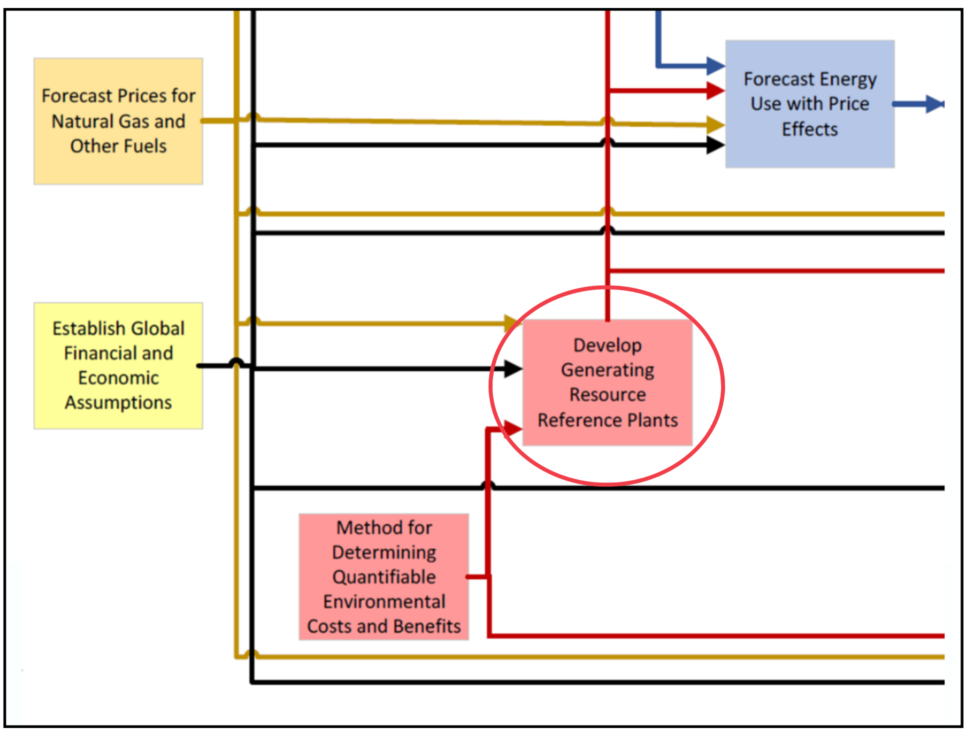


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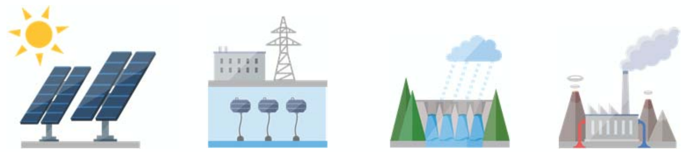
# What is a reference plant?



A **reference plant** is a collection of characteristics that describe a resource technology and its theoretical application in the region. It includes estimates of typical costs, logistics, and operating specifications.

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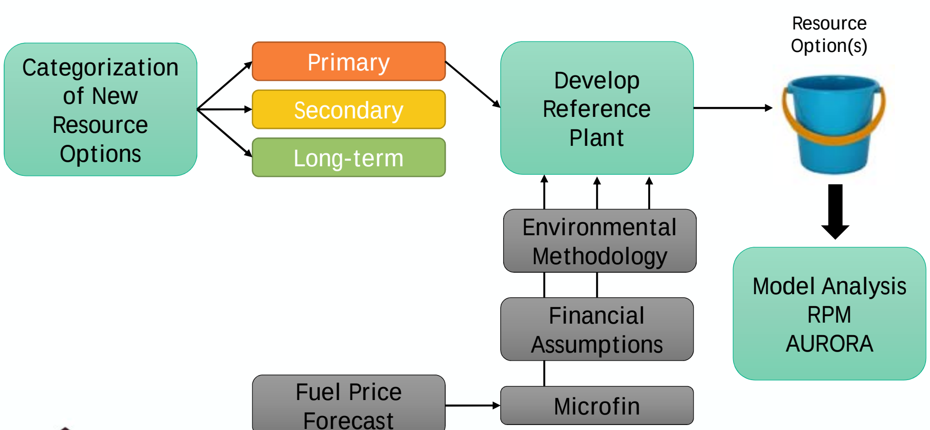
# Why develop reference plants?

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# Resource Categories

Prioritization based on a resource's commercial availability, constructability, cost-effectiveness, and quantity of developable resource in the region

**Primary; Significant**: Resources that look to play a major role in the future PNW power system.

Assessment: In-depth, quantitative characterization to support system integration and risk analysis modeling. Will be modeled in RPM.

**Secondary; Commercial w/ Limited Availability:** Resources that are fully commercial but that have limited developmental potential in the PNW.

Assessment: Mix of qualitative and some quantitative analysis sufficient for potential modeling in the RPM.

**Emerging/Long-term**: Resources that have long-term potential in the PNW but that are not commercially available yet.

Assessment: Qualitative discussion of status & regional potential, quantify key numbers as available. Will not be modeled in RPM.

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# Components of a reference plant

| Resource Attributes | Financials | Operating Characteristics | Development Potential |
|---|---|---|---|
| Technology Type | Financial Sponsor (IOU, IPP) | Capacity Factor | Location |
| Configuration (# of units x MW) | Overnight Capital Cost ($/MWh) | Heat Rate | Transmission/Gas Pipeline Access |
| Capacity (MW) | Fixed O&M ($/kW-yr) | Seasonal Shape | Maximum Build-out |
| Location(s) | Variable O&M ($/MWh) | | |
| Operating Life (yrs) | Fixed Fuel Cost | | |
| Development & construction schedule | Transmission Cost | | |
| Earliest in operation date (year) | | | |
| Transmission access | | | |

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# How do we develop reference plants?

Council staff presents its preliminary analyses to the GRAC for discussion and feedback on,

- Resource categorization into primary, secondary, and emerging/long-term
- Resource attributes and operating characteristics of a reference plant representative of a “typical” PNW configuration
- Estimated cost assumptions, especially the overnight capital cost and 20-yr cost curve

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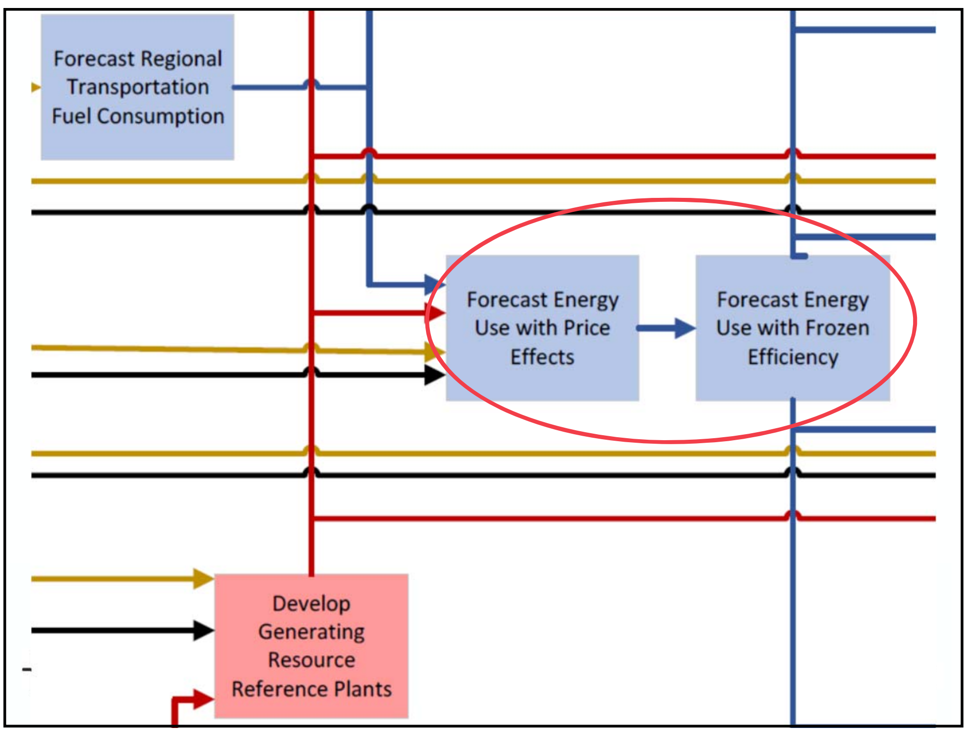


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# How do we forecast energy use?

