Scope of Commercial Analysis

- About 50 measure bundles
  - Commercial Buildings (square feet by segment)
  - High Rise Residential (New for 7 Plan)
  - Appliances (number of units)
  - Processes (flow rates or population based measures)
- Many measure permutations ~ 300
  - By building type, climate zone, vintage, heating system
  - By decision event (New, Retrofit, Natural Replacement)
  - Multiple efficiency tiers
Methodology (Units)

- Units driven by building segment floor space
  - Load forecast model provides SF by year by segment
  - SF driven by employment
- A few measure bundles are population driven:
  - Wastewater & Water Supply
  - Computers, package refrigeration
  - Streetlight & infrastructure
- Units estimates tied to load forecast

---

Data Sources

- Building-configuration dependent
  - New CBSA for characteristics & saturations
  - Sales data & market trend analysis
- Equipment regulated by Federal standards
  - Federal rulemakings, sales data
- Equipment or process-driven
  - EPA, State Agencies, Surveys, CPA’s, NEEA, AWWA, whatever we can get
Commercial Building Stock Assessment (CBSA)

- Database of PNW commercial building characteristics
- Conducted 2012 – 2014
- Random sample
- About 850 sites
  - 464 site-level data points on each
  - Lighting detail by space type within
  - Over 80 HVAC detail variables
- Characteristics data due end September
- Billing data less complete (need help)
- Higher estimate of floor area? (up >20%)

New Federal Efficiency Standards (Commercial)

- Metal Halide Lamp Fixtures
- Walk-In Coolers and Freezers
- Commercial Refrigeration Equipment
- Electric Motors
- External Power Supplies
- Small Electric Motors
- Fluorescent Lamp Ballasts
- Commercial CAC and HP (Water- and Evaporatively-Cooled)
- Clothes Washers, Commercial
- Pool Heaters
- Direct Heating Equipment
- Incandescent Reflector Lamps
- General Service Fluorescent Lamps
- Vending Machines
- Boilers, Commercial
- Packaged Terminal AC and HP

These set baseline kWh/unit for 7P
Savings from standards incorporated in load forecast
Lighting Standards Updates
(Three? in 7P Baseline, remainder as Potential)

<table>
<thead>
<tr>
<th>Product Covered</th>
<th>Initial Legislation</th>
<th>Updated DOE Standard Expected</th>
<th>Potential Effective Date</th>
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<tbody>
<tr>
<td>Candelabra &amp; Intermediate Base Incandescent Lamps</td>
<td>None</td>
<td>2015</td>
<td>2018</td>
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<tr>
<td>Ceiling Fans and Ceiling Fan Light Kits</td>
<td>EPACT 2005</td>
<td>2016</td>
<td>2019</td>
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<td>Compact Fluorescent Lamps</td>
<td>EPACT 2005</td>
<td>2017</td>
<td>2020</td>
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<tr>
<td>General Service Fluorescent Lamps</td>
<td>EPACT 1992</td>
<td>2014</td>
<td>2017</td>
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<tr>
<td>General Service Lamps: Incandescents plus CFLs, GSLED, GSOLED</td>
<td>None</td>
<td>2017</td>
<td>2020</td>
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<tr>
<td>HID Lamps</td>
<td>EPACT 1992</td>
<td>2015</td>
<td>2018</td>
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<tr>
<td>Incandescent Reflector Lamps</td>
<td>EPACT 1992</td>
<td>2014</td>
<td>2017</td>
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<tr>
<td>Incandescent Reflector Lamps (includes certain BR and Other Exempted IRLs)</td>
<td>EPACT 1992</td>
<td>2014</td>
<td>2017</td>
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<tr>
<td>Metal Halide Lamp Fixtures</td>
<td>EISA 2007</td>
<td>2019</td>
<td>2022</td>
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</table>

