Regional Transmission Planning in the East

State-Federal RPS Collaborative Webinar
Hosted by Clean Energy States Alliance
October 6, 2011

Clean Energy States Alliance

State-Federal RPS Collaborative

- With funding from the Energy Foundation and U.S. Department of Energy and the National Renewable Energy Laboratory, the Clean Energy States Alliance has established and facilitated, over the last three years, a **state-federal RPS collaborative**.
- Includes **state RPS administrators and regulators**, **federal agency representatives**, and other RPS stakeholders.
- Goal is to advance dialogue and learning about RPS programs by **examining the challenges and potential solutions** for successful implementation of state RPS programs, including **identification of best practices**.

Clean Energy States Alliance

Presenters

David Whiteley, Executive Director, Eastern Interconnection Planning Collaborative (EIPC)

Marya White, Executive Director, Eastern Interconnection States' Planning Council (EISPC)

Steve Gaw, Consultant, The Wind Coalition

Michael Goggin, Manager of Transmission Policy, American Wind Energy Association

CleanEnergy States Alliance

Contact Information

www.cleanenergystates.org

Warren Leon
Phone: 978-317-4559
Email: WLeon@cleanegroup.org

CleanEnergy States Alliance

CLEAN ENERGY. LET'S MAKE MORE.®

Eastern Interconnection Planning Collaborative

Eastern Interconnection Planning Collaborative (EIPC) Update

RPS Webinar: Regional Planning in the East
Sponsored by CleanEnergy States Alliance

October 6, 2011

EIPC History

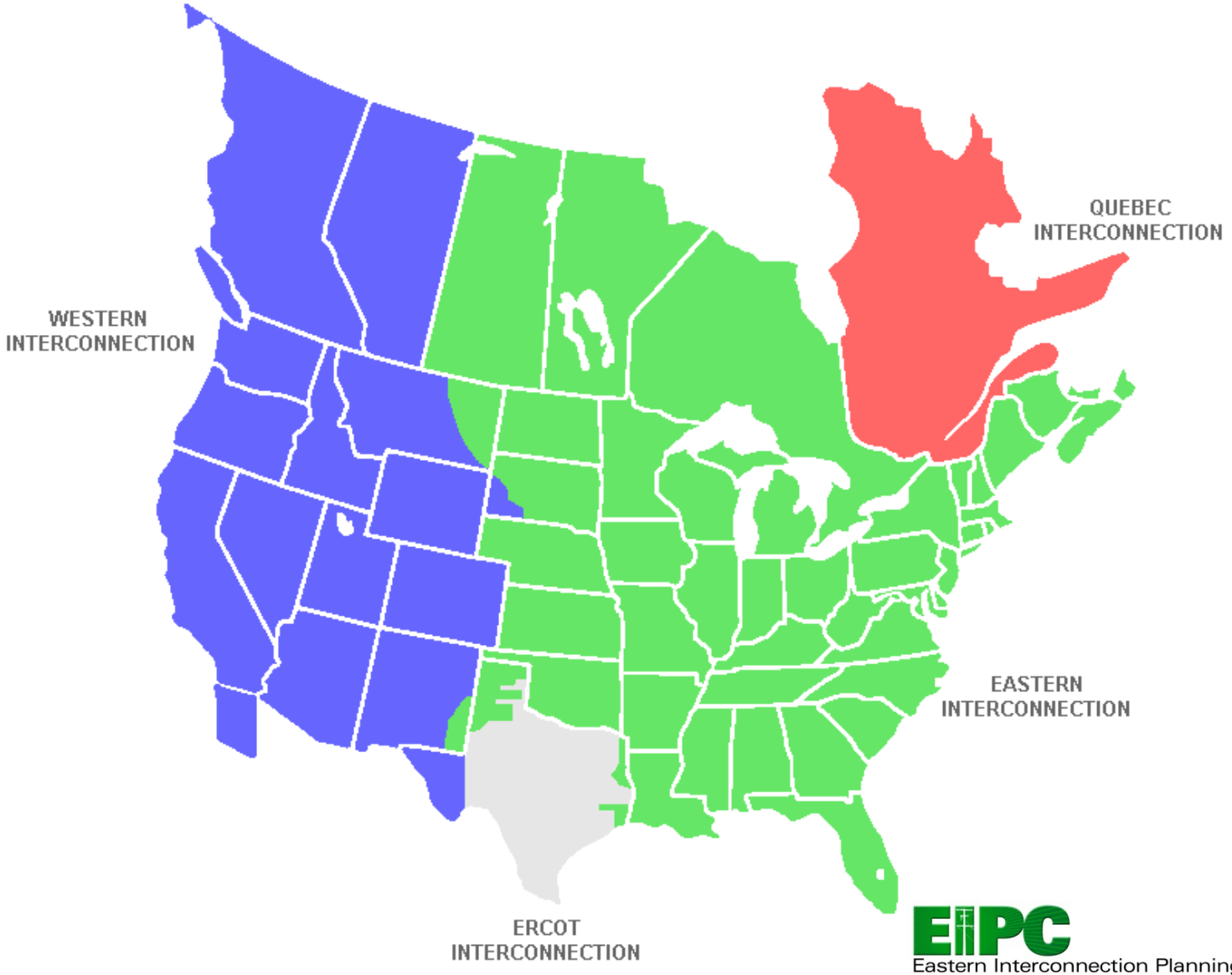
- Idea born in early Spring, 2009
  - Began through discussions between regional Planning Authorities
- Structure solidified in early Summer, 2009
- 26 Planning Authorities signed (U.S. and Canada)
  - Approximately 95% of the Eastern Interconnection customers covered

