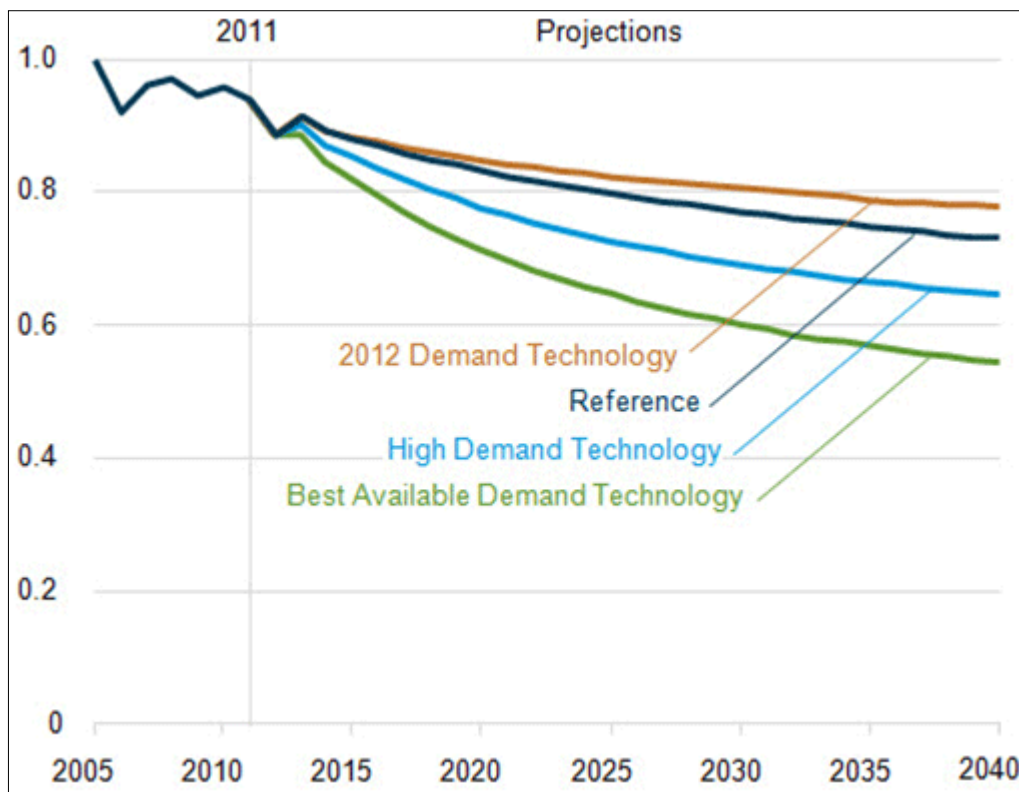




Efficiency Gains in Technology Creates Market Transformation

George Spargo - Manager of Efficiency Engineering - March 31, 2014

EIA Residential Electric Projections



Residential delivered energy intensity in four cases, 2005-2040 (index, 2005 = 1)