Consumption is determined in part by:

- Number of Units **(A)** based on projected
  - Population
  - Number of new and existing homes (Single, Multi-family, Manufactured)
  - New and existing building square footage of commercial space
  - Production from industrial, agricultural, and mining firms
- Unit fuel efficiency choices **(B)** based on projected
  - Up-front capital cost drive choice between baseline or increased efficiency
- Fuel choice **(C)** based on projected
  - Up-front capital, operation, and maintenance costs
  - Customer preference


**Energy use by an enduse = A * B * C**

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## Example: Energy Use from New Home Water Heating

To forecast energy use from electric water heaters in new homes we need:

A. Number of new single family homes: 20,000/yr

B. Baseline Electricity Efficiency: 0.90 Energy Factor = 3600 kWh/yr

C. Market share of electric: 69%

Thus forecast annual added energy use for water heating in new homes would be:

20,000*.69*3600 ~ 49,680 MWH ~ 5.67 MWa

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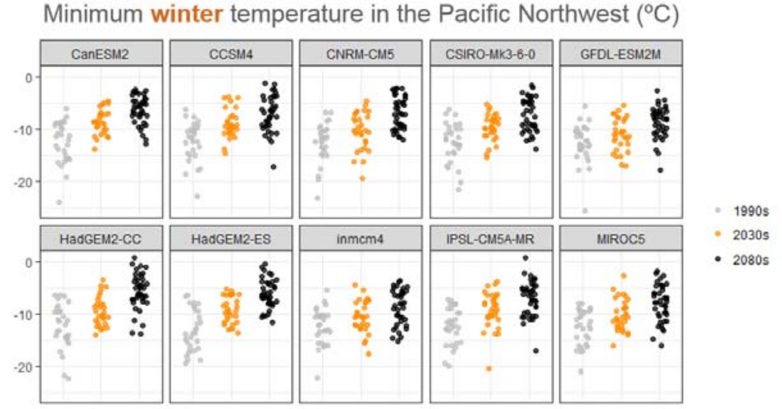
# All GCMs forecast warmer winters




Source: RMJOC2 projected air temperatures for a range of atmospheric models

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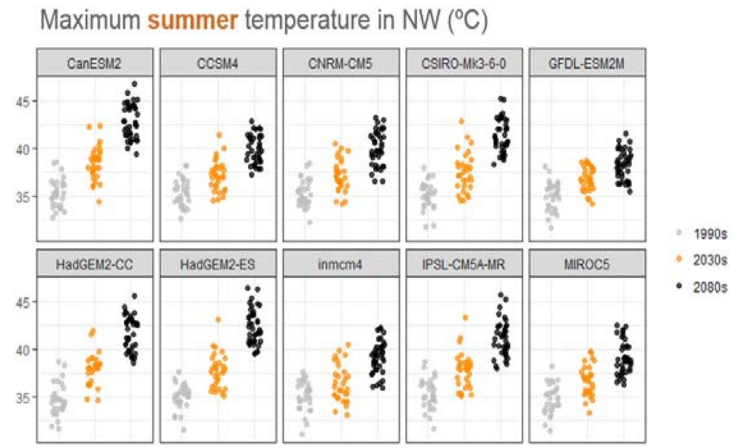
# All GCMs forecast hotter summers




Source: RMJOC2 projected air temperatures for a range of atmospheric models

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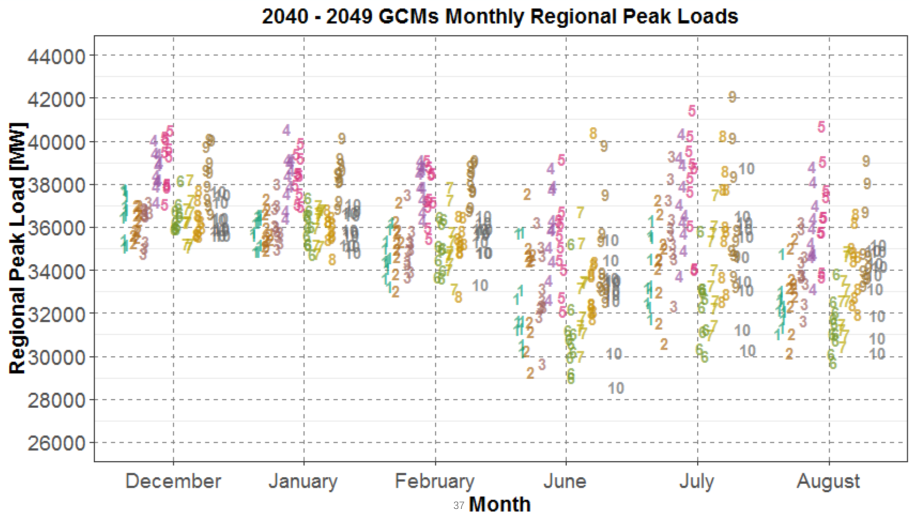
# 2040-2049 GCMs Winter & Summer Peak Loads

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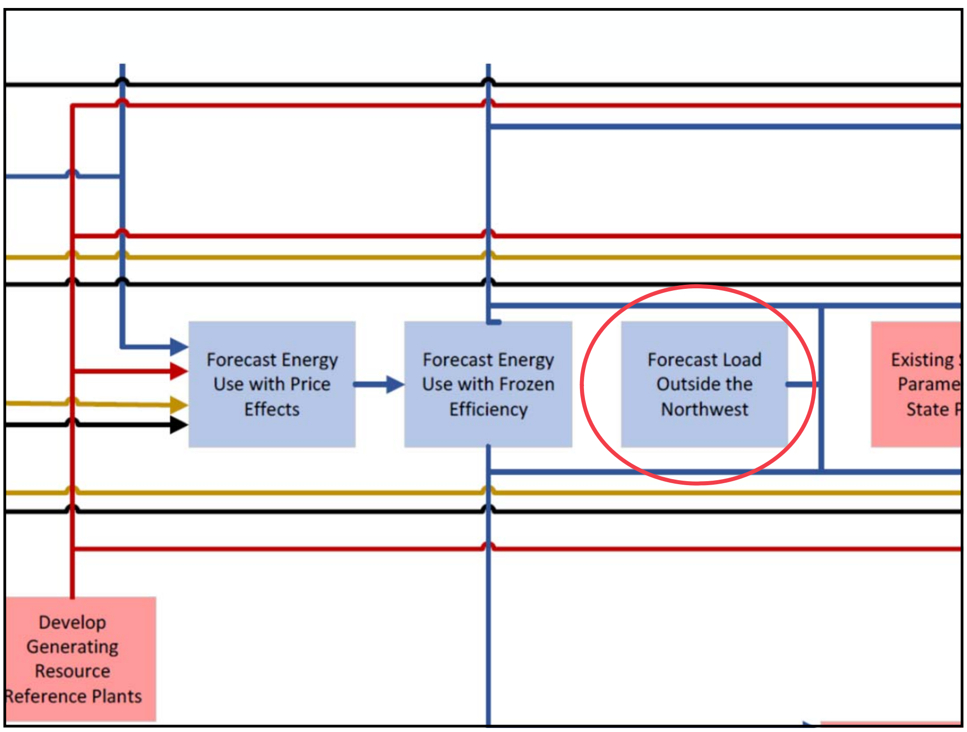


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# Why do we forecast load outside the Northwest?

- Electricity use outside the Northwest impacts the price and supply of electricity available in our markets
- Clean energy targets and renewable portfolio standards outside our region impact what generation outside the region – which impacts the evaluation of the cost of new generation inside the region

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# How do we forecast out-of-region load?

- Load forecasts external to the region are informed by two main sources:
  1. CEC (California load forecast)
  2. AURORA base WECC dataset – which in turn sources much of its data from the following sources:
     - NERC
     - EIA Form 826
     - FERC Form 714
     - Statistics Canada (for provincial information)
- Electricity price forecast requires a load forecast for each balancing authority (BA) area in the Western Grid

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# Impacts and Limitations of Out-of-region Load Forecasts

- Clean Energy and RPS targets for states outside the region will be driven by these forecasts
- Energy efficiency assumptions are not broken out except in California
  - CEC load forecast provides good information on assumed energy efficiency
- Climate change impacts are not identified in these forecasts

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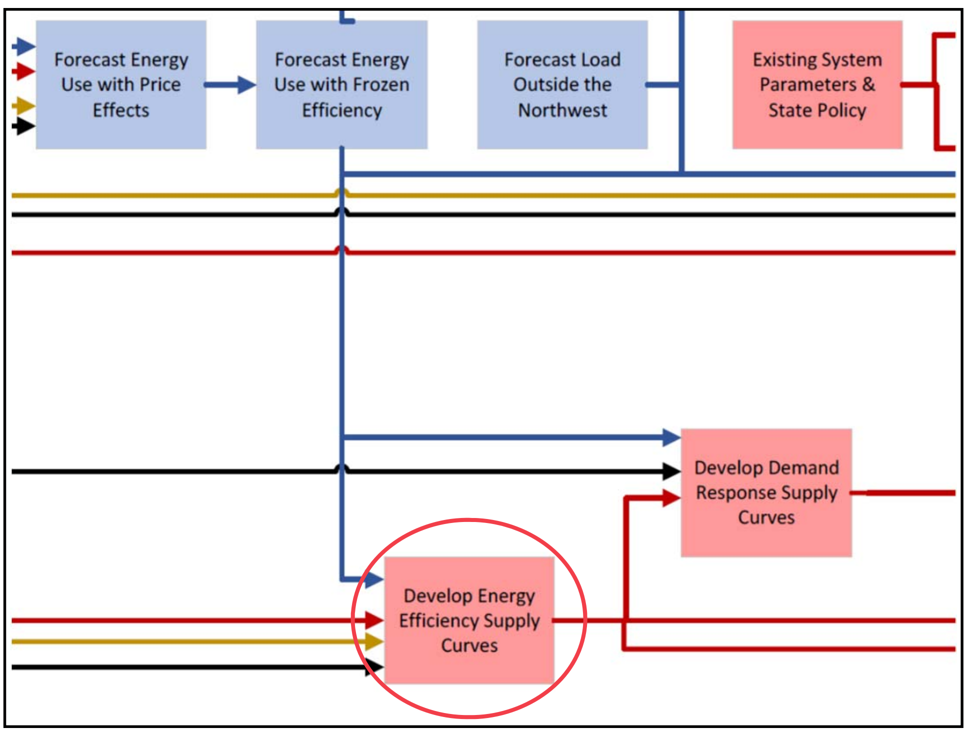


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# What is energy efficiency?
## Definition of conservation under the Power Act

"Conservation" means any reduction in electric power consumption as a result of increases in the efficiency of energy use, production, or distribution.

