"Futures" Development

EASTERN INTERCONNECTION STATES PLANNING COUNCIL

(EISPC)

March 26, 2010

Context for Presentations

- Engineering staffs from ISO-NE, Midwest ISO, PJM, and SPP were asked to assist in presenting general information about transmission studies, and how the elements of the EISPC project plan relate to long term transmission studies
- The presentations are meant to be generic in nature to provide basic understanding of inputs and outputs to be considered in transmission studies, and in developing "Futures" for use in scenario analyses
- The presentations are not on behalf of the EIPC, nor do the concepts represent the specific process described in the EIPC's proposal in response to the DOE-FOA
- Because there are regional differences, the presentations are not intended to describe the specific regional planning processes of any of the presenters

Topics to be Covered

- Purpose
- Definitions
- “Futures”
- Variables
- Resource expansion model
- Summary

PURPOSE

Purpose of this Presentation

- Give a high level overview of “futures” development
- Identify key policy decision points
  - Identified with 
- Identify assumptions that may need to be considered in developing “futures” for use in scenario analyses

DEFINITIONS

Definitions

- What is a “future”?
  - An outline of a supposed sequence of events that provide guidance to the definition of the variable assumptions to be modeled
- What is an assumption?
  - A value which may or may not change from “future” to “future”

“Futures”

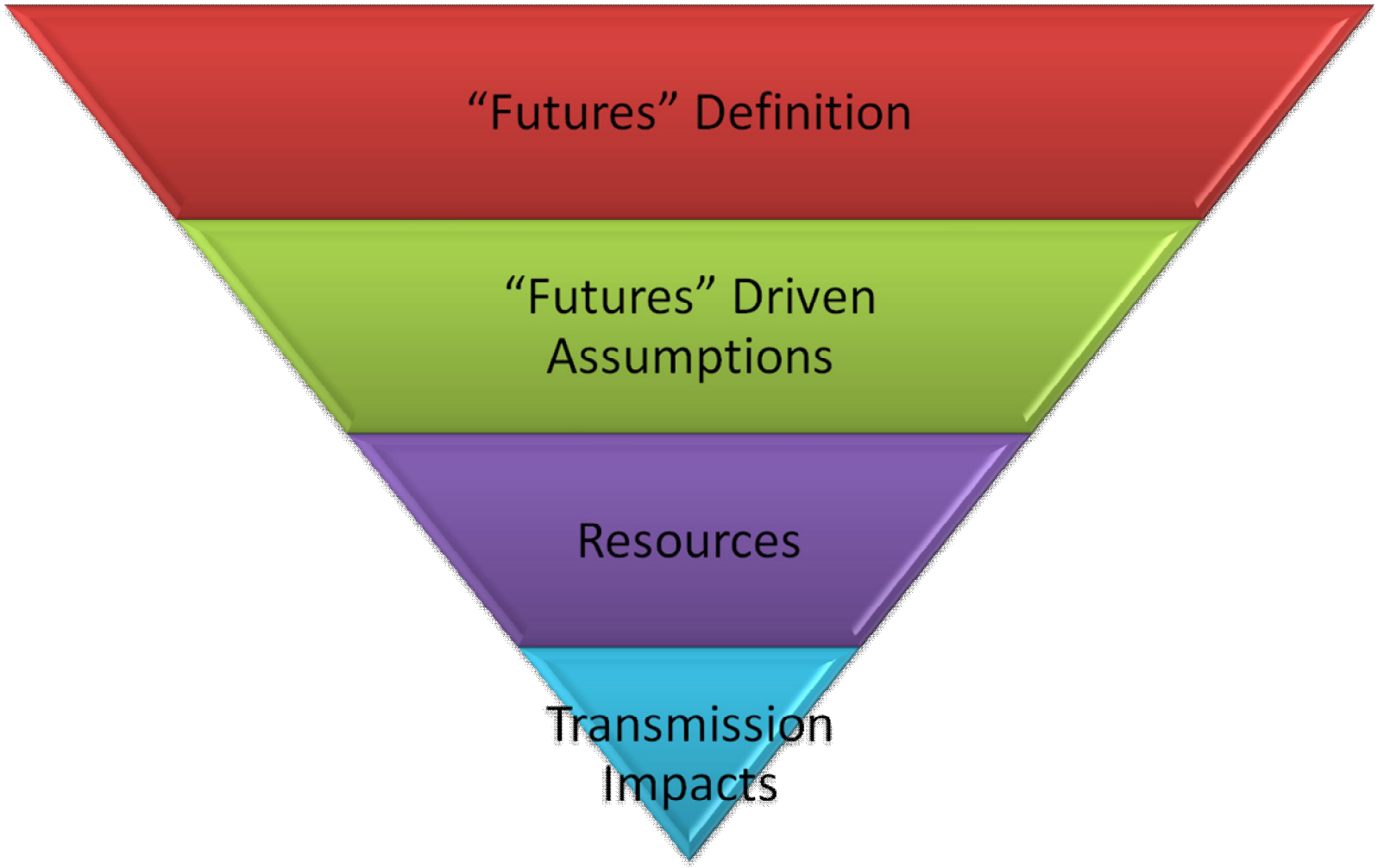
Why “Futures”