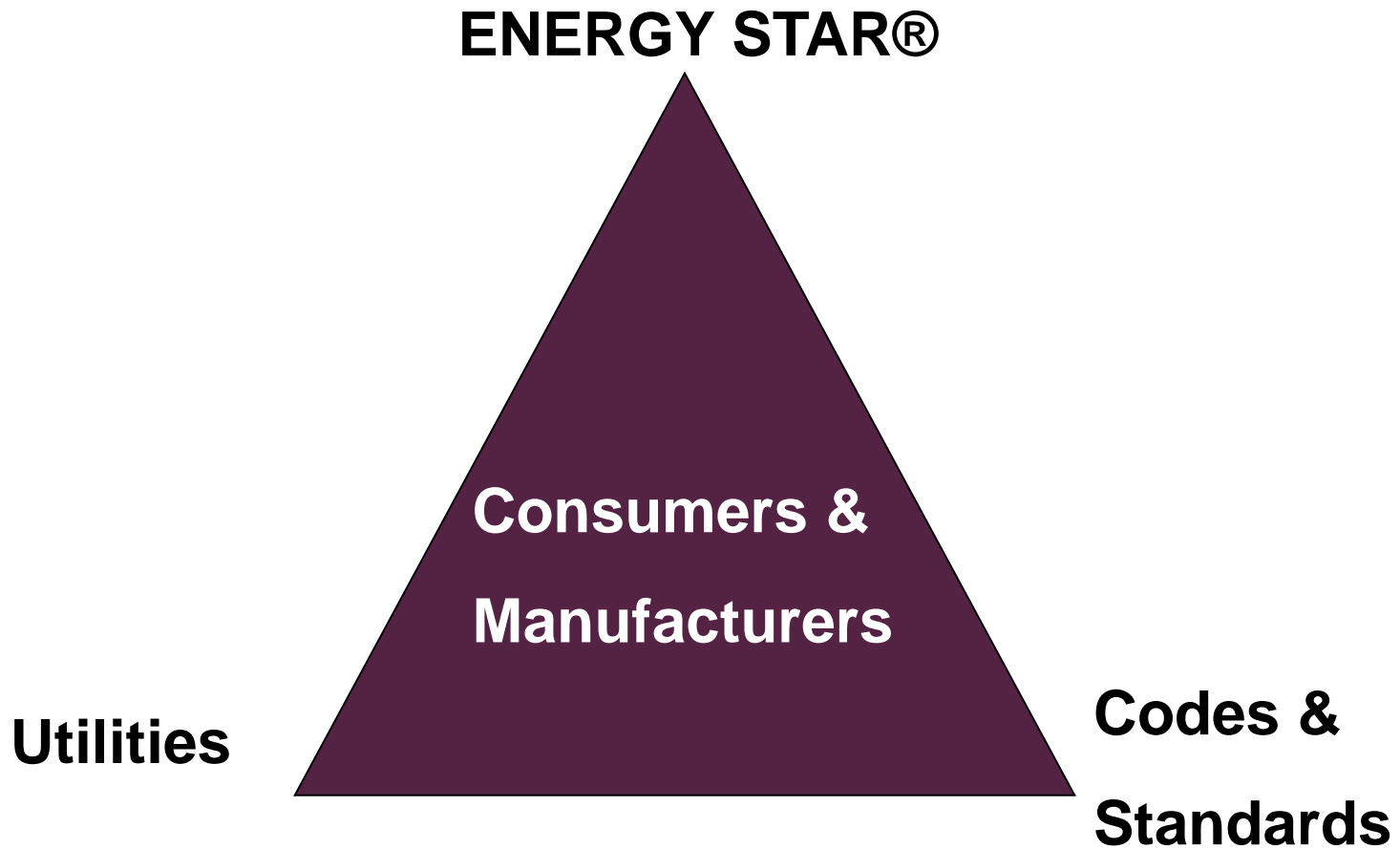
Source: Energy Information Administration (EIA) - Annual Energy Outlook 2013

Our estimate is in line with High Demand Technology case

- **Reference Case-12%***
 - The energy intensity of residential demand declines from 97.2 million Btu in 2011 to 75.5 million Btu in 2040. Reference case does not incorporate continued enhancement of standards such as Energy STAR.
- **High Demand Technology Case-17%***
 - Assumes higher efficiency, earlier availability, lower cost, and more frequent energy-efficient purchases for some equipment.
- **Best Available Technology Case-24%***
 - Limits customer purchases of new and replacement equipment to the most efficient models available at the time of purchase – regardless of cost.

*EIA data includes migration of people to warmer climates, artificially increasing kWh.

Market Transformation (MT) How the Cycle Works



ENERGY STAR® and Voluntary Initiatives

- Central AC
- Refrigerators
- Televisions
- Set Top Box
- Furnaces
- Cookers
- Freezers
- Fans
- Displays
- Ice Makers
- Dishwashers
- Doors
- Windows
- Computers
- Water Heaters
- LED & CFL Lights
- Vending Machines
- Computer Power Management
- Cloths Washers
- Roof Products
- Water Coolers
- Dehumidifiers
- Pool Pumps
- Standby Power
- Power Supply
- Battery Chargers
- Savings Calculators
- Educational Tools
- Benchmarking
- Recognition
- ENERGY STAR® Label
- Tier 1
- Tier 2
- Most Efficient

Utility Programs and MT

Our programs today;