1. Does the opportunity reduce electric power consumption?
2. Is the reduction in electric power consumption the result of an increase in efficiency of energy use, production, or distribution?

Also, must be "...reliable and available within the time it is needed..."



# The basic formula for savings

**Achievable Savings Potential =**
Number Units * kWh savings per Unit * Achievable Penetration

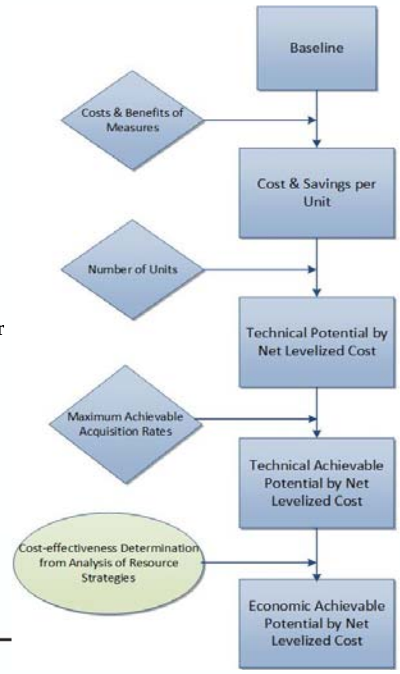
Examples:
- Number Homes
- Floor Area of Retail
- Number of Refrigerators
- Acres Irrigated
- Number transformers

Fraction of available or remaining stock that is realistically achievable over time

(kWh/Unit at **Baseline** Efficiency – kWh/Unit at **Improved** Efficiency)

# How do we develop energy efficiency supply curves?

1. Baseline
   - Identify measures that save electricity
   - Establish the measure's "baseline" consumption (i.e., what the measure is compared against)
2. Cost & Savings Per Unit
   - Estimate incremental electricity & capacity savings per unit
   - Estimate incremental costs & benefits per unit
   - Estimate measure life
3. Technical Potential
   - Calculate cost per kWh saved
   - Calculate number of units available
   - Multiply unit savings and cost by the number of units
4. Technical Achievable Potential
   - Apply achievability limits
   - Ramp rates

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# 1. Establish baseline: identify EE measures

- Example - Nearly 100 measures categories in Seventh Power Plan *(e.g., Air Source Heat Pump)*
  - Buildings (insulation, windows, heat pumps, etc.)
  - Appliances (refrigerators, dishwashers, ovens, steamers, etc.)
  - Processes (energy management, pump optimization, etc.)
  - Utility distribution system (poles, wires, and transformers)
- Over 1600 measure permutations *(e.g., Energy Star Air Source Heat Pump, heating zone 1, new construction)*
  - By heating zone, vintage, heating system type
  - Factors that change incremental cost or savings


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# 2. Develop measure data: cost & savings per unit

**Energy Savings (kWh)**
- kWh per unit at the site (annual)
- Line losses from source to site
- Seasonal & daily shape of savings
- Measure interactions
- Measure "Take Back"

**Costs**
- Capital & Financing
- Labor
- Program Administration
- Operations & Maintenance
- Reinstallation Cost

**Capacity Benefits (kW)**
- Deferred distribution and transmission line expansion cost ($/kW-yr) where coincident with system peak

**Non-Electric Impacts**
- Water use changes
- Gas use changes
- Operations & maintenance
- Lamp replacements
- Quantifiable Environmental Impacts

**Measure Life**
- Expected lifetime of the measure

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# 3. Estimate technical potential: estimate number of units

**Examples of Units**
- Number of replacement clothes washers per year (360,000)
- Number of new single family homes per year (60,000)
- Floor area of Mini Mart groceries (45,000,000)
- Sq.Ft. of attics with no insulation in older homes (540,000,000)

Data Sources:
- Stock assessments (RBSA, CBSA, IFSA)
- Council forecast models
- DOE Rule makings
- Product sales data

Annual Estimates
- Year-by-year for 20-year forecast period
- Existing stock minus demolition & conversion
- New stock added
- New appliances added
- Appliance & equipment turnover

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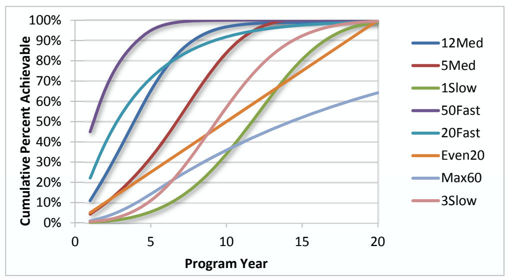
# 4. Estimate achievable potential

Achievability Assumes:

- Less than 100% adoption - not all customers will accept the efficient unit, even if offered at no cost to the consumer
- Annual Achievability is limited by "Ramp Rates" - Not all energy efficiency can be acquired immediately
- Utility system can pay full cost of measures that are cost-effective based on estimated power system benefits – i.e. the consumer ability to pay does not limit achievable potential

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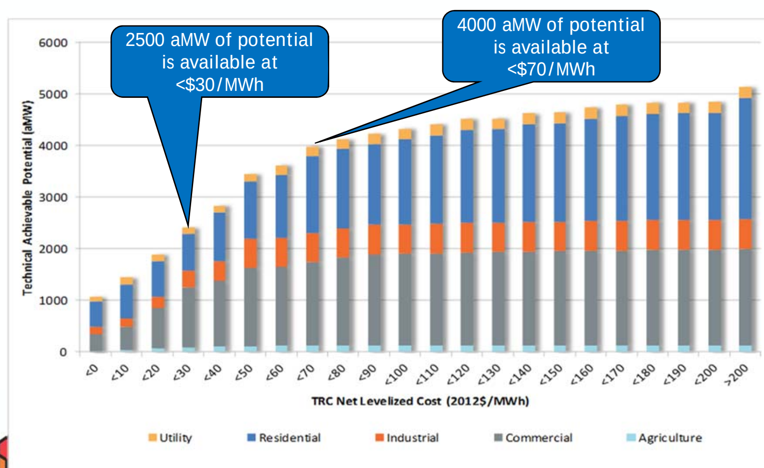
# Achievable potential supply curve:

## add up each measure cost and savings

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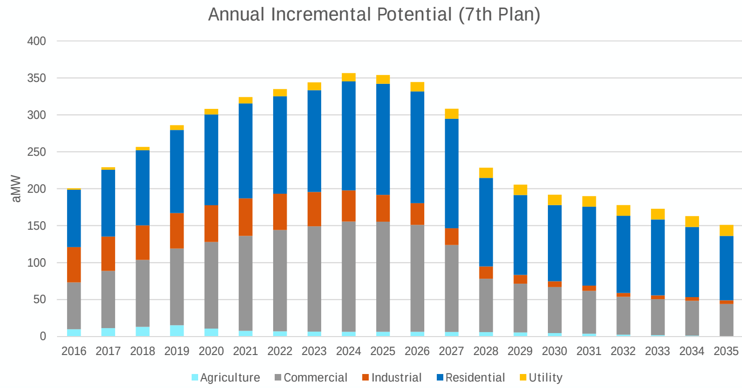
# Annual potential including ramp rates

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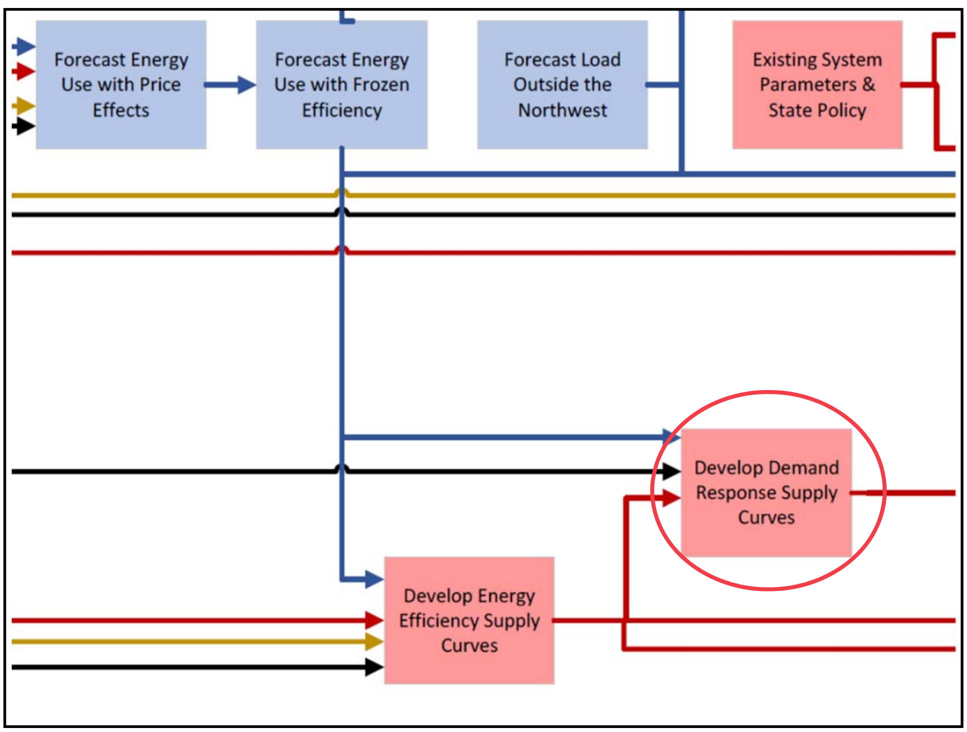


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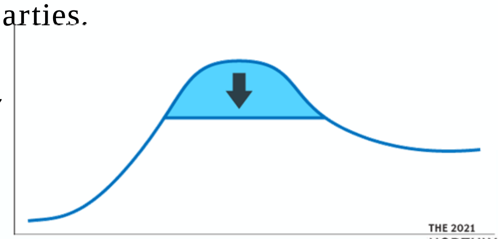
# What is demand response?

