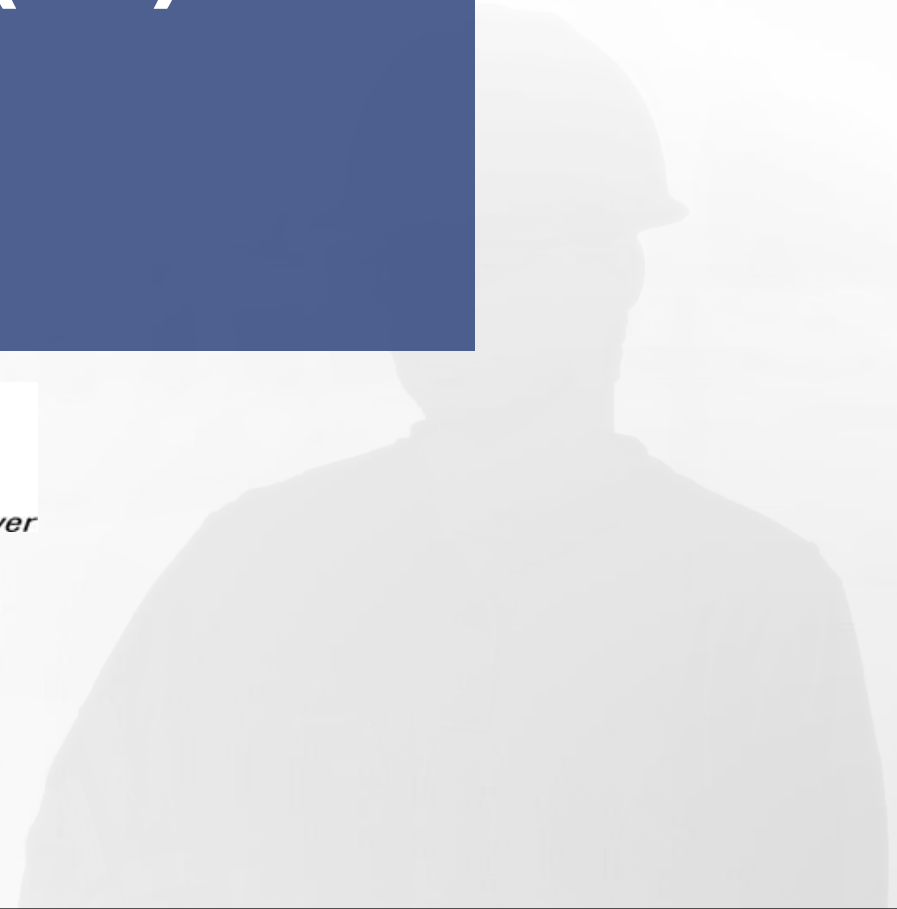


Joint Integrated Resource Plan (IRP) Stakeholder Presentation February 3, 2016



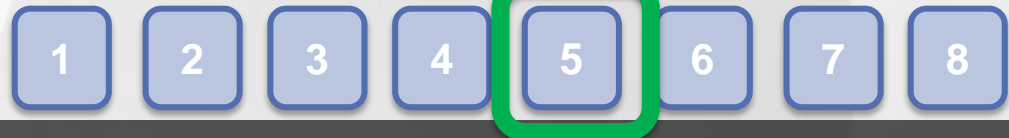


5

RESOURCES (DUKE)