- Future is uncertain
- Shows effect of potential policy decisions
- Demonstrates extent of strategic flexibility

“Futures” vs. Sensitivities

- “Futures”
  - Model impact of policy decisions
  - Requires the ability to project the inter-relationship between variable assumptions
  - More than one variable may change between “futures”
- Sensitivities
  - Test of specific variable assumptions
  - Only one or small set of assumptions will change per run
  - Only considers the impact of a small number of changed variable assumptions at a time

“Futures” Trickle-Down



“Futures” Definition Drivers

- Potential policy shifts
  - Carbon Constraints
  - National renewable energy policy
  - Other environmental policies
- Overall energy strategy
  - Resource expansion
  - Electric Vehicle expansion
  - Demand-side resources
  - Retirement/Repowering of Units
  - Other new technologies (smart grid, energy storage)

“Futures” Definition Drivers

- Other
  - Economy driven changes in energy consumption
  - Technology advancements
  - Location of future resources
  - Regional coordination

Sample “Futures”

- Business as Usual (BAU)
  - The future is based on current policy and no external factors that would impact assumptions different from today’s knowledge
- Federal RPS
  - Models a policy change that would require meeting a specific energy requirement to be met with renewables on a national level
- Carbon Constraint
  - Models a penalty for carbon production within the resource fleet.
- Smart Grid Application
  - Models the ability to manage energy usage by time that would result in reducing peaking hour demand requirements while maintaining energy usage (shift hourly usage from on-peak hours to off-peak hours, flattening the demand curve)
- Energy Efficiency
  - Changes in expected load growth due to reduced energy usage or distributed resources
- Energy Storage
  - Large scale or distributed energy storage penetration
- Combinations of the above

Assumptions

2 Types of Assumptions

- Static Assumptions
  - Once defined, the values do not change from “future” to “future,” except for sensitivity analysis
- Variable Assumptions
  - The values can change from “future” to “future”, and reflect the definition of a “future” being modeled
- Definitions of variables are to be addressed during the EISPC current work plan
- Some variables are straight forward and are easily defined. However, some may be more difficult and require additional analytical work