Demand response is a non-persistent intentional change in net electricity usage by end-use customers from normal consumptive patterns in response to a request on behalf of, or by, a power and/or distribution/ transmission system operator. This change is driven by an agreement, potentially financial, or tariff between two or more participating parties.

*Defined by DRAC Aug 2017*



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# How do we develop demand response supply curves?

- Define DR Products
- Estimate Technical Potential
- Estimate Achievable Potential
- Calculate Levelized Costs
- Develop Supply Curves

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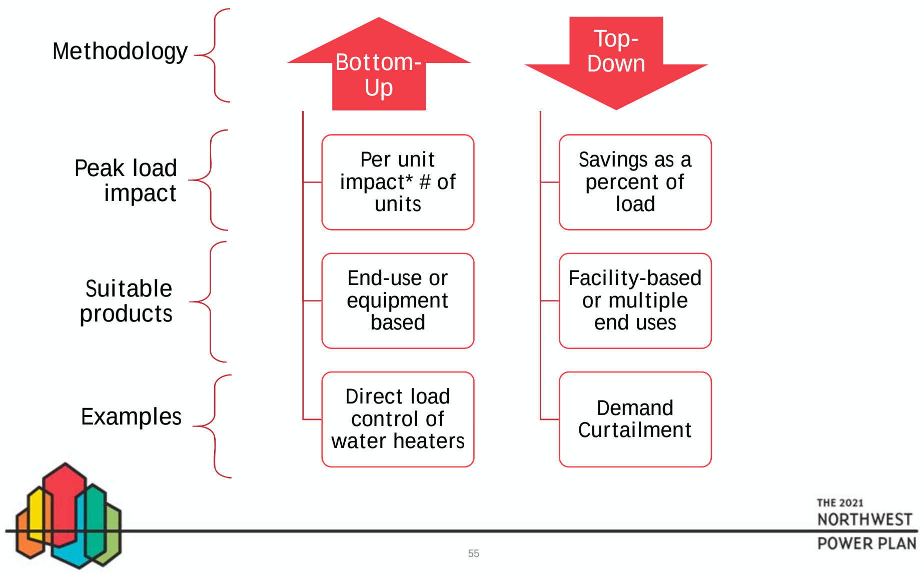
# Methods to estimate potential

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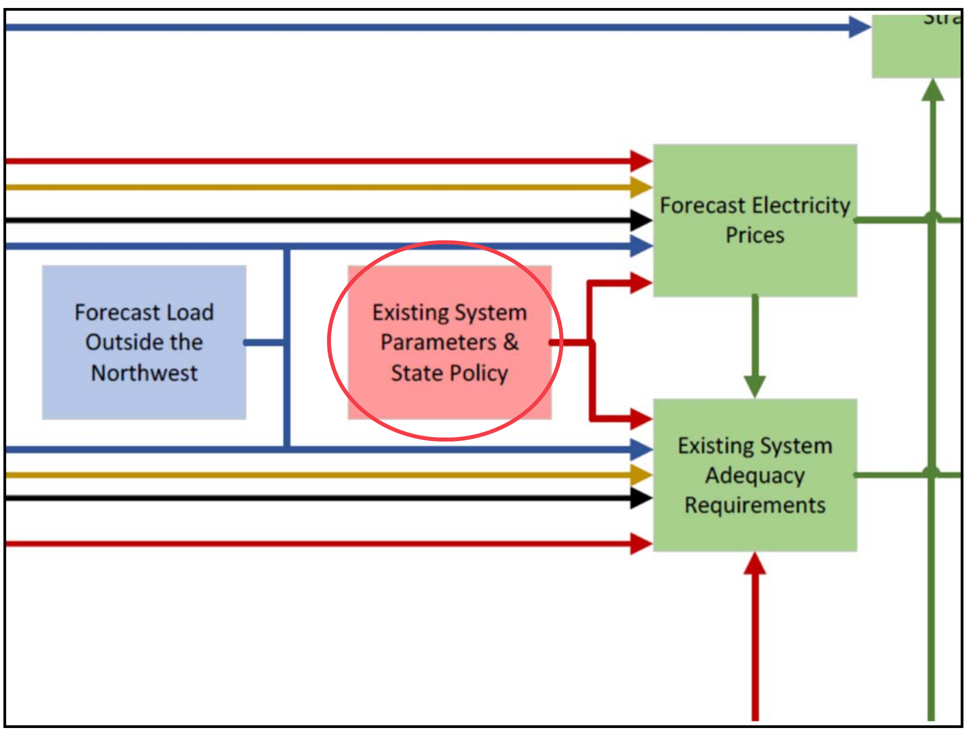


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# What are existing system parameters?

- The quantities, attributes and operating characteristics of the existing resources in the region
- Known future retirements
- State policies that govern current resource operation and future resource development


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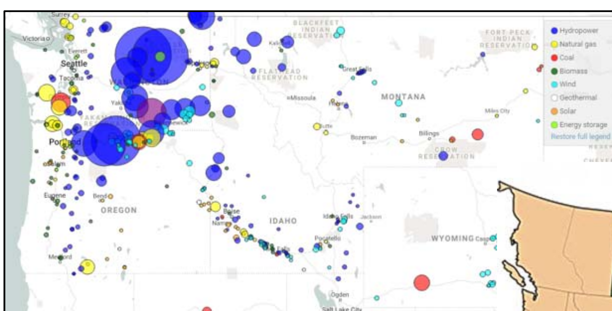
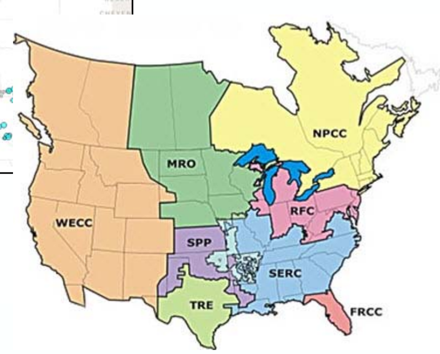
# *Quick note about the region and WECC*




Power Plan is a plan *for the region*…




…however the Northwest is obviously directly affected by the resources and policies that exist in the surrounding states and markets

It is our intent to capture both – to the *extent possible*

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## Examples of existing system parameters

**Existing plant/unit parameters**

- Capacity
- Fraction dedicated to the region
- Heat rate
- Forced outage rate/maintenance outage assumptions
- Unit retirements

**Existing transmission parameters**

- Transmission capacity for imports and exports
- Wheeling charges

**Historical operations**

- Annual carbon emissions

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## Examples of existing policies to catalog and interpret

**Renewable portfolio standards**

- State standards, rules, and eligible resources
- Qualified resources assigned to meet RPS, renewable energy credit (REC) bank balances

**Clean energy policies**

- Requirements of state legislation, rules, eligible resources
- Qualified resources in operation/under construction to meet targets

Analysis relies on staff interpretation and application of the policies; we rely on our advisory committees to aide us in this process

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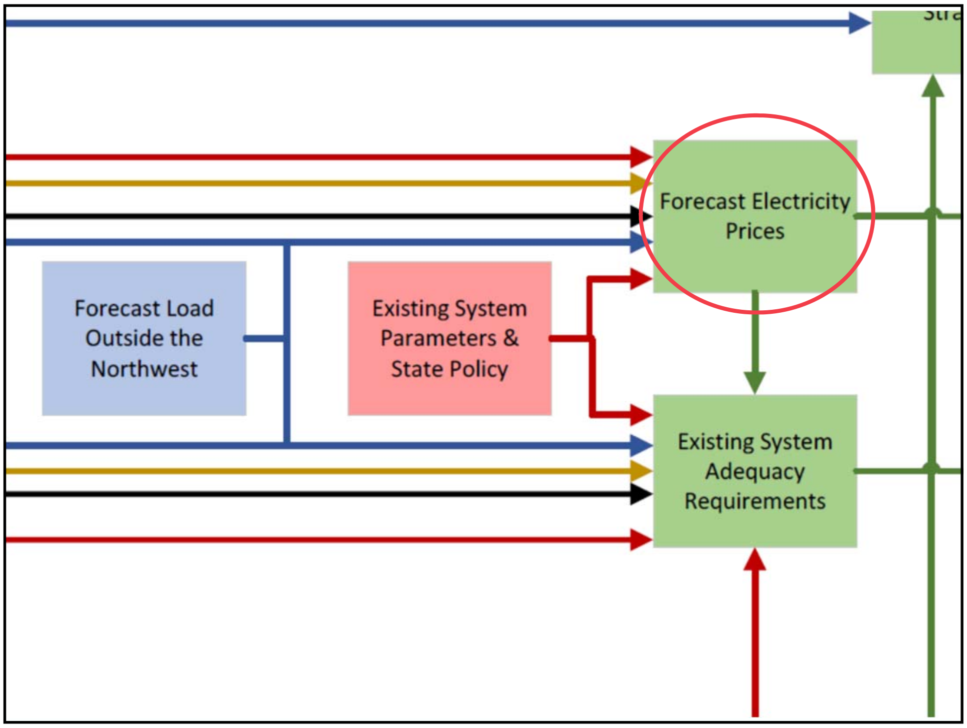


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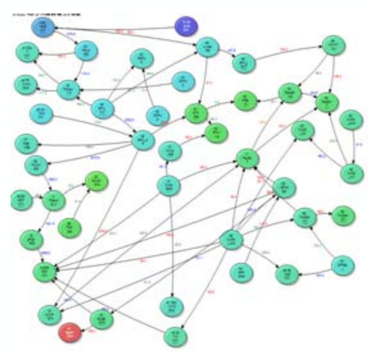
# How do we forecast electricity prices?

