Northwest Power and Conservation Council

January 7, 2014

MEMORANDUM

TO: Power Committee

FROM: Charlie Grist

SUBJECT: Incorporating Energy Efficiency Technology Improvement Forecasts into the Seventh Northwest Power Plan

The power planning process requires making assumptions about the future. Forecasting electricity demands and conservation resource potential both require estimates of end user equipment choices and behavior. Technology change is an important factor to consider when making these estimates because it impacts the cost, performance and penetration of energy using equipment and practices.

At the Power Committee meeting, staff will:

- provide a briefing on the Council's past approaches to estimating impacts of technology change in power planning
- outline the consequences of those approaches, and
- identify potential alternative approaches.

To date, Council conservation potential assessments have been based on costs and performance of technologies available at the time the power plan is developed. One of the chief items for the Council to consider is the question of whether to forecast changes in the cost and performance of energy efficiency using equipment beyond levels available today. This is important due to rapid changes for certain existing technologies as well as emerging new technologies. The briefing will also touch on the impact of these analytical choices on electric resource strategies.

Staff is not seeking a decision on this topic now. Instead, the discussion is intended to set the stage for future Council decisions that will need to occur during the development of the Seventh Northwest Power Plan.

851 S.W. Sixth Avenue, Suite 1100
Portland, Oregon 97204-1348
www.nwcouncil.org

Steve Crow
Executive Director

503-222-5161
800-452-5161
Fax: 503-820-2370

Incorporating Energy Efficiency Technology Improvement Forecasts into the Seventh Plan

Power Committee

January 14, 2013

Northwest Power and Conservation Council

1

Outline

- End use technology trends inherently uncertain
- A challenge for planning
- Council approach in past plans
  - What the Act says
  - Past practice for EE and for Generation
- The challenges of "fast" markets
  - TV examples
  - Lighting examples
- Treatment technology trends in Seventh Plan
  - Choices and implications

Northwest Power and Conservation Council

2

What the Act Says

- What makes a resource **cost-effective** under the Act? "Cost-effective" defined in Section 3(4):
  - To be cost-effective a resource must:
  - be reliable and available
  - meet or reduce demand of the "consumers of the customers" at "an estimated incremental system cost no greater than that of the least-cost similarly reliable and available alternative measure or resource"

Northwest Power and Conservation Council

3

Council's Analysis of Available & Reliable Differs for EE & Generation

Northwest Power and Conservation Council

4

Available & Reliable Generation

- Commercially available & proven technology
- Forecast changes in cost & performance
  - Capital costs decline for wind, gas-fired, solar
  - Transmission & integration costs are forecast
  - Some cost elements go up some down
- Resource costs based on forecast in-service date

Northwest Power and Conservation Council

5

Available & Reliable EE

- Available in the market <u>at time plan developed</u>
  - No measures not yet invented or not reliable
- Demonstrated to reliably produce savings
  - Field tests, pilot programs, lab tests
- Load forecast & conservation mechanics
  - Load forecast & conservation assessment must use same assumptions – same baseline

Northwest Power and Conservation Council

6

Typical Power Planning Methods for Emerging Tech in EE & Load Forecast

- Baseline
  - Federal standards or State codes **OR** better
- Stock Turn-Over Rates
  - Equipment turnover rates play key role
  - Frequency of appliance replacement, lamp burnout, fixture replacements & system remodels
- Frozen Efficiency Baseline
  - Replacements are frozen at today's efficiency levels & costs

Challenged by Fast changing technology or markets

Northwest Power and Conservation Council

Consequences of EE Approach

- Good near-term estimates EE cost/kWh
- Likely conservative for EE in long term
  - Not capture improvements EE cost/kWh
  - Not capture out-year market changes loads
- Miss out on emergent technology
- But re-estimate every five years or so
  - New Plan = new baseline for
    - Price, Performance, Penetration
  - A lead-time issue with regard to resources