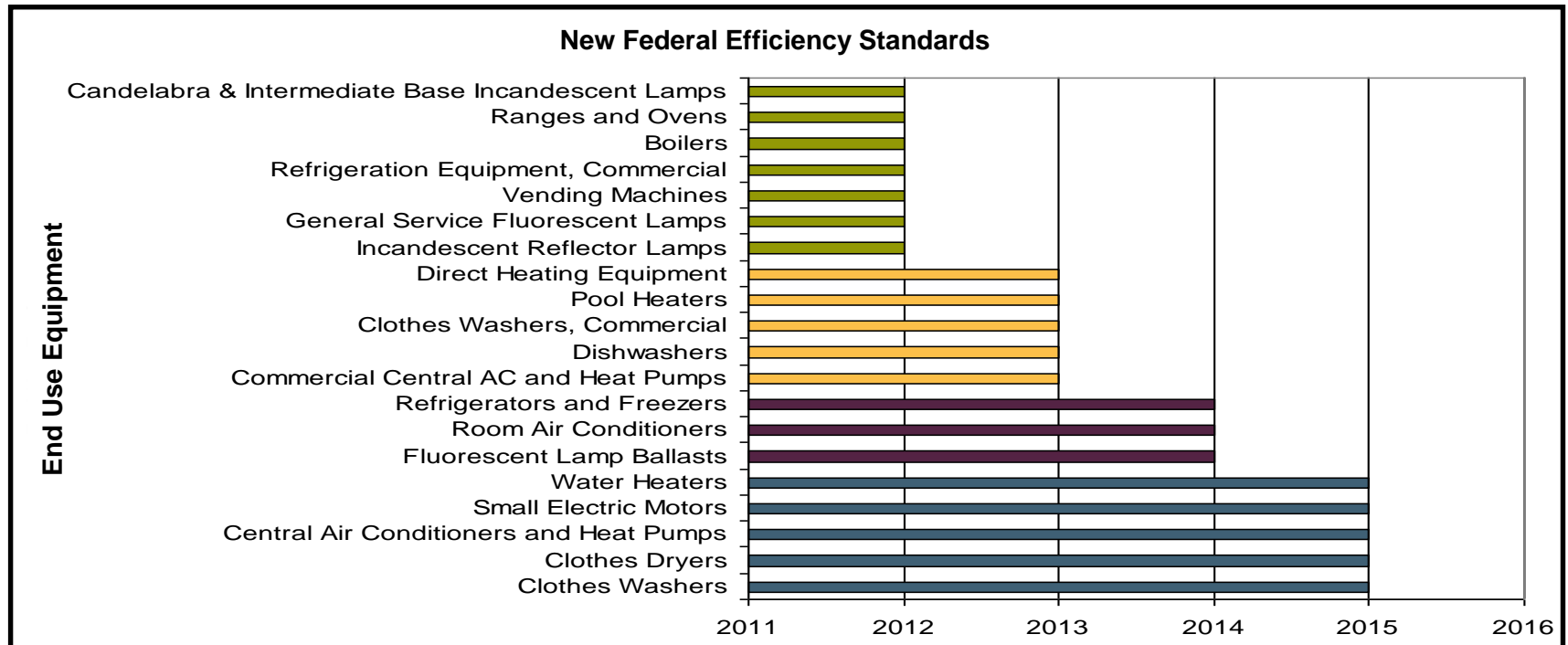
- **Central AC w Quality Install**
- High efficiency Transformer - Computer
- Water Heaters
- EC Motors
- Furnaces
- Education
- **Light Bulbs**
- Insulation

Our programs that have been retired;

- Room AC
- Refrigerators
- Freezer


Federal Energy Efficiency Standards Adjustments through 2015

New federal efficiency standards will continue to impact the purchase of many new products. The impacts will show up gradually as the equipment is replaced.



Source: Tom Eckman, Northwest Power Conservation Council, presented at the 2013 National Symposium on Market Transformation (March 2013).

Technology slides

- Three residential end use areas contribute the majority of the residential impact:
 - Lighting
 - Electronics
 - Heating and air conditioning
- The following slides show net results with higher saturation creating MT.
-  Indicates typical equipment replacement cycles which quantify the lag between equipment availability and corresponding impact on our load.

Residential Lighting

Efficient lighting will be a large contributor to MT

Replacement Cycle

2011
1500 kWh



2020

400-750 kWh

- Incandescent 100 watt
 - Phase out started in 2010
- Compact Fluorescent 25 watt
 - 36% 2011 penetration
- Light Emitting Diode (Today) 24 Watt
 - Low 2011 penetration
 - 75%+ combined 2020 LED/CFL penetration expected
- Light Emitting Diode (Future) 12-17 Watt
 - Not yet available



2 years



10 years



20 years



30 years

Residential Electronics

Short replacement cycles means slower MT

- Computers 2011 450 kWh → 2020 100-400 kWh
 - Desktops → Laptops → Tablets
 - Adoption of PC power management
 - CRT Displays → Fluorescent LCD → LED LCD
 - Spinning disk storage → Solid state storage
- Televisions: CRT → Fluorescent LCD → LED LCD
 - 2011 550 kWh → 2020 200-350 kWh
- Set Top Boxes → ENERGY STAR®
 - 2011 250 kWh → 2020 100-200 kWh

Replacement Cycle



6 years



8 years



8 years

Residential HVAC

Long replacement cycles means very slow MT

- Cooling 2011 750 kWh → 2020 500-650 kWh
 - Federal standards increasing
 - Electronically commutated circulation motors
- Furnace (Add EC circulation motor)
 - 2011 650 kWh → 2020 300-550 kWh
- Electric heat*
 - 2011 700 kWh → 2020 500-650 kWh