The AURORA model:

1. simulates dispatch of power plants – and calculates a price for each balancing authority (BA)
2. Simulates building new power plants based on:
   a. Plant retirements and additions
   b. Adequacy for planning regions
   c. State and regional policies (e.g. RPS, clean resource policies, cap & trade)



Transport representation of the transmission system in the WECC

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# Why do we forecast electricity prices?

- To help estimate market impacts on requirements for regional resource adequacy
- To inform estimate of risk for regional resource expansion

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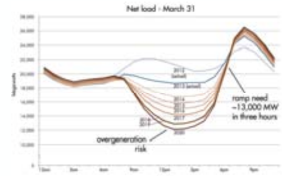
# Establish market supply curve for adequacy analysis

**What do we do?**

**Simplify market representation in adequacy work**

- Convert AURORA buildout to market supply curve for GENESYS
- Simplifies external market calculations to supply blocks
  - Considers external market impacts on flexibility and operations via seasonal shape of electricity price blocks
  - Considers regional resources, particularly hydro, responding to external markets





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## Develop electricity price futures in RPM





**What do we do?**

**Use AURORA prices as a starting point for RPM economic calculations**

- Convert electricity price forecasts in AURORA to a distribution of electricity price futures for the Regional Portfolio Model
- Correlate electricity price with natural gas price, load and hydro
- Use the price forecast as starting point for an equilibrium price calculations which takes into account the supply demand balance within the region

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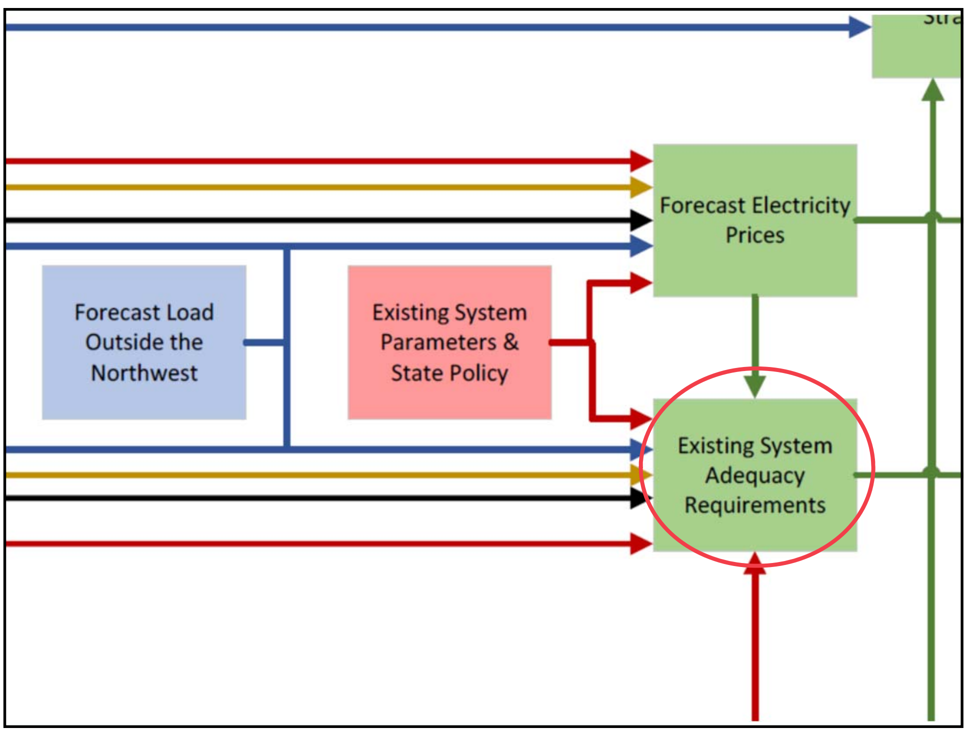


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# Why estimate system adequacy requirements?

2(2). to assure the Pacific Northwest of an **adequate**, efficient, economical, and reliable power supply; [Northwest Power Act, §2(2), 94 Stat. 2697.]

- Part of establishing a plan to add resource for an adequate supply of electricity
- Connects the power plan and the annual adequacy assessment

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# How do we estimate system adequacy requirements?
## (ARM and ASCC)

- The Adequacy Reserve Margin (ARM) is the amount of surplus capacity (or energy) needed, over the expected to meet the adequacy standard (in percent of expected load)
- The ARM is used in the Regional Portfolio Model to approximate resource builds need to meet the Council's adequacy standard

- The Associated System Capacity Contribution (ASCC) is capacity gained when a resource is added to the power supply ( in percent of nameplate capacity)
- ASCC values are used to estimate how much resource needs to be built to meets the ARM

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# Calculating ARMs

- The capacity ARM is calculated by subtracting the expected peak load from the aggregate capacity of a system whose LOLP is exactly 5%, divided by the load.
- The energy ARM is calculated by subtracting the expected average load from the aggregate average generating capability of a system whose LOLP is 5%, divided by the load.

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# $ARM_C$ (Capacity)

= (peaking capacity – peak load)/peak load

| Resource Type | Adequacy Reserve Calc | Value (MW) |
|---|---|---|
| Thermal | Nameplate | 15,000 |
| Wind | ASCC value of 5% | 250 |
| Hydro | Lowest 10-hr sustained peak | 20,625 |
| Solar | ASCC value of 25% | 125 |
| Imports | Max per hour | 2,500 |
| **Total Resource** | | **38,500** |
| Load | Peak-hour Load | 35,000 |
| **ARM Capacity** | **(Resource - Load)/Load** | **10%** |

(Based on a power supply just at a 5% LOLP)

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# Example of how the $ARM_C$ works

| For a Future Operating Year | |
|---|---|
| Peaking capability | 41,000 MW |
| Peak load | 39,000 MW |
| Implied adequacy reserve | (41,000 – 39,000)/39,000 = 5% |
| ARM Capacity Requirement | 10% |
| Assessment: | System is inadequate |
| | |
| Action: | More resource needed |
| Resource need = (ARM * Load) + Load | (0.1 * 39,000) + 39,000 = 42,900 MW |
| Incremental resource need = Resource need – peaking capability | 42,900 – 41,000 = 1,900 MW |

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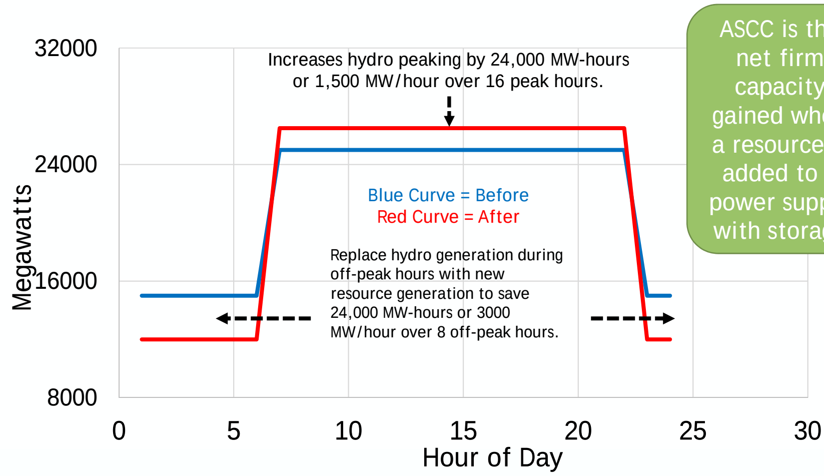
# Hydro capacity gained with new resources:

using hydro storage to increase capacity




ASCC is the net firm capacity gained when a resource is added to a power supply with storage