Northwest Power and Conservation Council

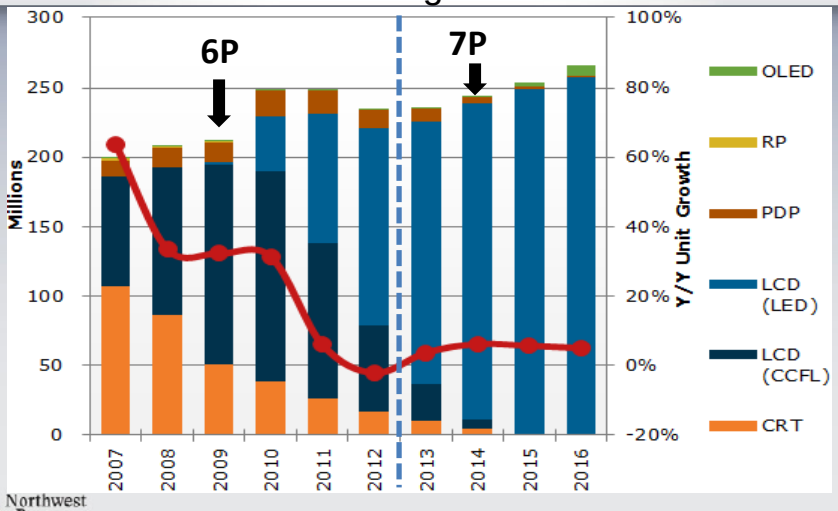
8

The Challenge:
Fast-Changing Technology or Markets




Northwest Power and Conservation Council

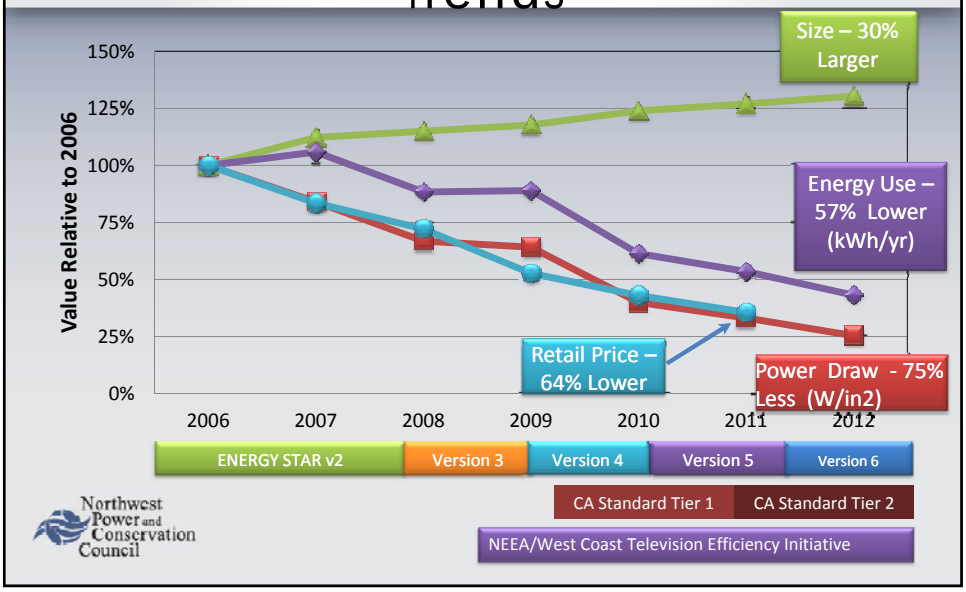
TV Technology Shift
CFL to LED Light Source



Northwest Power and Conservation Council

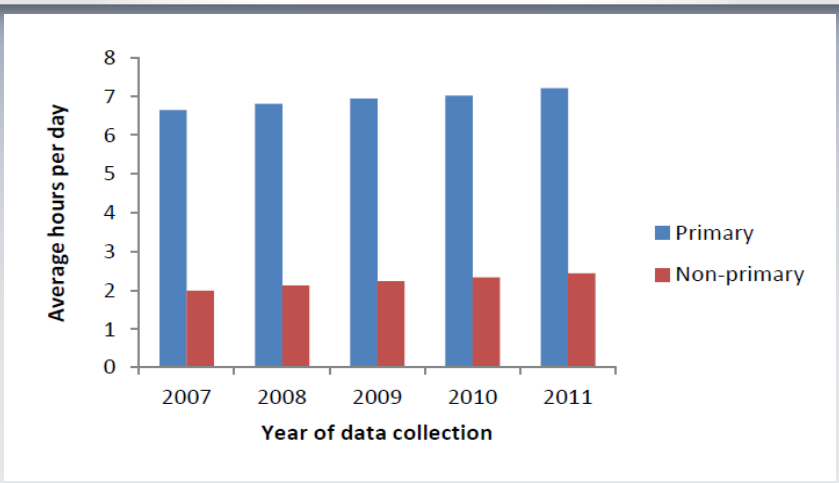
Global TV Shipment Growth
Source: Display Search, January 2013

TV Efficiency, Size, Power & Price Trends



Northwest Power and Conservation Council

While TV Viewing Time Increased



Source: Neilsen

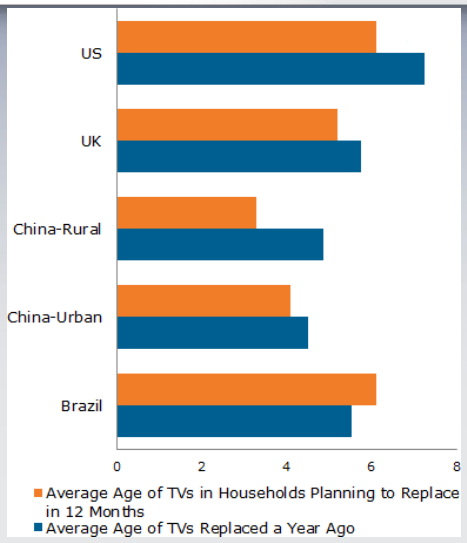
Northwest Power and Conservation Council