Replacement Cycle



12 years



12 years

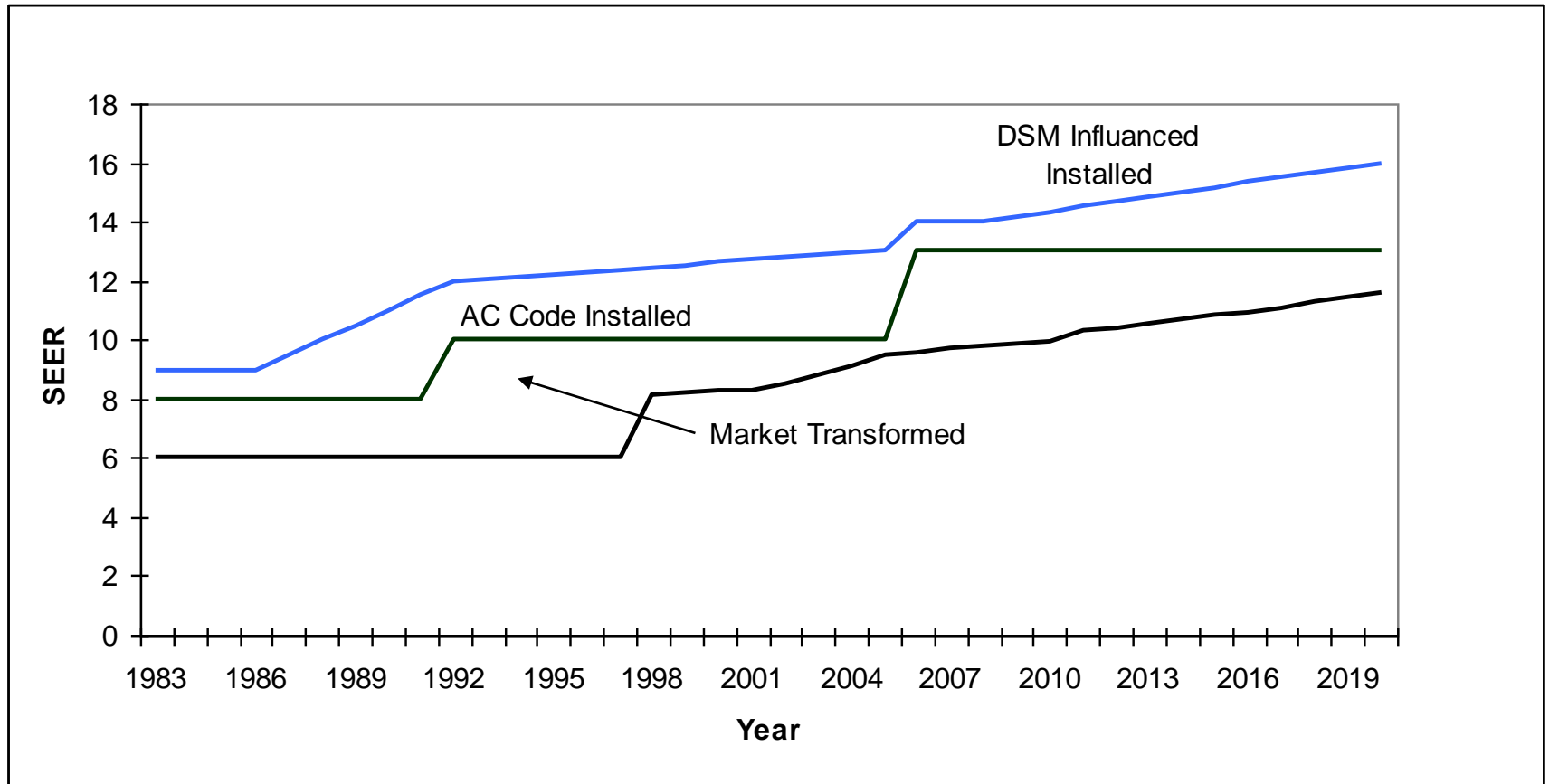


12 years

*Electric heat energy decrease driven primarily by the addition of insulation

MT - Residential Air Conditioning

Code and DSM Influenced Energy Reduction



Conclusions

Market Transformation will occur as:

- Adoption rate of efficient equipment increases, which is dependant on costs of equipment, innovation, users preferences, customer interest/knowledge of ENERGY STAR® products, and replacement cycle times
- New codes and standards will be mandated if ENERGY STAR® and Utilities are successful
- Then above steps will repeat

“What’ s Next?”

More Education and Marketing

"Good Housekeeping Seal of Approval."