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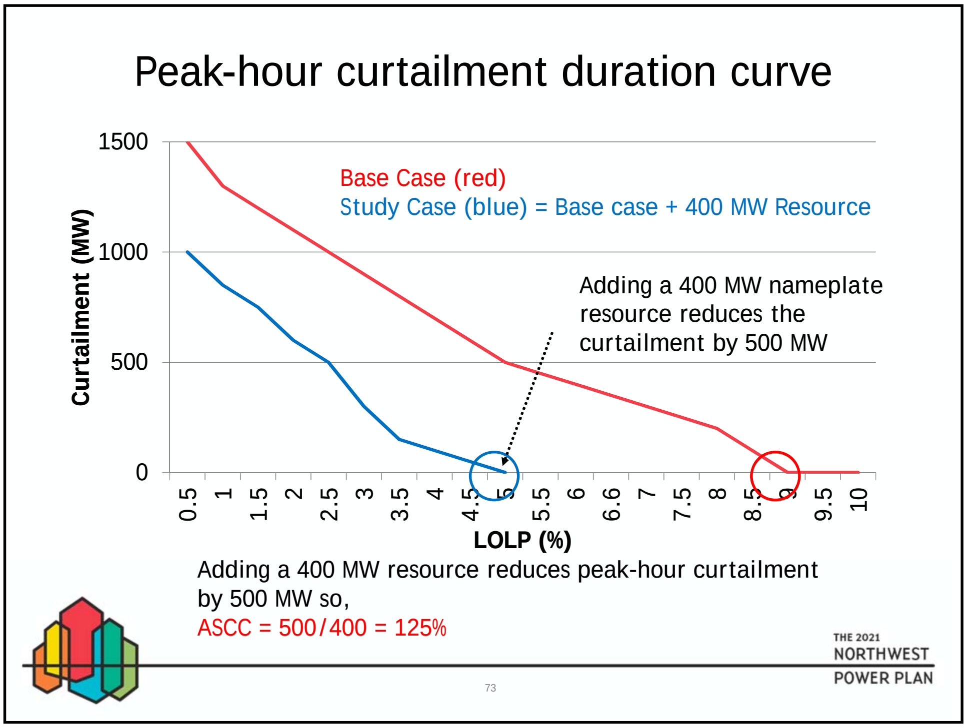
Peak-hour curtailment duration curve
1500
1000
500
0
Curtailment (MW)
Base Case (red)
Study Case (blue) = Base case + 400 MW Resource
Adding a 400 MW nameplate resource reduces the curtailment by 500 MW
0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.6 7 7.5 8 8.5 9 9.5 10
LOLP (%)
Adding a 400 MW resource reduces peak-hour curtailment by 500 MW so,
ASCC = 500/400 = 125%
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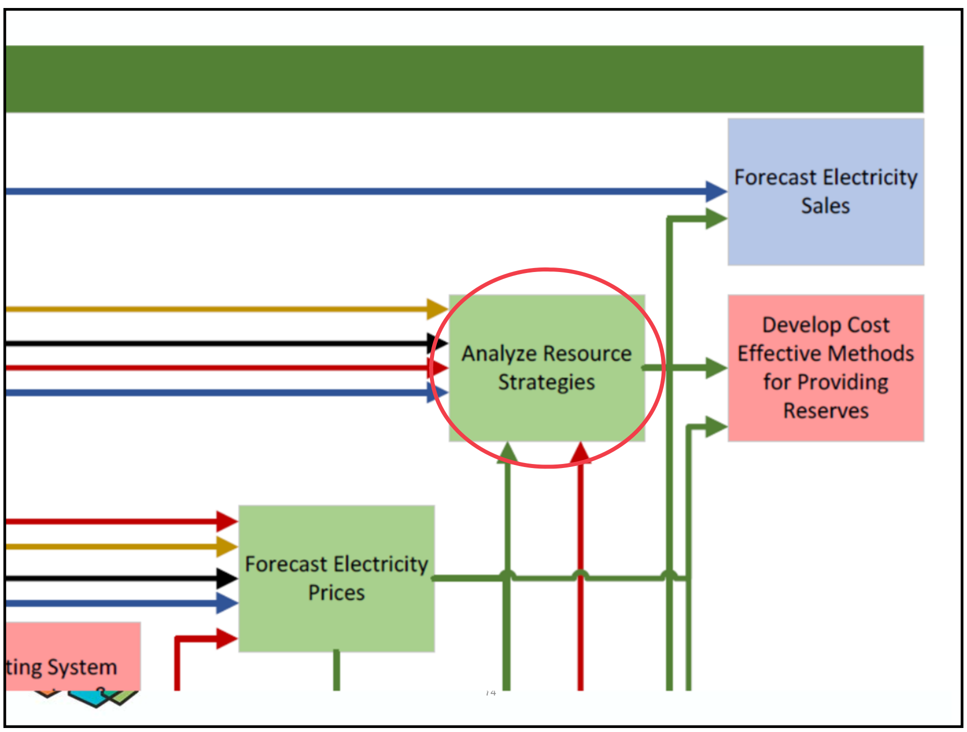
Forecast Electricity Sales
Analyze Resource Strategies
Develop Cost Effective Methods for Providing Reserves
Forecast Electricity Prices
ting System

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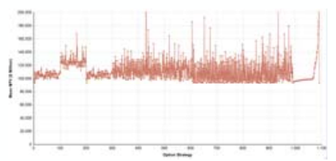
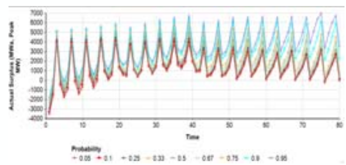
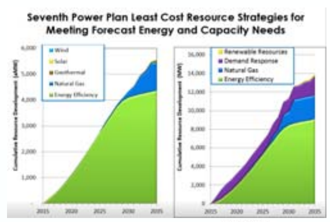
# What is resource strategy analysis?

**Assess the cost associated with different regional investment strategies in RPM**

- Test optioning and building generic new resources at different times during the 20 year time horizon to determine the least cost investment strategy
- Consider market reliance and adequacy but do not model hourly and topological detail in the RPM
  - Focus on capital investment decisions to meet adequacy and policy constraints in the most economic way
  - External market economics reflected in external market electricity price and emissions forecast
  - Regional adequacy reflected via the Adequacy Reserve Margin (ARM) and Associated System Capacity Contribution (ASCC)





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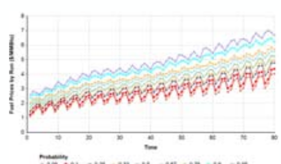
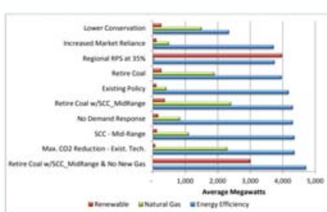
# Why do we analyze resource strategies?



What If????




- Examine risks like fuel prices, regional growth, wholesale market electricity price, and hydro conditions
- Using scenario analysis, examine potential regional policies and decisions
- Look for robust solutions that minimize cost and risk – including investment in new generation and demand-side resources

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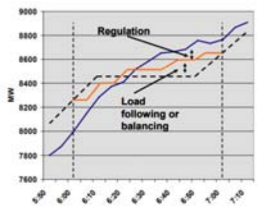
# Resource strategy adequacy check




- Considered implicitly in RPM but not in detail:
  - Plant retirements and additions (out of the region)
  - Reliance on external markets and adherence to planning reserve margins for WECC planning areas
  - Existing state and regional policies (i.e. RPS, clean policies, carbon cap and trade policies, etc.)
  - Operational feasibility
- Use AURORA to examine WECC-wide repercussions of resource strategies
- Use GENESYS to test operability and verify adequacy standard are met

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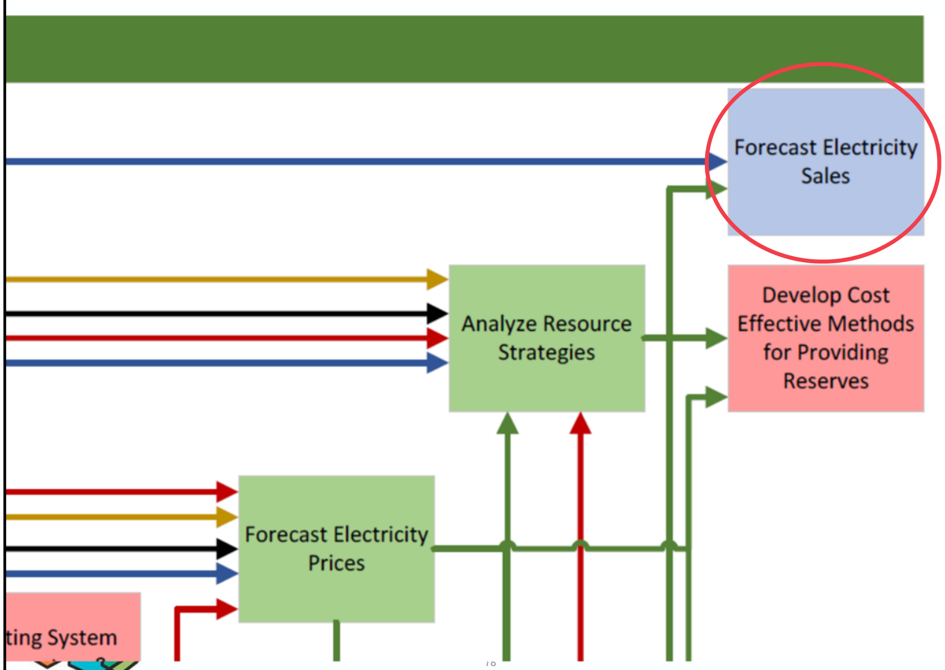


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# How do we forecast electricity sales?