What are the Objectives of the EIPC?

1. Integration and analysis of approved regional plans – aka “The Roll-Up”
2. Development of possible interregional expansion scenarios to be studied
3. Development of interregional transmission expansion options

The EIPC is committed to an open and transparent process that uses a roll-up of regional plans as a starting point and is consistent with FERC Order 890 principles.

Four North American Interconnections



EIPC
Eastern Interconnection Planning Collaborative

DOE Interconnection Studies

- EIPC applied for funding of interconnection-wide studies in September, 2009
- **DOE funding (award) in place - $16M**
- DOE funding also in place for the Eastern Interconnection States' Planning Council (EISPC) - $14M
- Awards also made for WECC and ERCOT

Principles and Objectives

- Open and transparent processes
- Stakeholder input from all industry sectors
- Application of existing expertise from the regional planning authorities to interconnection-wide analyses
- Consistent with FERC Order 890 principles
- Stakeholder process for input and strategic guidance
- Development of interregional resource expansion scenarios to be studied
- Development of interregional transmission expansion options

Process Development and Results

- New stakeholder process to provide input and strategic guidance to the studies
- Roll-up and integration of regional plans for 2020
- 8 Macroeconomic resource expansion “futures”
  - Input assumptions determined by states/stakeholders
  - Up to 9 sensitivities of input variables on each “future”
- 3 Future scenarios with fully developed transmission build-out options that meet reliability requirements
- 2 Project reports – December, 2012 and December, 2013

We have come a long way …

- The stakeholder process is functioning in a robust and active manner
  - Consensus based
  - Active and intense dialog
- The interface with the states (EISPC) is operating smoothly
- Consensus reached on Phase I studies
- Phase I analysis nearing completion

Resource Expansion Futures

1. "Business as Usual"
   - This Future assumes that present trends continue into the future based on historical indices
2. Federal Carbon Constraint: National Implementation
3. Federal Carbon Constraint: Regional Implementation
4. Aggressive Energy Efficiency, Demand Response, Distributed Generation and Smart Grid
5. National RPS: National Implementation (top down)
6. National RPS: State and Regional Implementation
7. Nuclear Resurgence
8. Combined Federal Climate and Energy Policy Future

Example Results – Future 6

- In F6B relative to F5B, on-shore wind decreases in MISO and SPP and increases in PJM_ROR.
- In F6S1 relative to F6B, wind builds move from SPP_N to SPP_S and NE F5S1 & F5S2, wind moves toward the "better" locations in SPP to meet the same RPS targets