12

Replacement Rates Got Shorter

Replacement Cycles

- Cathode Ray Tube TV: 10-15 years
- Flat Screen & HDTV: 6-7 years & falling



Source: Display Search 2012

Northwest Power and Conservation Council

13

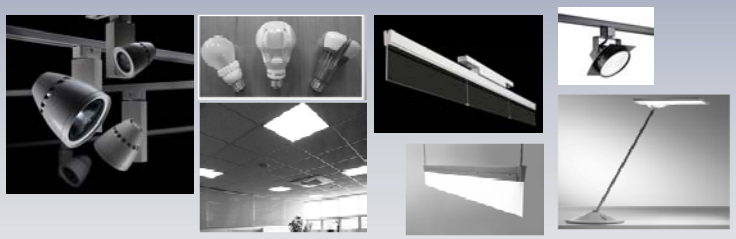
TV Example Take-Aways

- Many factors influence TV energy use
  - Technology, size, consumer behavior
- Reality & forecasts can depart quickly in fast markets
- Load forecast & conservation assessment must use same forecast assumptions
- Frequent updates required for planning and for conservation implementation

Northwest Power and Conservation Council

14

Solid Sate Lighting



Northwest Power and Conservation Council

15

Select Best-In-Class Incumbent Comparison 2013

In Efficacy: LED products are challenging some Best-In-Class incumbent technologies.

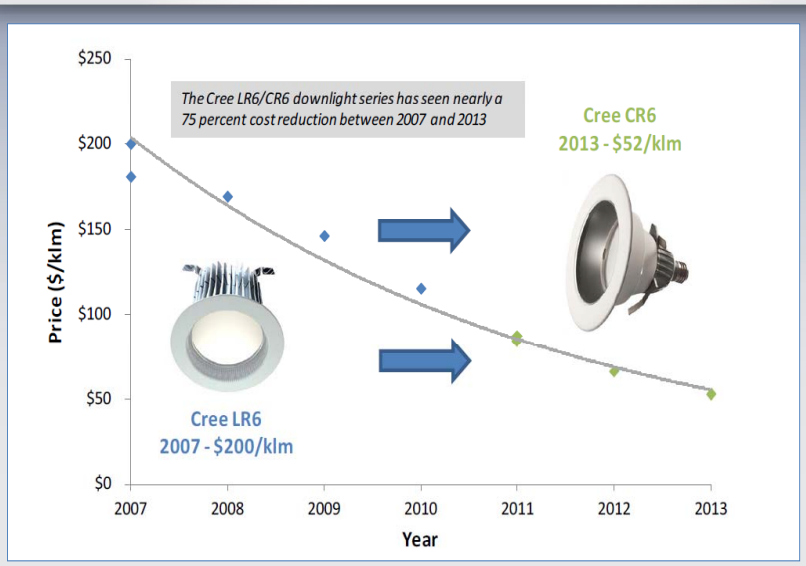
But it's not all about efficacy:
- Cost
- Life
- Output
- Color
- Maintenance

Form Factor	Incumbent Technology	Best 2013 Incumbent Efficacy (lm/Watt)	Best 2013 LED Efficacy (lm/Watt)
A-19 bulb	Halogen IR	30	94
A-19 bulb	CFL	70	94
PAR-38 bulb	Halogen IR	26	89
MR-16 Bulb	Halogen IR	20	77
Candelabra	Incandescent	10	80
Downlight	CFL	40	88
4-Foot Linear Pendant	Linear Fluor	90	119
2x2 Recessed Troffer	U-Bent Fluor	50	90
High Bay	Metal Halide	100	110
Streetlight	HPS	75	110

Northwest Power and Conservation Council

16

Downlight Cost Trends



17

USDOE: Forecast Lumens by Source

Source: *Energy Savings Potential of Solid-State Lighting in General Illumination Applications*, USDOE/EERE January 2012