- Using Resource Strategy outcomes:
  - Regional EE Target
  - Market reliance on out-of-region resources
  - Expected Regional DR Adoption
- And Forecast Energy Use:
  - Behind-the-meter solar & solar+storage
  - Transportation
  - Consumption of Natural Gas
  - Etc.
- Net out impacts on utility loads and create a forecast of regional electricity sales by state and sector

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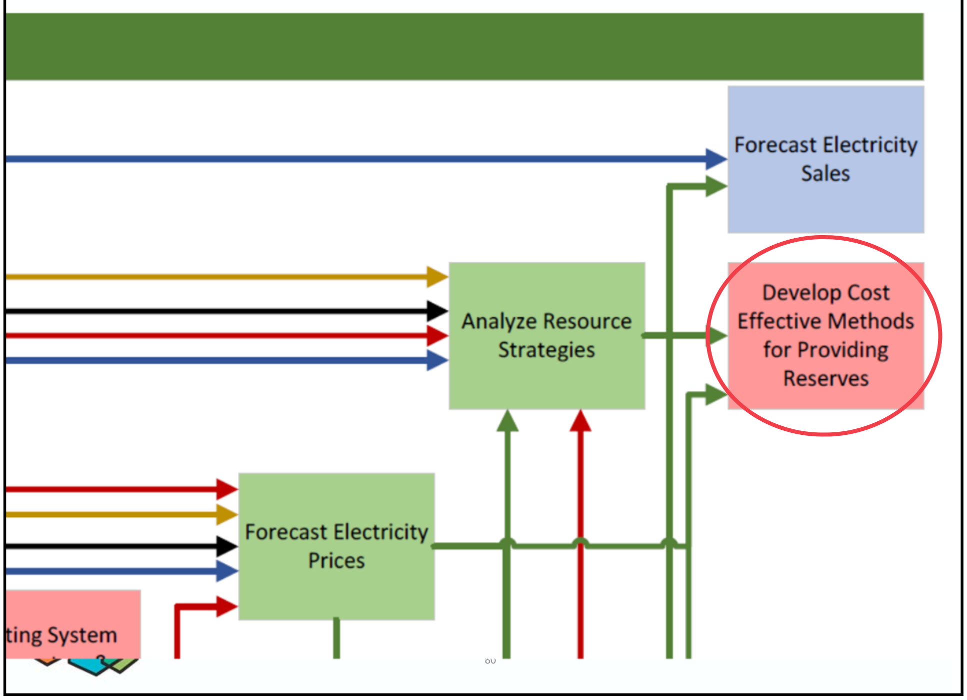


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# What are cost-effective methods of providing reserves?

Per NW Power Act Section 4(e)(3)(E) the plan shall include:

***An analysis of reserve and reliability requirements and cost-effective methods of providing reserves designed to insure adequate electric power at the lowest probable cost***

***Where cost-effective is***

1. Reliable and available within the time it is needed
2. At an estimated incremental system cost no greater than that of the least-cost similarly reliable and available alternative measure or resource

***And reserves is***

1. Electric power needed to avert particular planning or operating shortages (A) from resources or (B) from rights to interrupt, curtail, or otherwise withdraw portions of the electric power supplied to customers

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# Reserves in Council modeling

- **Operating reserves** are used to cover short-term mismatches between load and resources
  - Balancing and contingency reserve requirements for each balancing authority in GENESYS/AURORA
  - Provided by fast ramping resources with some certainty about fuel supply
    - Modeled as part of hourly dispatch and fuel accounting dispatch in GENESYS and AURORA, and results converted into Associated System Capacity Contribution (ASCC) in RPM
- **Planning reserves** should include any additional requirements to address long-term mismatches between load and resources
  - Planning reserve margins for external to the region areas in AURORA and adequacy reserve margin (ARM) in RPM
  - Provided by diverse portfolio resources and long-term market products with some certainty about seasonal fuel availability and peaking capability
    - Implicitly considered as part of hourly dispatch and fuel accounting dispatch in GENESYS and AURORA, and results converted into Associated System Capacity Contribution (ASCC) in RPM
- **All reserves can be made up of generating resources and/or load-management actions.**

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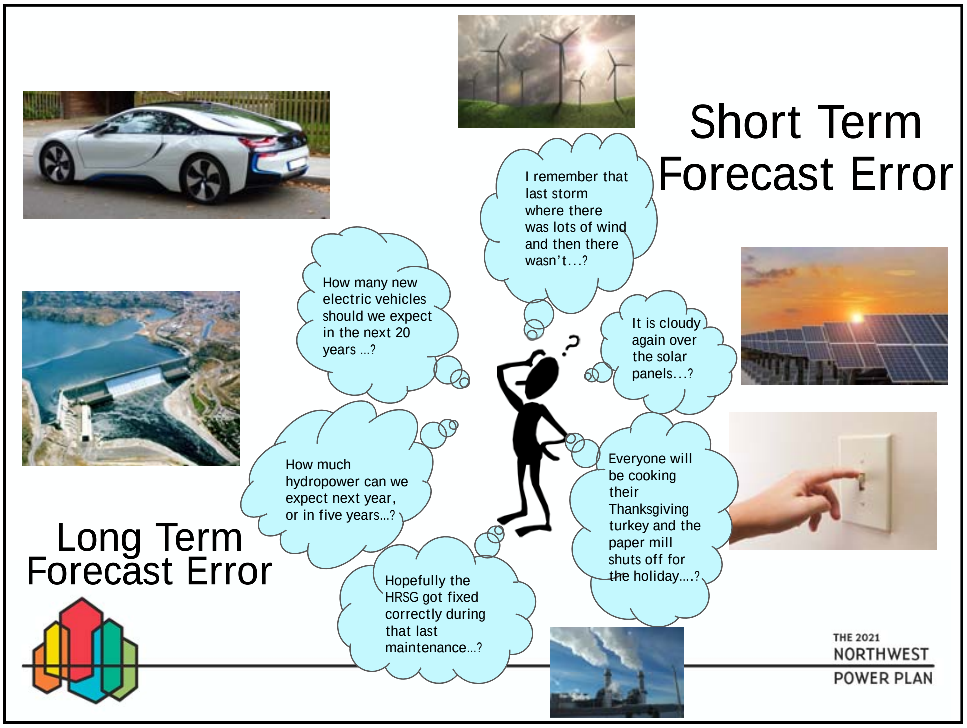


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## Integrate Cost-effective Methods for Providing Reserves into the Resource Strategy

Make long term resource decisions that address the following uncertainties in the context of an *adequate* system:

- **Reserves are held to account for forecast error over different time frames**
  - Uncertainty in demand, forced outages, hydro runoff and renewable resource availability can be addressed with varying tools from planning to operating reserves.
- **Cost-effective methods for providing reserves are implicit in developing a resource strategy**
  - Sufficient reserves are a constraint on a well-developed resource strategy and the cost for providing them is included in the total system cost
  - Since different resource strategy actions have differing fueling, ramping and scheduling/commitment characteristics, *1-to-1 reserve replacement options are uncommon*

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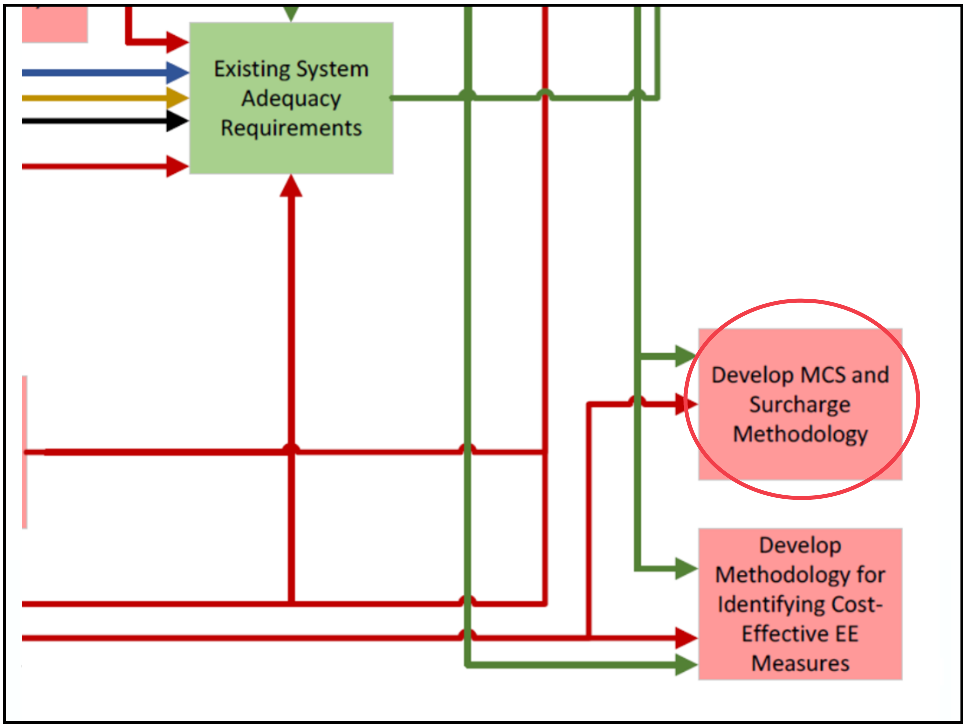


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## What are the Model Conservation Standards and Surcharge Methodology?

The Plan should include:

1. Standards designed to produce all power savings that are cost-effective for the region and economically feasible for consumers taking into account financial assistance
2. A surcharge methodology, which with recommendation of the Council and imposition by the Administrator, would be an incremental charge to Bonneville customers not meeting the standards

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# Model Conservation Standards (MCS)

The MCS are a prescriptive means of acquiring energy efficiency – that is, specific requirements such as building insulation levels or utility program features.

The Power Act directs the plan include MCS applicable to:

(i) new and existing structures;
(ii) utility, customer, and governmental conservation programs;
(iii) other consumer actions for achieving conservation.

The Act requires:

- the standards reflect geographic and climatic differences and other appropriate considerations
- that the Council design the MCS to produce all power savings that are cost-effective and economically feasible for consumers, taking into account financial assistance from the Bonneville Power Administration and the region's utilities.