Other Standards Updates
Many Will Provide Data for Savings Potential

<table>
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<tr>
<td>Automatic Commercial Ice Makers</td>
<td>EPACT 2005</td>
<td>2015</td>
<td>2018</td>
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<tr>
<td>Boilers, Commercial</td>
<td>EPACT 1992</td>
<td>2015</td>
<td>2018</td>
</tr>
<tr>
<td>Clothes Washers, Commercial</td>
<td>EPACT 2005</td>
<td>2015</td>
<td>2018</td>
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<tr>
<td>Commercial CAC and HP (65,000 Btu/hr to 760,000 Btu/hr)</td>
<td>EPACT 1992</td>
<td>2016</td>
<td>2019</td>
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<tr>
<td>Commercial CAC and HP (&gt;55,000 Btu/hr)</td>
<td>EPACT 1992</td>
<td>2015</td>
<td>2018</td>
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<tr>
<td>Commercial CAC and HP (Water- and Evaporatively-Cooled)</td>
<td>EPACT 1992</td>
<td>2019</td>
<td>2021</td>
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<tr>
<td>Commercial Refrigeration Equipment</td>
<td>EPACT 2005</td>
<td>2022</td>
<td>2025</td>
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<tr>
<td>Commercial Water Heaters</td>
<td>EPACT 1992</td>
<td>2016</td>
<td>2019</td>
</tr>
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<td>Compressors</td>
<td>EPACT 1992</td>
<td>2016</td>
<td>2021</td>
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<tr>
<td>Electric Motors</td>
<td>EPACT 1992</td>
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<td>2021</td>
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<tr>
<td>Fans and Blowers</td>
<td>EPACT 1992</td>
<td>2016</td>
<td>2021</td>
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<td>Furnaces, Commercial Warm Air</td>
<td>EPACT 1992</td>
<td>2016</td>
<td>2019</td>
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<tr>
<td>Packaged Terminal AC and HP</td>
<td>EPACT 1992</td>
<td>2015</td>
<td>2018</td>
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<tr>
<td>Pre-Rise Spray Valves</td>
<td>EPACT 2005</td>
<td>Initiating a Rulemaking TBD</td>
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<td>Pumps, Commercial and Industrial</td>
<td>EPACT 1992</td>
<td>2015</td>
<td>2018</td>
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<tr>
<td>Single Package Vertical Air Conditioners and Heat Pumps</td>
<td>EPACT 1992</td>
<td>2015</td>
<td>2018</td>
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<tr>
<td>Small Electric Motors</td>
<td>EPACT 1992</td>
<td>2016</td>
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<td>EPACT 2005</td>
<td>2016</td>
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<td>Walk-In Coolers and Freezers</td>
<td>EISA 2007</td>
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<td>Water-Source Heat Pumps</td>
<td>EPACT 1992</td>
<td>2015</td>
<td>2018</td>
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</tbody>
</table>
238 Measures in 6P

Key Measures from Sixth Plan
All Being Updated

- Lighting
  - Building LPD improvements
    - CBSA on saturation & baseline
    - Federal standards & codes
    - Cost, Efficacy & Availability of SSL
- Lighting Controls
- Street Lighting
  - Need data on adoption to date
- Daylighting
- Exterior building lighting
  - Much better data in new CBSA
- Parking lot lighting
6P Key Measures, Cont

- HVAC – Update with CBSA data, standards
  - Rooftop system optimization
  - Premium HVAC Equipment
    - Chillers, heat pumps, advanced rooftop systems
  - Demand Controlled Ventilation
  - ECM on VAV systems
  - \textit{Need better measured end-use data (heating, cooling \\ & ventilation loads)}

6P Key Measures, Cont

- Wastewater Treatment and Water Supply
  - EPA database of wastewater systems
  - ETO project data
  - AWWA data
  - \textit{Additional consumption (kWh/MGD) and savings data in kWh/MGD would improve estimates}
  - \textit{What has already been done?}
  - \textit{Are Water Supply Measures being adopted?}
6P Key Measures, Cont

- Refrigeration – Grocery & Packaged
  - Grocery store update based on program data and CBSA
  - Packaged equipment analysis update from Federal standards
- Integrated Building Design - New
  - *Apply to Existing Building Renovation Market?*
- Envelope
  - CBSA on existing glazing & heating system
  - Windows
  - Roof
- Cooking equipment
  - Update with new RTF values

Measure Expansion or Expanded Savings

- Solid State Lighting
  - Vast expansion of options compared to 6P
  - All form factors now in play, all applications
  - *Freeze cost & efficacy improvements at projected 2017*
- Lighting Controls
  - Luminaire level, self commissioning, smart
  - *Highly variable savings: Need better data on savings reductions across applications*
New Measures: Commercial
New or Expanded Applications