Sample Assumptions

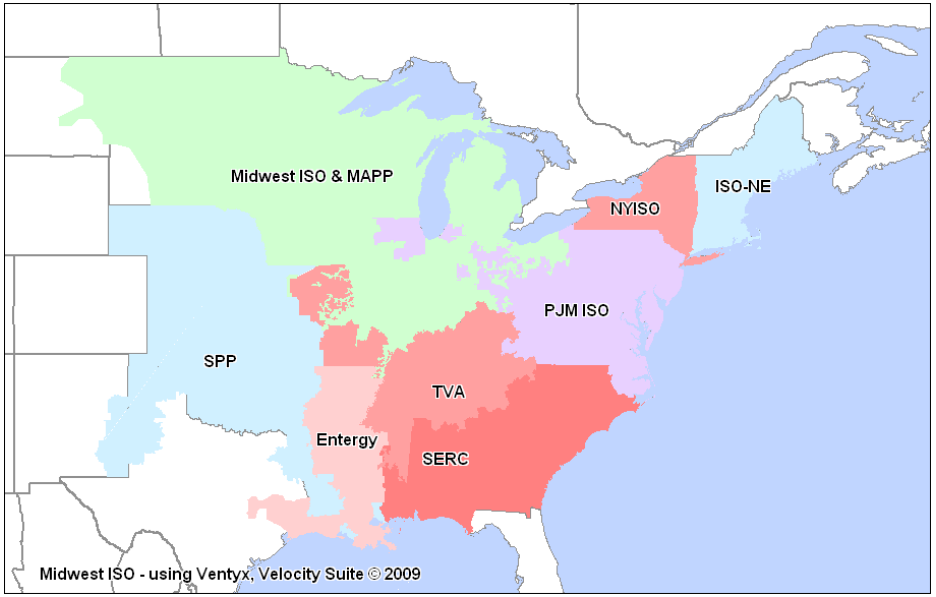
- Study period
- Modeled regions
- Demand & Energy
- Demand Response & Energy Efficiency
- Resource information (existing and new)
- Renewable Portfolio Standards application
- Financial
- Reserve margins
- Fuel prices
- Environmental constraints
- Location of resources

Study Period

- Resource expansion modeling can look at a range of years
- Detailed production cost modeling, as well as reliability modeling can be built for a defined year or years

Modeled Regions

- Model limitations may require regional groupings to meet software constraints
- To the right is an example



Demand & Energy

- Starting point
- Growth Rates
  - Rates vary by region and potentially sub-region
  - Important driver in “futures” outputs
  - Must be aware if demand response and energy efficiency are included in load projections or are considered a separate item

Demand Response & Energy Efficiency

- Can be modeled as a separate assumption
- Make sure that programs and growth are not double counted through demand and energy growth projections
- For modeling of programs, it is important to know:
  - Costs
  - Maximum penetration levels
  - Retention capability of programs
  - Operational profiles

Resource Information

- Existing fleet
- Future fleet
  - Assumptions provided by stakeholders and policy makers
  - Application of Interconnection Queues
  - Resource expansions based on modeling results
- Retirements (licensing, aging, environmental)
  - Known
  - Assumptions provided by stakeholders and policy makers
  - Modeling results
- Technology assumptions
  - Wind
  - Solar
  - EE/DR

Resource Information

- Resource parameters 
  - Capital costs for new resources
  - Fixed O&M
  - Variable O&M
  - Unit Maintenance
  - Forced Outage Rate
  - Fuel Cost
  - Rate of emissions
  - Other

Renewable Portfolio Standards

- Assumption on existing and future state law application
- Federal law application
- Level and type of renewable resource expansion can further define assumptions

Electric Market Overview: Renewables

Federal Energy Regulatory Commission • Market Oversight @ FERC.gov

Renewable Energy Portfolio Standards (RPS)