	Cum New Builds in 2030					Cum New CCs in 2030					Cum New On-Sh Wind 2030				
	F1S3	F5B	F5S2	F6B	F6S1	F1S3	F5B	F5S2	F6B	F6S1	F1S3	F5B	F5S2	F6B	F6S1
	BAU Base	Nat RPS	25% Soft	Reg RPS	25% Soft	BAU Base	Nat RPS	25% Soft	Reg RPS	25% Soft	BAU Base	Nat RPS	25% Soft	Reg RPS	25% Soft
ENT	4	4	1	2	2	3	0	0	1	1	0	2	0	0	0
FRCC	16	10	10	9	9	13	7	7	4	4	0	0	0	0	0
IESO	5	5	5	5	5	1	1	1	1	1	2	2	2	2	2
MAPP_CA	2	5	5	5	5	2	0	0	0	0	0	0	0	0	0
MAPP_US	2	7	6	8	8	0	0	0	0	0	1	7	6	7	7
MISO_IN	5	20	1	1	1	4	0	0	0	0	0	19	0	0	0
MISO_MI	3	3	3	3	3	0	0	0	0	0	3	3	2	2	2
MISO_MO-IL	2	20	3	3	3	0	0	0	0	0	0	18	0	0	0
MISO_W	9	40	7	17	17	0	0	0	0	0	9	40	7	17	17
MISO_WUMS	10	13	19	14	14	4	0	0	0	2	1	5	1	1	1
NE	1	15	64	1	1	0	0	0	0	0	0	15	64	0	3
NEISO	9	9	8	9	9	2	2	2	2	2	5	5	4	5	5
NonRTO_Mid	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
NYISO_A-F	4	7	4	4	4	1	1	1	1	1	4	6	3	3	3
NYISO_G-I	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
NYISO_J-K	3	2	2	3	3	1	1	1	1	1	0	0	0	0	0
PJM_E	7	7	7	16	16	5	5	5	5	5	1	1	1	1	1
PJM_ROM	12	6	12	14	14	2	2	2	2	2	7	1	7	7	7
PJM_ROR	20	27	17	61	61	8	3	3	3	3	9	20	10	54	54
SOCO	10	8	8	14	14	8	5	5	5	5	0	0	0	0	0
SPP_N	3	28	30	14	14	2	0	0	0	0	0	28	29	13	4
SPP_S	8	43	58	26	26	2	0	0	0	0	3	41	56	24	30
TVA	8	8	8	10	10	4	2	4	1	1	0	0	0	0	0
VACAR	20	19	19	48	48	11	10	9	3	3	4	4	4	4	4
	165	310	298	287	287	75	39	40	30	31	49	218	197	141	141

High Level Transmission Analyses

- Estimates of cost for increased inter-regional transmission capability provided by PAs
- Building block approach

Case	Total Miles of Transmission	Cost Estimate Range ($ billiion)	
		Low End	High End
Future 2	10,757	34.1	48.8
Future 3	1,171	1.7	2.7
Future 5	13,613	39.2	58.3
Future 6	650	2.1	3.1
Future 8	11,648	36.7	51.1

Phase II – Transmission Analysis

- Phase II will be conducted in 2012
- 3 Scenarios chosen by stakeholders will be analyzed:
  - The study year will be 2030
  - Transmission additions required to meet reliability standards
  - Focus on 230kV and above
  - Include a production cost run for each resulting system
  - Include an estimate of the costs for generation and transmission expansion in each scenario

Phase II – 3 Scenarios

1. National Carbon Constraint with Increased Energy Efficiency/Demand Response/Distributed Generation/SmartGrid
2. Regionally Implemented National RPS
3. "Business As Usual" – no new policies/ regulations on carbon, no new RPS, no new EPA regulations

For More Information …

Please see our website –

eipconline.com

Or email me at –

d.a.whiteley@eipconline.com

Questions and Discussion

EISPC

EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

Eastern Interconnection States' Planning Council: Formation and Future

Marya M. White

Director

Presentation to the Clean Energy States Alliance

Regional Planning in the East

October 6, 2011

EISPC

EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

Why do this now?

The United States operates on electricity.