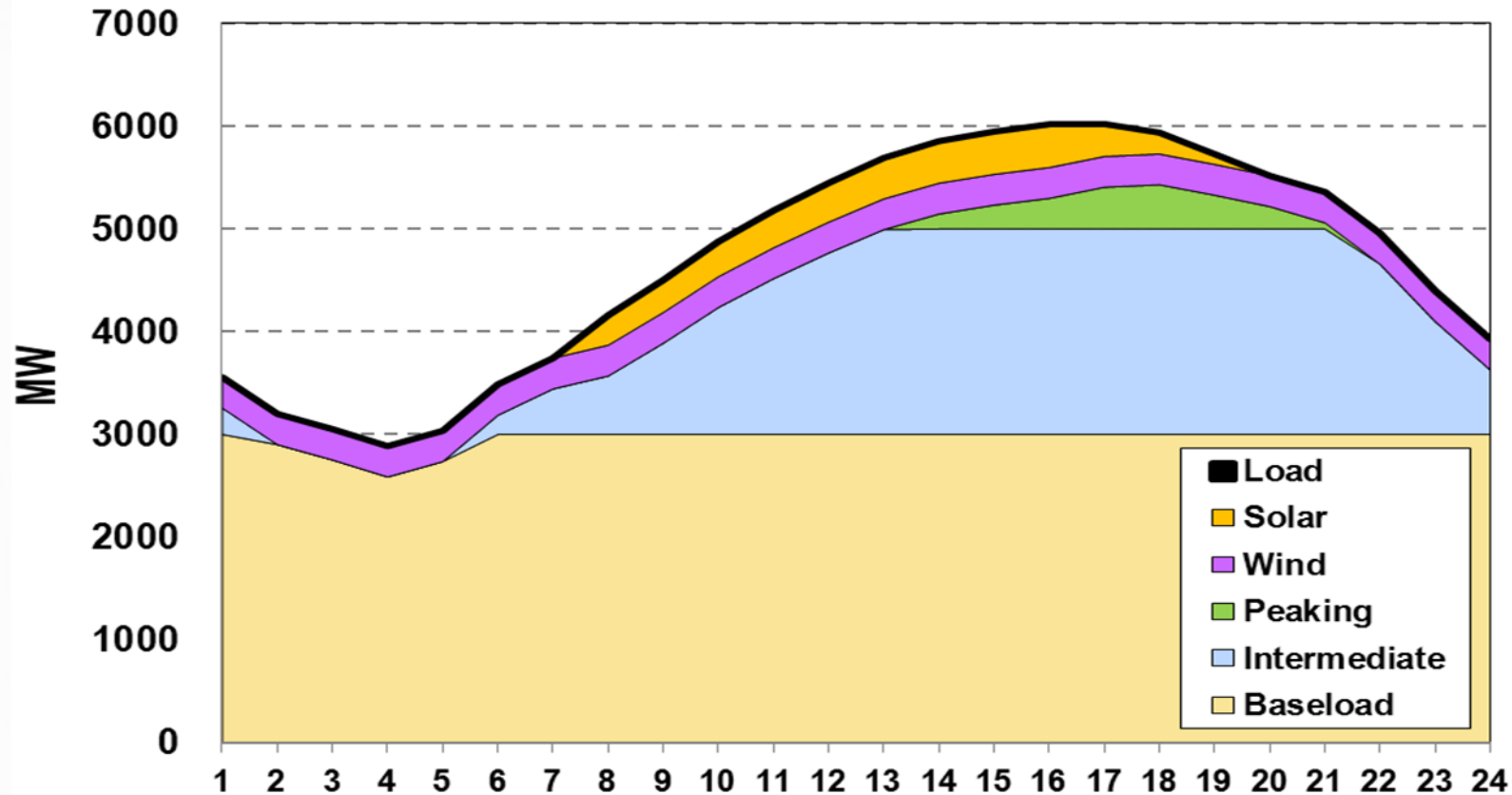
Resources Overview

- Load Shapes
- Resources categories:
 - Dispatchable supply side
 - Variable supply side
 - Demand side
 - Distributed generation