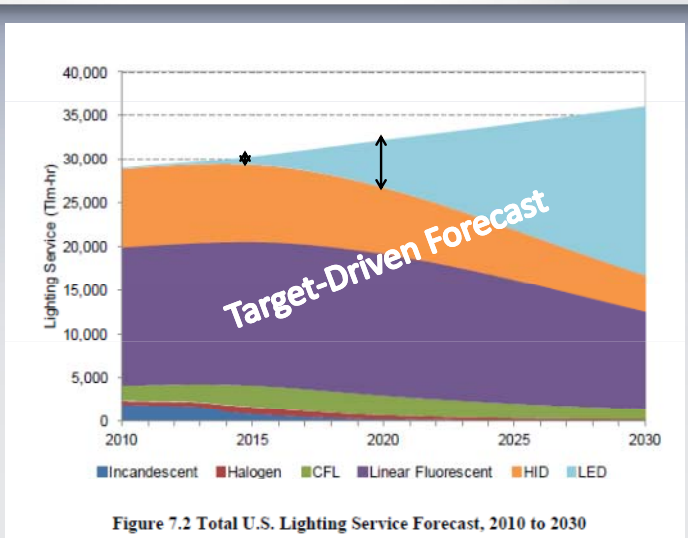


Figure 7.2 Total U.S. Lighting Service Forecast, 2010 to 2030

Northwest Power and Conservation Council

18

USDOE: Forecast Big Savings Potential from SSL Uptake

Source: *Energy Savings Potential of Solid-State Lighting in General Illumination Applications*, USDOE/EERE January 2012

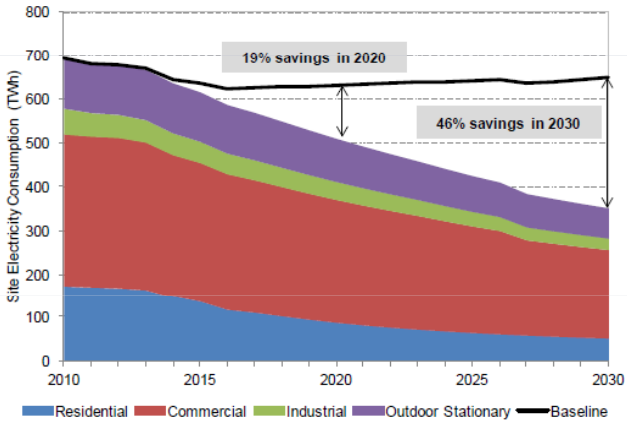


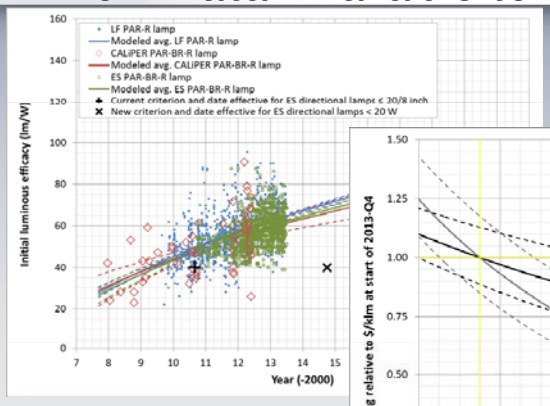
Figure 7.1 Total U.S. Lighting Energy Consumption Forecast, 2010 to 2030

Northwest Power and Conservation Council

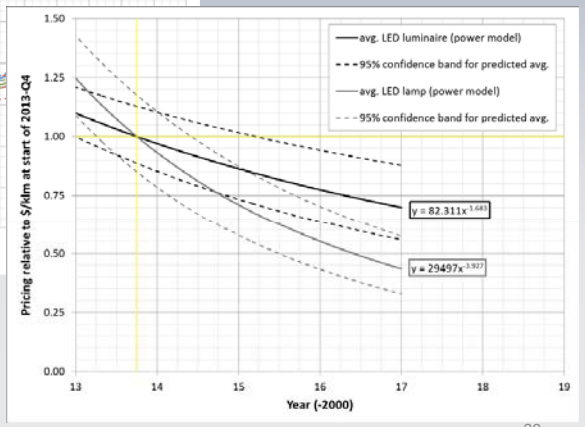
19

Analysis of SSL Pace of Trends

New Data Available to Inform Planning



Source: PNNL for USDOE 2013



Northwest Power and Conservation Council

20

Not Soley EE & Emerging Tech

- Forecast all end user equipment & behavior
- Forecast models:
  - Use cost & performance estimates for all major components for new & replacement stock
  - Consider behavioral & market uptake too
- Efficiency models:
  - Estimates based on forecast baseline
  - Savings and cost above baseline

Northwest Power and Conservation Council

21

Potential Fast Markets for Seventh Plan

- Solid state lighting
- Cheap digital controls
  - IP addressable hardware, smart phone apps
- Roof-top solar PV
- Information technology
  - Data centers, servers, storage
- Information revolution impact on behavior
  - Electronic info displaces physical behaviors

Northwest Power and Conservation Council

22

Key Planning Decisions for Seventh Plan

- Identify near-term innovation trends
- Include end use forecast cost trends beyond 2015?
  - Forecast price & performance
  - Forecast pace of market uptake
  - Forecast turnover rates in face of new tech
- Impact on resource strategies – near-term/long term

Get advice from Demand Forecasting (DFAC) and Conservation Resource Advisory Committee (CRAC)

Northwest Power and Conservation Council

23