29 States including D.C. have an RPS

WA: 15% by 2020

OR: 25% by 2025; small utilities 5-10%

ID: Priority to DR, EE, and in-state RE

CA: 20% by 2010; goal: 33% by 2020

NV: 20% by 2015; solar 5% per year

UT: 20% by 2025

CO: 20% by 2020; co-ops & munis 10%; includes 4% solar

AZ: 15% by 2025; includes 30% DG

NM: 20% by 2020; co-ops 10%

TX: 5,880 MW by 2015; goal: 10,000 MW by 2025

HI: 20% by 2020; *proposed increase to 40% by 2030 agreed to for 2009 session*

MT: 15% by 2015

ND: 10% by 2015

SD: 10% by 2015

NE: studying RPS

KS: goal - 20% wind by 2020

MN: 25% by 2025 Xcel 30% by 2020

IA: 105 MW in RPS goal: 1,000 MW wind by '11

MO: 15% by 2021; at least 2% solar

OK: Studying an RPS

AR: Utility IRPs to include RE

WI: 10% by 2015

IL: 25% by 2025

MI: 10% by 2015, and new RE capacity: 1,100 MW by 2015

OH: 12.5% by 2025; 0.5% solar

IN: 2 bills introduced

KY: Report recommends RPS

ME: 40% by 2017 goal: 3 GW wind by 2020

NH: 23.8% BY 2025

VT: 25% by 2025

MA:15% by 2020; two goals: 250 MW solar 2017; 2 GW wind 2020

RI: 16% by 2019

CT: 23% Class I/II by 2020 4% Class III by 2010

NY: 25% by 2013

PA: 8% Tier I, 10% Tier II by 2020; 0.5% solar set-aside

NJ: 22.5% by 2020; 2% solar

DE: 20% by 2019, with 2% solar

DC: 20% by 2020, with 0.4% solar

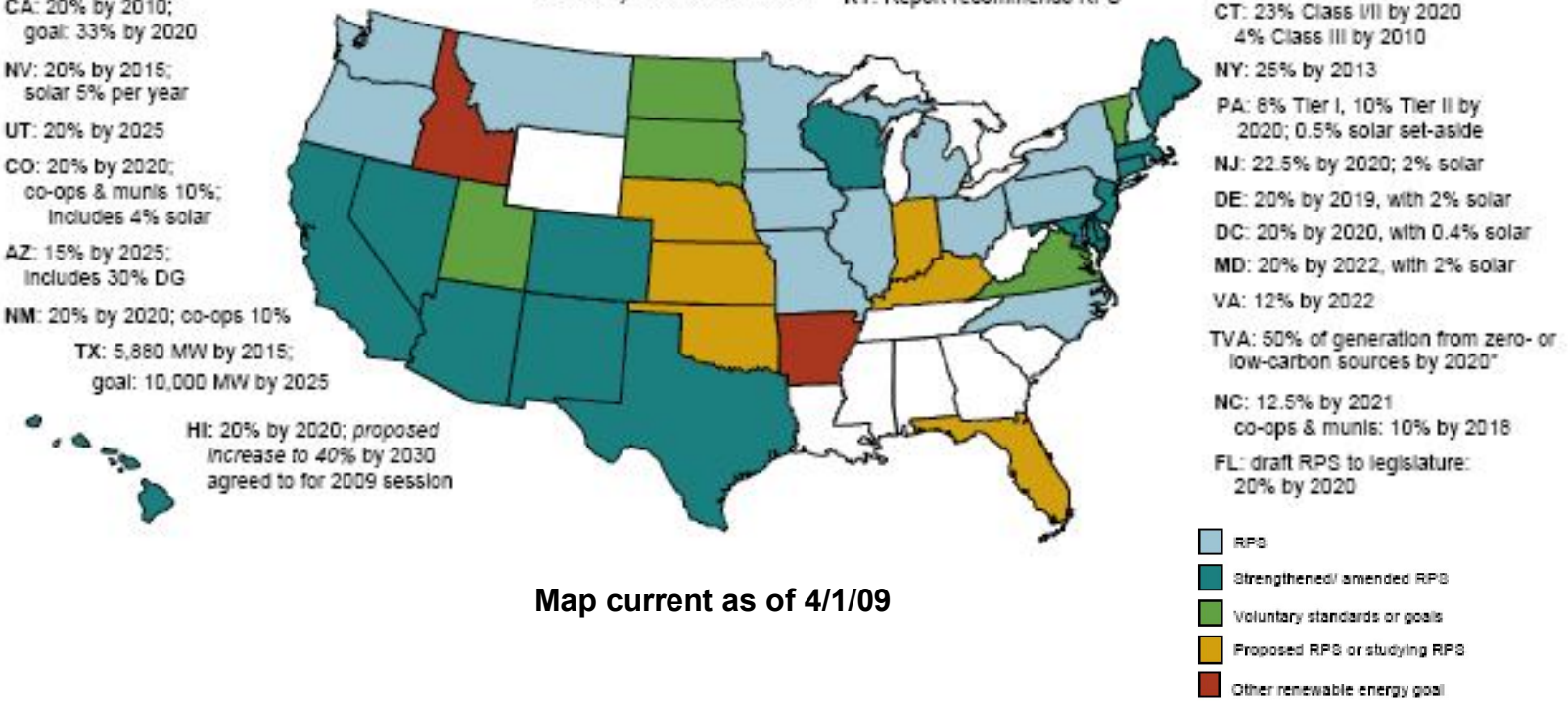
MD: 20% by 2022, with 2% solar

VA: 12% by 2022

TVA: 50% of generation from zero- or low-carbon sources by 2020*

NC: 12.5% by 2021 co-ops & munis: 10% by 2018

FL: draft RPS to legislature: 20% by 2020



Map current as of 4/1/09

Source: http://www.ferc.gov/market-oversight/mkt-electric/overview/elec-ovr-rps.pdf

Financial

- Composite tax rate
- Insurance rate
- Property tax rate
- AFUDC rate
- Rate of Return
- Cost of financing
- Discount rate
- Inflation rate 

Reserve Margins

- Reserve margins represent the resource criteria to reliably serve the demand on the system
- Reserve margins vary by region
- Reserve margins are impacted by
  - The size and operating characteristics of resources
  - Location of resources
  - Availability of resources
  - The demand coincident factors
  - Transmission capability

Fuel Prices

- The difference between fuel costs affects energy revenues and cost to load as modeled in production cost simulations
  - Energy revenues may affect resource expansion
- Assumptions drive potential results
  - Beginning costs
  - Escalation of costs over time
- Primary fuels to consider:
  - Gas
  - Coal
  - Uranium
  - Oil
  - Waste Energy/Biomass
- Important to note that fuel prices will have regional diversity based on availability and transportation costs