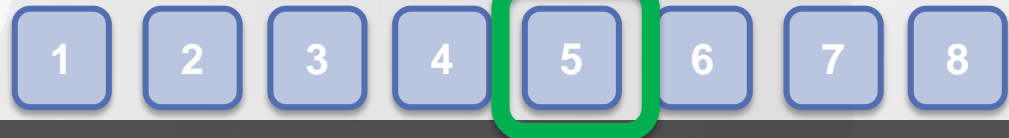
Resources – Summer & Winter Load Shapes

How a generation portfolio serves a daily load

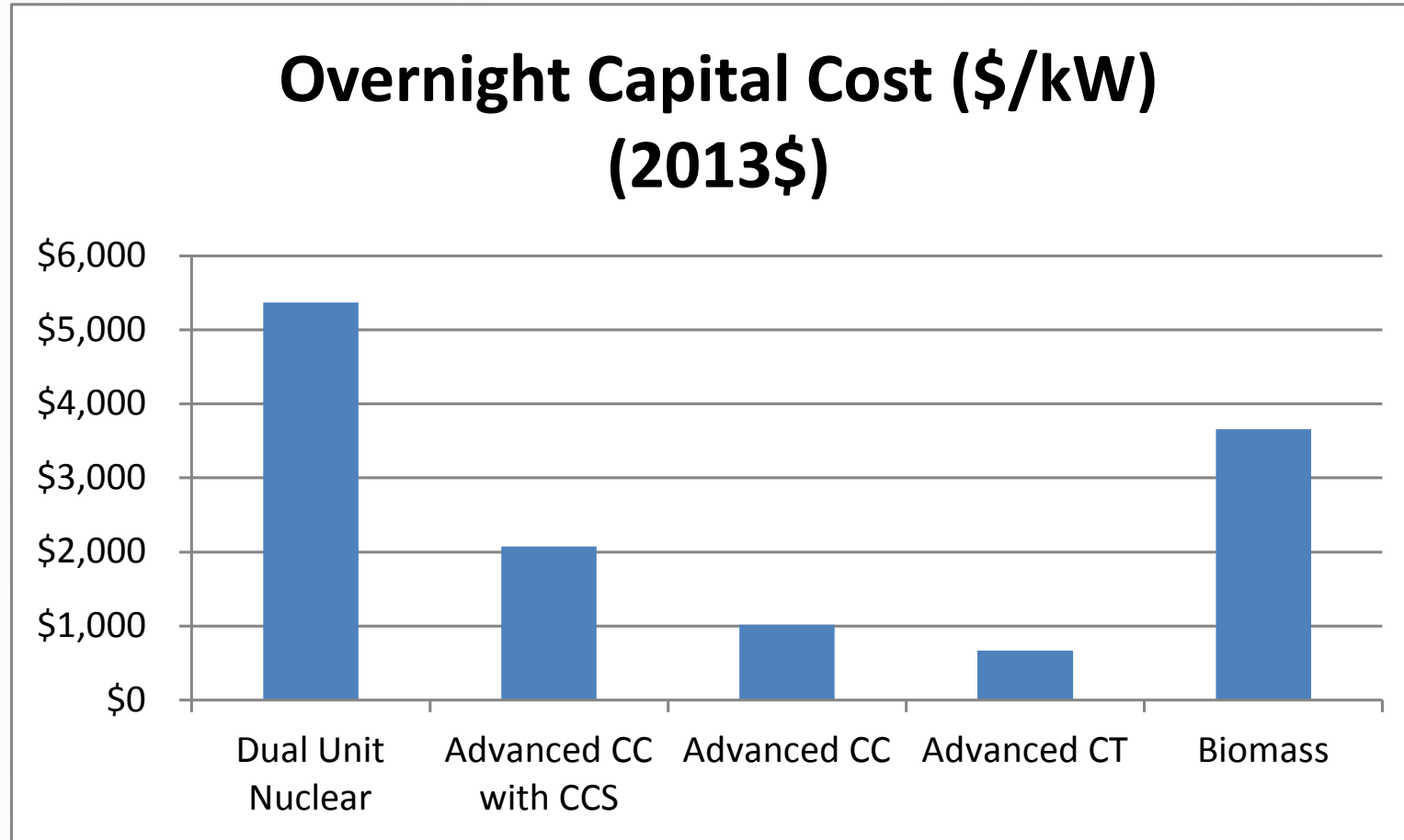


Resources Categories

- Dispatchable supply side
 - Nuclear, coal, combined cycle (CC)/ combustion turbine (CT)
 - Biomass, reservoir hydro, batteries, combined heat & power (CHP)
- Variable supply side
 - Solar & wind
 - Run of river hydro
- Demand side
 - Energy Efficiency
 - Demand Response
- Distributed Generation