1. Data Centers: Embedded & Dedicated
2. Compressed Air Systems
3. Chiller retrofits
4. Advanced Roof Top HVAC
5. Evaporative Assist Roof Top HVAC*
6. HPWH, Showerhead, gravity flow heat exchanger
7. Water Cooler Controls
8. Switch Reluctance Motors, Motor Rewind
9. Clothes Washers, Freezers, Refrigerators (from RTF)
10. School Weatherization (from RTF)
11. Smart Plug Strips*
12. Demand Control Ventilation for Garages
13. Pool Pumps

New Measures: Commercial
New Technology or Practice

1. Strategic Energy Management in Commercial
2. Glazing: Secondary Window, Dynamic Windows
3. Integrated Circulating Pump ECM & Drive
4. Block Heater Controls for Engine Generator Sets
5. AC Heat Recovery for Water Heating
6. Web-enabled t-stats*
7. Variable Capacity Heat Pump and VRF*
8. CO2 Heat Pump*
9. Heat Pump Clothes Dryer*  

* Fuzzy: May drop
High Priority New Measures

- Strategic Energy Management in Commercial
  - Sixth plan at least partially covered this
  - Should be strong potential here
  - Data from NEEA and ETO
  - What market segments applicable?

- Data Centers
  - Embedded & Dedicated
  - Sub-contract
  - CBSA data set on embedded

- Compressed Air Systems
  - Not just industrial any more

- Circulating Pump ECM & Drive
  - Data from federal standards analysis plus CBSA

High Priority New/Update

- Glazing
  - Secondary glazing systems (inside) (R-1 to R-7) (half the cost)
  - Dynamic windows (PNL)

- Advanced Roof Top HVAC
  - Aiming at fan energy
  - BPA seeing savings in 50% range
  - Catalyst & others
Lower Priority New/Update

- Water heating
  - Gravity flow heat exchanger (MF)
  - Showerhead, HPWH
- Parking Garage Ventilation Controls, VSD
- High Rise Multi-Family
  - New RBSA Data
  - Appliances & Lighting part of Residential Analysis
  - Possible Multi-Family Measures
    - Windows
    - Common Area HVAC
    - Central Water Heating HPWH

Measures to Drop

- HVAC Controls Commissioning & Optimization
  - Incorporate into Commercial SEM
- Sign Lighting?
  - May have transformed to SSL
- Roof Insulation on Re-Roof
- Heated and Cooled Office Chair?
Summary of Issues and Data Needs: Commercial

- CBSA
  - Billing data less complete (need help)
  - Higher estimate of floor area? (up >20%)

- HVAC Measures
  - Need better measured end-use data (heating, cooling & ventilation loads)

- Water/Wastewater
  - Additional consumption (kWh/MGD) and savings data in kWh/MGD
  - Are Water Supply Measures being adopted?

- Lighting
  - Freeze cost & efficacy improvements at projected 2017
  - Controls: Need better data on savings reductions across applications

- Integrated Building Design - New
  - Apply to Existing Building Renovation Market?

- Strategic Energy Management
  - What markets to include?

- Advice on New Measures
  - Any data and or advice on the proposed new measures?
What Was in Sixth Plan?

- Doubled potential compared with Fifth Plan
- 63 Measures applied to 19 PNW Industries
- Nearly 800 aMW potential
- Most less than $50/MWh
- A top-down methodology
  - End use shares of electric load
  - Percent savings by measure by end use
  - Fraction incomplete
  - Measure interactions
Seventh Plan Approach: Same Measures, Update End Use

- New IFSA data on end use shares
- New IFSA data on saturation of measures
- *Where IFSA data are missing, revert to 6P estimates*
- Remove accomplishments per regional reports
  - 130 aMW as of 2012
- Update costs and/or savings information based on program data & recent evaluations
- Include a few new measures
- Break out stone/clay/glass as new sub-industry

Next Federal Efficiency Standards (Industrial)

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May provide data for costs & savings of new measure. But may be end of 2014.
Industrial Facility Site Assessment