Environmental Constraints

- Existing legislation and potential future legislation
- Production cost models do not have feedback capability to appropriately dictate value for trading costs
  - This means assumptions must be made prior to model runs that will effectively simulate emission costs within the model
- Examples of emissions that can be modeled
  - SO_2
  - NO_x
  - Hg
  - CO_2

Environmental Constraints

- Varying ways to model emission constraints
  - Straight cost application that will affect dispatching of system
  - Cap the production of the emissions which also affects the dispatch of the system
- Constraint assumptions
  - Base year
  - Aggressiveness of reduction goals
  - Allowance cost

Locating Resources

- If modeling output of future resources is needed, then locations for the resources on the electric grid need to be identified
- This is not an easy task
- Most likely, all sites selected are wrong
- Having multiple “futures” will help mitigate the inaccuracies of each specific “future”
- It is important to have rule set established that will provide a realistic and repeatable methodology

Information to Consider

- Policy concerns
- Existing fleet locations
- Transmission lines
- Substations
- Railroads
- Natural gas pipelines
- Rivers & lakes
- Urban areas
- Class 1 lands
- Non attainment regions
- Wind areas by class

Sample Assumptions

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Bringing it All Together, A Sample

	Variable Assumptions																													
	Resource Information														Demand and Energy		Fuel Information				Emission Constraints				Financial			RPS	
"Futures"	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption
Generic Future 1	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
Generic Future 2	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
Generic Future 3	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
Generic Future 4	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
Generic Future 5	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
Generic Future 6	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V

The “V” would represent specific values associated with each assumption that fits into the definition of the “futures” defined

SUMMARY

Wrap-up

- “Futures” provide context to assumptions development
- Assumptions dictate resource expansions and locations that drive transmission evaluation impacts
  - Long term transmission needs are impacted by long term resource expectations
- Future scenarios of EISPC process guide expectations of future resources which in turn guide options for future transmission