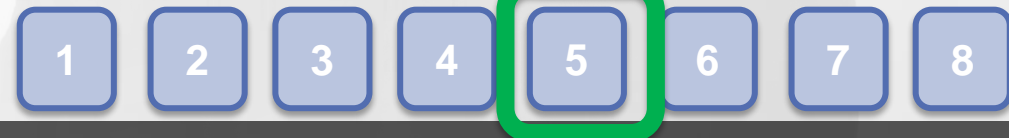


Resources – Dispatchable Supply Side

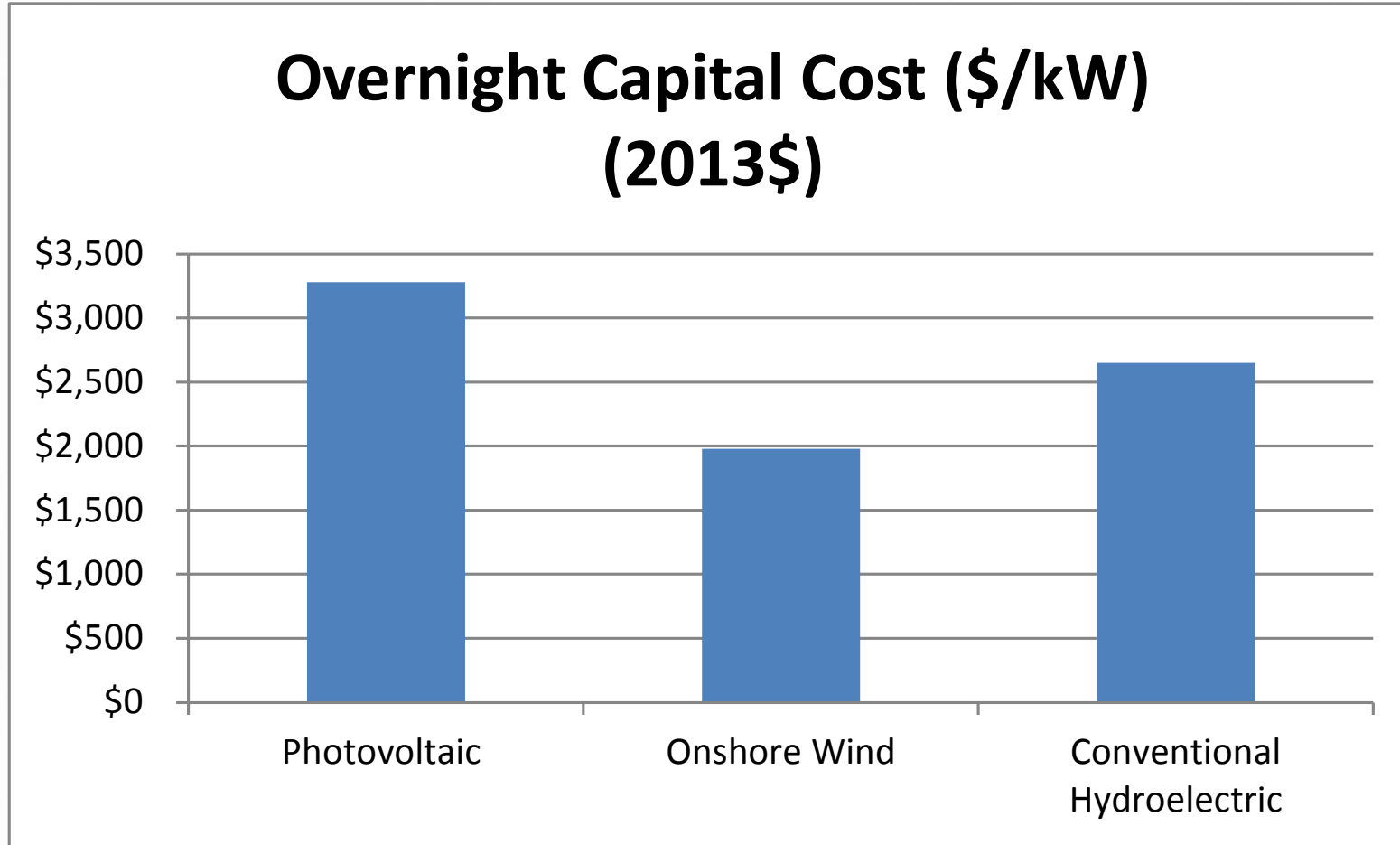


CCS: Carbon Capture and Sequestration or Carbon Capture and Storage
CC: Combined Cycle
CT: Combustion Turbine

Source: U.S. Energy Information Administration | Assumptions to the Annual Energy Outlook 2015



Resources - Variable Supply Side

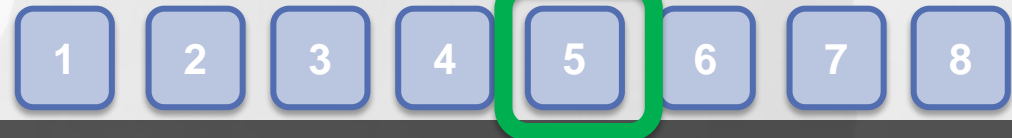


Source: U.S. Energy Information Administration | Assumptions to the Annual Energy Outlook 2015



Resources – Demand Side (Energy Efficiency)

- Resource Description
 - EE is not a single resource but rather a collection of hundreds of different measures such as lighting, appliances or motors
- Typically,
 - EE is incorporated into the load forecast implicitly
 - EE levels are frequently described in terms of
 - Technical potential
 - Economic potential
 - Achievable potential
- There are various methods to model DSM/EE
 - Indiana Utilities will address this within their IRP Stakeholder Meetings



Resources – Demand Side (Energy Efficiency)

- Resource Description

- EE can be incented by the utility, but frequently requires an action by the customer
 - Participation is less than what purely economic behavior would suggest