EISPC

EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

However:

- ***Infrastructure is generally old and at capacity***
- ***New Policies & Technologies use Infrastructure differently***

EISPC

EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

In addition to the demands placed on electricity, the construction of the electricity delivery system – the "power line grid" – has not kept pace with today's demands for electricity.

Public policies regarding renewable energy use and renewable energy located far from major population centers exacerbate the issue.

EISPC

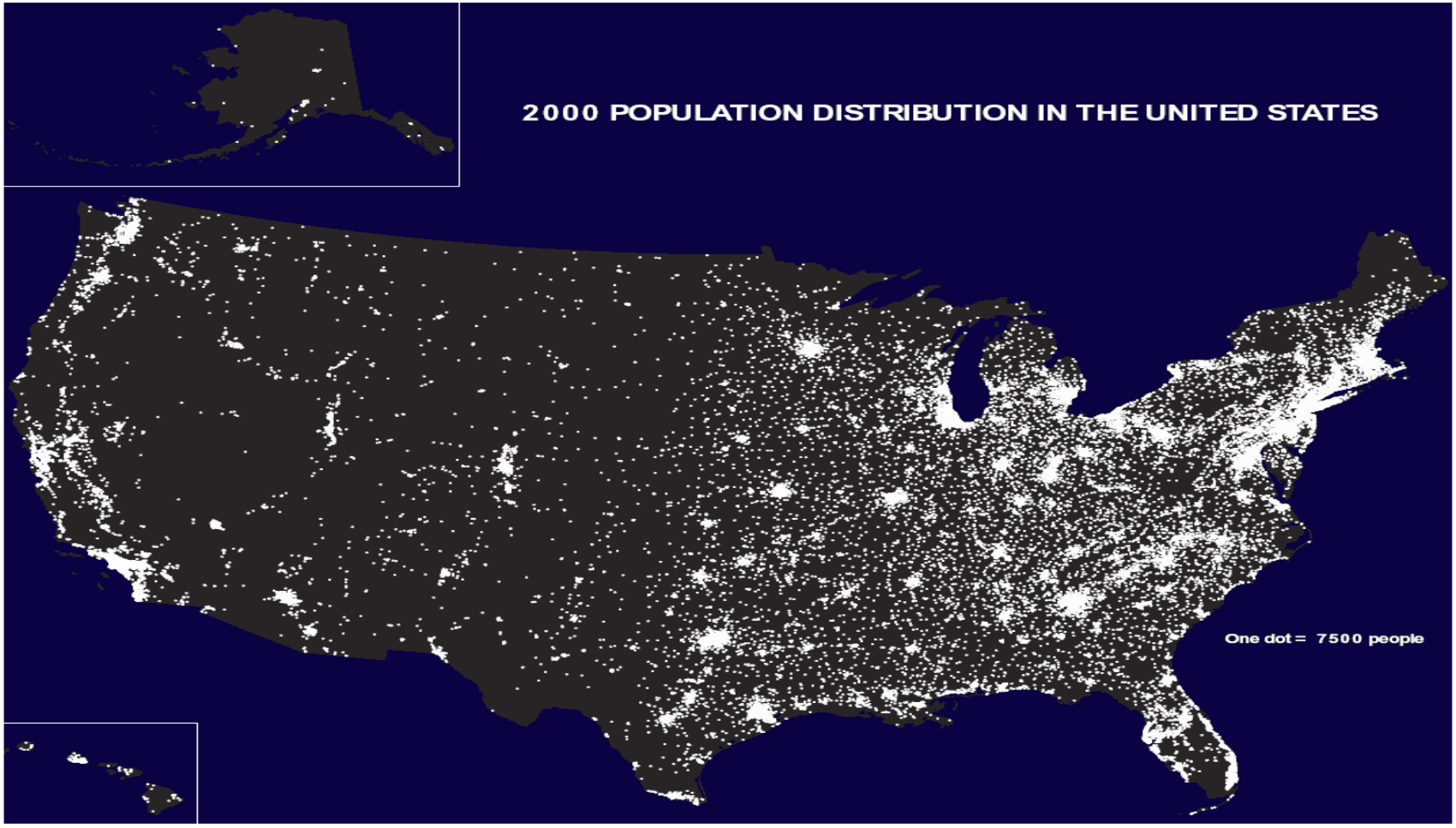
EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

Why do this now?