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# Surcharge Methodology

- May be imposed on Bonneville customers' full load or portion of their load not meeting the MCS
- Should be designed to recover additional costs incurred because projected energy savings have not been achieved
- Must be no less than 10 percent and no more than 50 percent of the rates for a customer's load or portion of load not meeting the MCS
- Provides a strong incentive to utilities and state and local jurisdictions to adopt and enforce the MCS

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# Example MCS Table from Plan 1

***Table J4-1.***
***Thermal Performance Criteria for Low-Rise Residential Buildings***
***(Occupancy Groups R-1 and R-3)***

| | Climate Zone* | | | | | |
|---|---|---|---|---|---|---|
| | Zone 1 Group R | | Zone 2 Group R | | Zone 3 Group R | |
| **Element** | **Div. 3** | **Div. 1** | **Div. 3** | **Div. 1** | **Div. 3** | **Div. 1** |
| Walls[1] ($U_O$ Value) | .10 | .115 | .09 | .115 | .09 | .115 |
| Roof/Ceiling[2] ($U_O$ Value) | .028 | .035 | .028 | .035 | .028 | .035 |
| Floors over Unconditioned Spaces ($U_O$ Value)[3] | | | | | | |
| Exposed to Outdoor Air | .05 | .05 | .035 | .035 | .035 | .035 |
| All Others ($U_O$ Value) | .08 | .08 | .05 | .05 | .05 | .05 |
| Slab-on-Grade Floors | | | | | | |
| Unheated[4] (R Value) | 5 | 5 | 10 | 10 | 10 | 10 |
| Heated (R Value) | 10 | 10 | 12 | 12 | 15 | 15 |

*Zone 1 = 4000 - 6000 heating degree days at 65° F
*Zone 2 = 6001 - 8000 heating degree days at 65° F
*Zone 3 = over 8000 heating degree days at 65° F
[1]Includes all components of gross wall area (see definition)
[2]Includes all components of skylights in gross roof/ceiling area (see definition)
[3]Includes all components of gross floor area (see definition)
[4]Not incorporating a heating system within floor slab

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# MCS in the Seventh Plan

Focused on three areas intended to improve program design and delivery:

- Ensuring full participation in programs
  - MCS-1 – Improve participation in programs from "hard to reach" or "underserved" markets
- Achieving voltage optimization
  - MCS-2 – Evaluate and pursue savings on utility distribution circuits
- Enhancing codes and standards
  - MCS-3 through MCS-7 – efforts related to supporting building codes and Federal standards
  - Much of this is accomplished through NEEA

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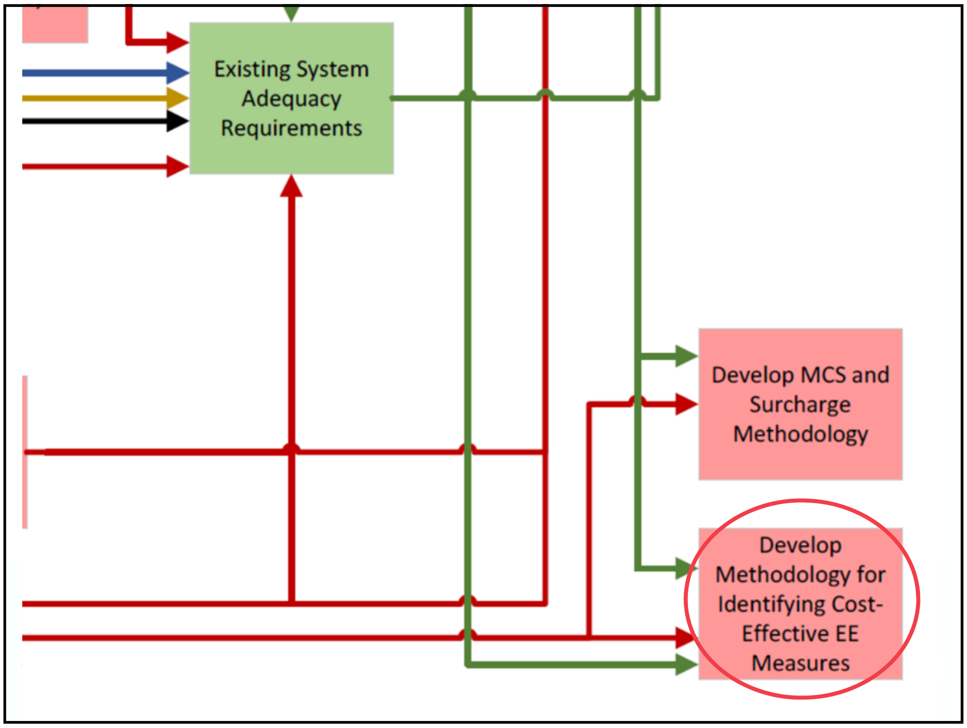
Existing System Adequacy Requirements
Develop MCS and Surcharge Methodology
Develop Methodology for Identifying Cost-Effective EE Measures

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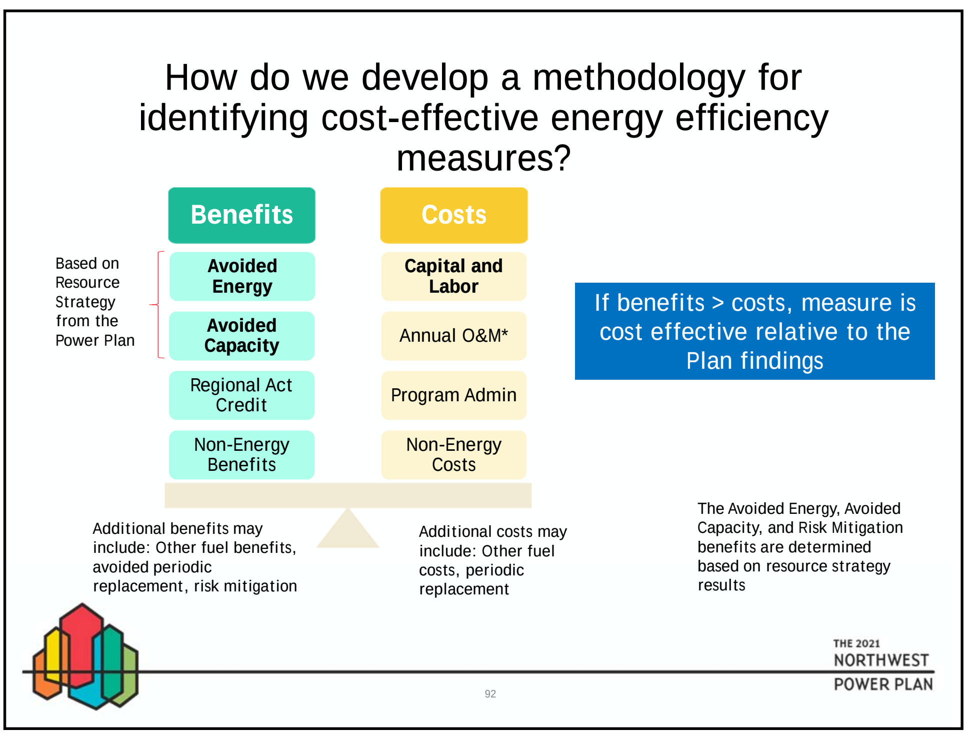
How do we develop a methodology for identifying cost-effective energy efficiency measures?
Benefits
Costs
Based on Resource Strategy from the Power Plan
Avoided Energy
Avoided Capacity
Regional Act Credit
Non-Energy Benefits
Capital and Labor
Annual O&M*
Program Admin
Non-Energy Costs
If benefits > costs, measure is cost effective relative to the Plan findings
Additional benefits may include: Other fuel benefits, avoided periodic replacement, risk mitigation
Additional costs may include: Other fuel costs, periodic replacement
The Avoided Energy, Avoided Capacity, and Risk Mitigation benefits are determined based on resource strategy results
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# Estimating economic achievable potential

- The Economic Potential is determined by the resource strategy analysis
  - Council determines this potential based on analytical results and judgment
  - Results in the regional EE targets/goals
- After the regional EE target is established, we need a method for determining if new measures are cost-effective relative to the Plan results

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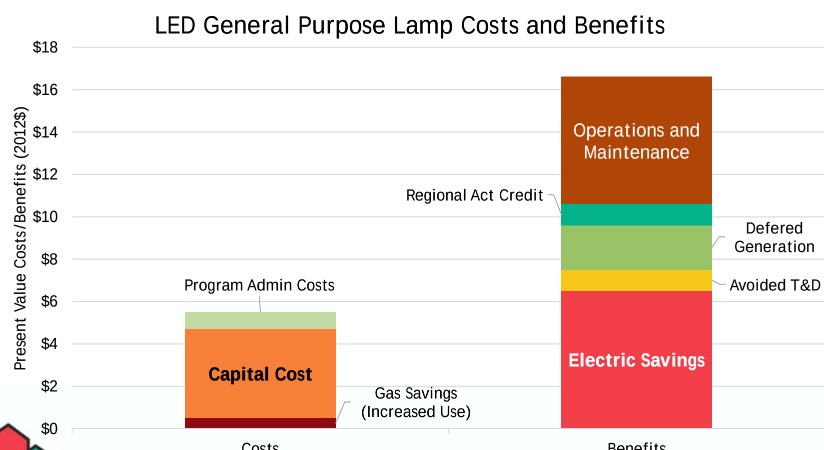
# An example: LED light bulb

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