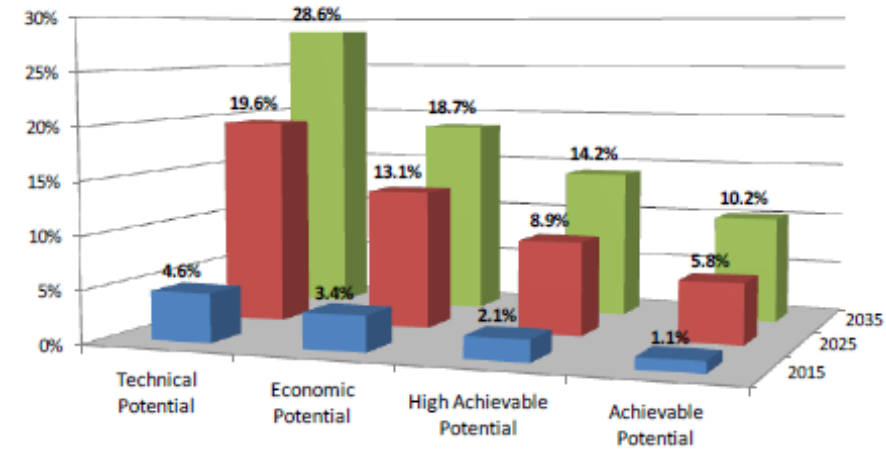
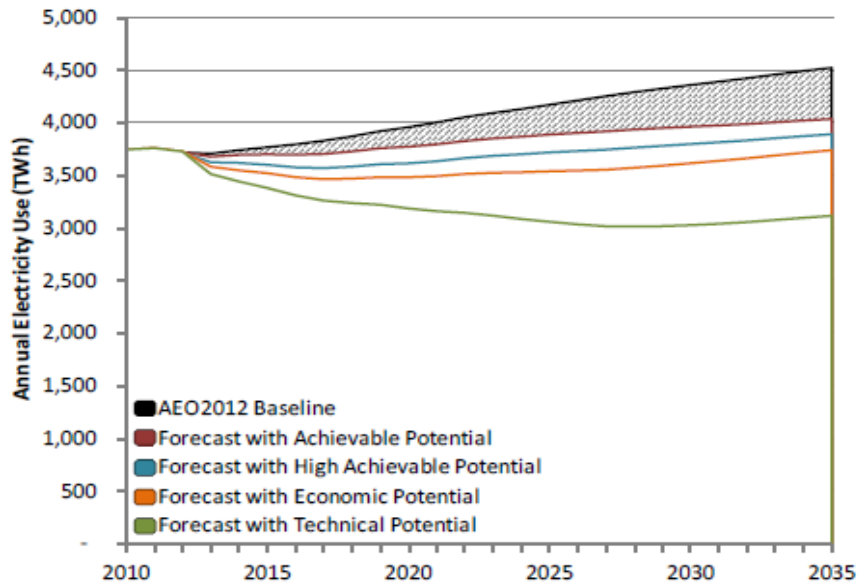


Figure 12
U.S. Summer Coincident Peak Demand Reduction

Resources – Demand Side (Demand Response)

- Resource Description
 - Demand Response (DR) is a resource used to reduce peak load by one of these options:
 - Customers agreeing to load curtailment in exchange for an option, e.g. Air Conditioning Load Management (ACLM) or industrial curtailment
 - Calling upon customer-owned generation
 - Utility modifies system operating parameters, e.g. Conservation Voltage Reduction or Volt/VAR Optimization



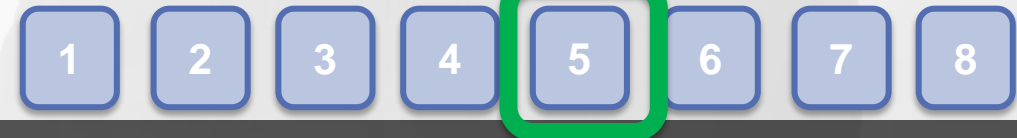
Resources – Demand Side (Demand Response)

Benefits

- Capacity value in RTO market
- Opportunity for customers to lower bill in exchange for agreeing to load curtailment
- Useful in peak shaving or shifting
- May include EE benefits too

Challenges

- Unique Evaluation Measurement & Verification (EM&V) requirements
- Higher use of DR may drive customers away from program
- Incremental DR capacity gets increasingly expensive
 - Higher payments are needed to incent new participants and that higher rate also gets paid to all participants and drives up the cost of incremental DR



Resources – Distributed Generation

Resource Description: Distributed Generation are resources connected on distribution circuits. Examples include solar, wind, combined heat and power (CHP), and energy storage.

Benefits

- Avoided line losses/T&D expenses
- Less “chunky” resource additions
- Potential customer specific reliability improvements
- Customer choices
- Reduced emissions

Challenges

- System operations
 - Dispatch-ability
 - Intermittency
- Interconnection issues
- Loss of economies of scale