- Sponsored by Northwest Energy Efficiency Alliance
- Began in March 2013; NEEA reviewing draft report
- The primary goal of the IFSA was to obtain end-use energy consumption data for the Northwest industrial sector.
- The IFSA intent to provide:
  - Representative accounting of PNW energy use
  - Comprehensive analysis of energy use & management
- The IFSA is the first study of its kind to collect comprehensive information on this level
- **Site count less than expected**

Key Measure & Practices

- Air Compressor Demand Reduction
- Air Compressor Equipment
- Air Compressor Management
- HighBay Lighting
- Lighting Controls
- Motors: Efficient Rewind VSD Controls
- Motor Management Program
- Fan Efficient Centrifugal
- Food: Fans and Blowers
- Other: Fans and Blowers
- Fan ASD Control
- Premium Pump
- Pump ASD Control
- Transformers
- Synchronous Belts
- Food: Cooling and Storage
- Food: Refrig Storage O&M
- Metal: New Arc Furnace
- Paper: Medium Consistency Pump
- Mech Pulp: Refiner Replacement
- Mech Pulp: Premium Process
- Mech Pulp: Refiner Plate Improvement
- Kraft Pulp: Effluent Treatment System
- Kraft Pulp: Efficient Agitator
- Paper: Efficient Pulp Screen
- Paper: Premium Fan
- Paper: Material Handling
- Wood: Replace Pneumatic Conveyor
- Wood: Hydraulic Press
- Cold Storage Retrofit
- Cold Storage Tuneup
- Fruit Storage Refer Retrofit
- CS Retrofit -- CO2 Scrub
- CS Retrofit -- Membrane
- Fruit Storage Tuneup
- Groc Dist Retrofit & Tuneup
- Generic O&M
Proposed Measure Changes 7P

- Drop Transformers
  - Little beyond new federal standards
  - Next round of transformer standards 2022
- Revise Industrial Energy Management
- Review Refrigeration Potential & Ramp Rates
- Update Lighting Baseline

Industrial Energy Management

- Was introduced in Sixth Plan – three levels
  - Energy Project Management (level 1)
  - Plant Energy Management (level 2)
  - Integrated Plant Energy Management (level 3)
- Significant program adoption & savings 2010-2012
  - BPA & ETO early leaders
  - Now significant regional experience
  - Measurement tools improving
  - Delivery infrastructure developing
Industrial Energy Management
Seventh Plan

- Keep the measure set
- Align approach with program experience & recommendations of NEEA Strategic Energy Management (SEM) Collaborative
  - *How to represent levels of adoption & applicability*
- Update costs, savings from program data & evaluations
  - *Review and update measure life?*
- Harvest data from IFSA
- *More utility program data needed*
New Measures: Industrial

1. Switched Reluctance Motors
2. Microwave Sterilization & Pasteurization Technologies
3. Efficient Power Supplies
4. Integrated Motor/Pump/Drive or Fan/Pump/Drive
5. CO2 Heat Pumps

Summary of Issues and Data Needs: Industrial

- Where IFSA data are missing, revert to 6P estimates
- Industrial Strategic Energy Management
  - How to represent levels of adoption & applicability
  - More utility program data needed
- New Measures
  - Missing any?
  - Need to develop costs and savings
Distribution System

Energy & Capacity Savings
Methodology

- The Distribution System efficiency measures were new in the Sixth Plan (~400 aMW potential)
  - But they were also in the First Power Plan in 1981
- Based on NEEA Distribution System Efficiency Initiative 2008 (4-year study)
- Dominated by Conservation Voltage Reduction (CVR)

Distribution System Measures

- 1 - Reduce system voltage w/ LDC voltage control method
- 2 - Light system improvements (var mgmt, phase load balancing, and feeder load balancing)
- 3 - Major system improvements (voltage regulators on 1 of 4 substations, and select reconductoring on 1 of every 2 substations)
- 4 - EOL voltage control method
Updating Distribution Efficiency

- What’s been done last five years (mixed bag)
- Review evaluations PNW & USA
- Review costs from recent applications & update
- Review/update achievable fraction & ramp rates

Summary of Issues and Data Needs:
Distribution System

- Achievable Fraction and Ramp Rates
  - How much is happening outside the conservation program arena?
  - Institutional barriers?
  - Physical limitations or differences among utilities?