The U.S. Needs Electricity that is:

- ***Reliable***
- ***Economic***
- ***Environmentally Sensitive***

Population distribution in the US.

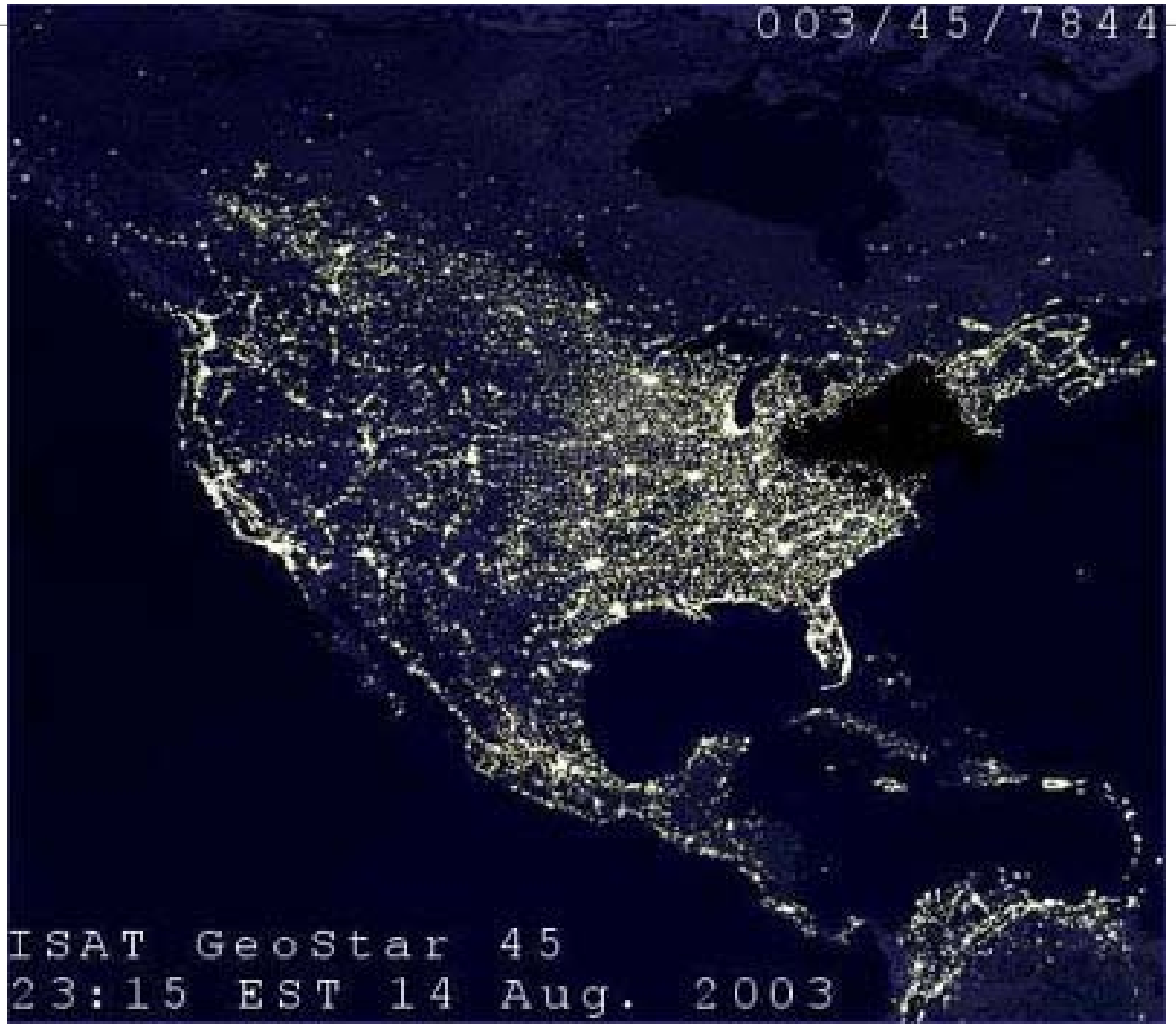


EISPC

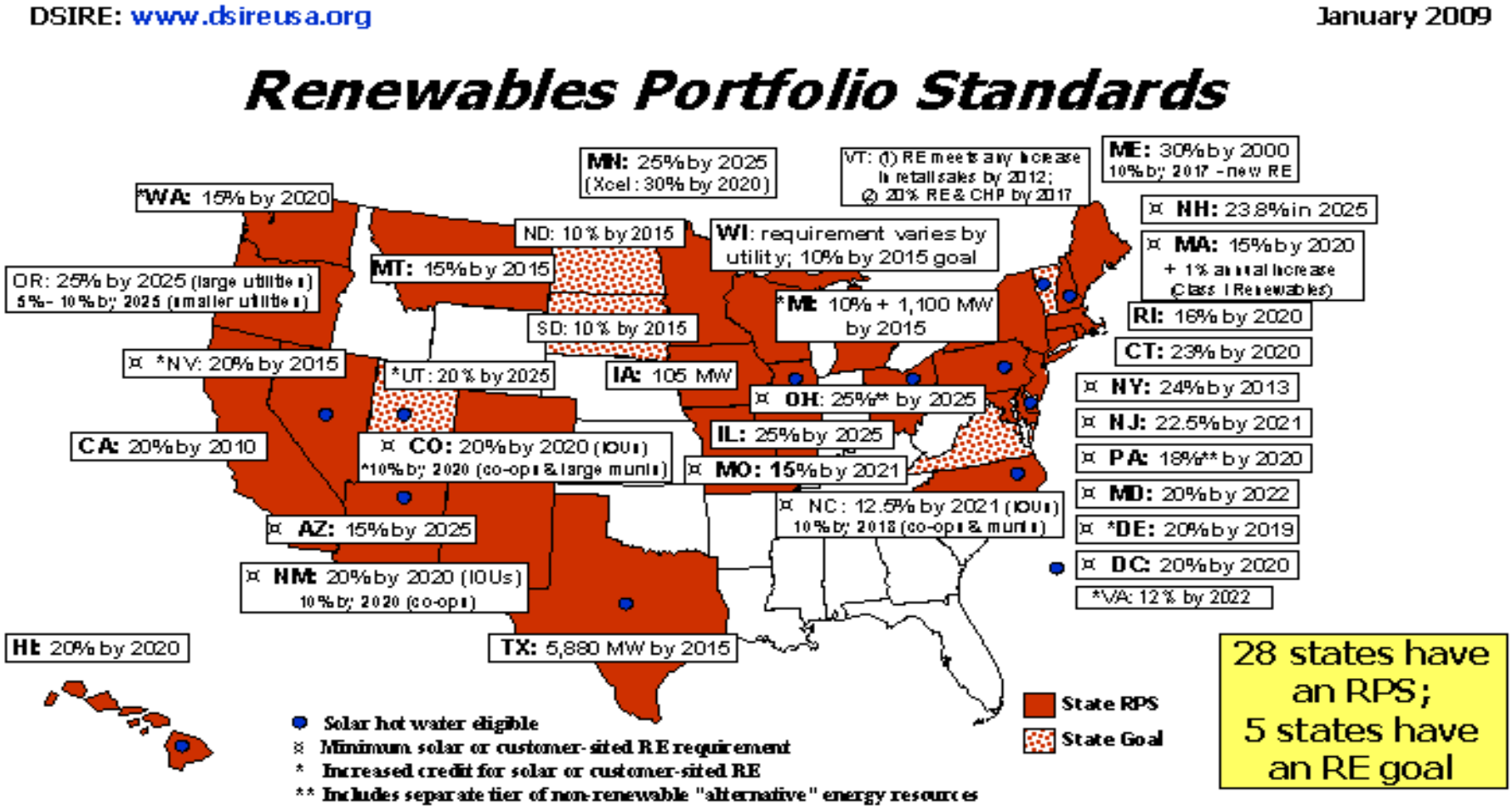
EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

Interdependence

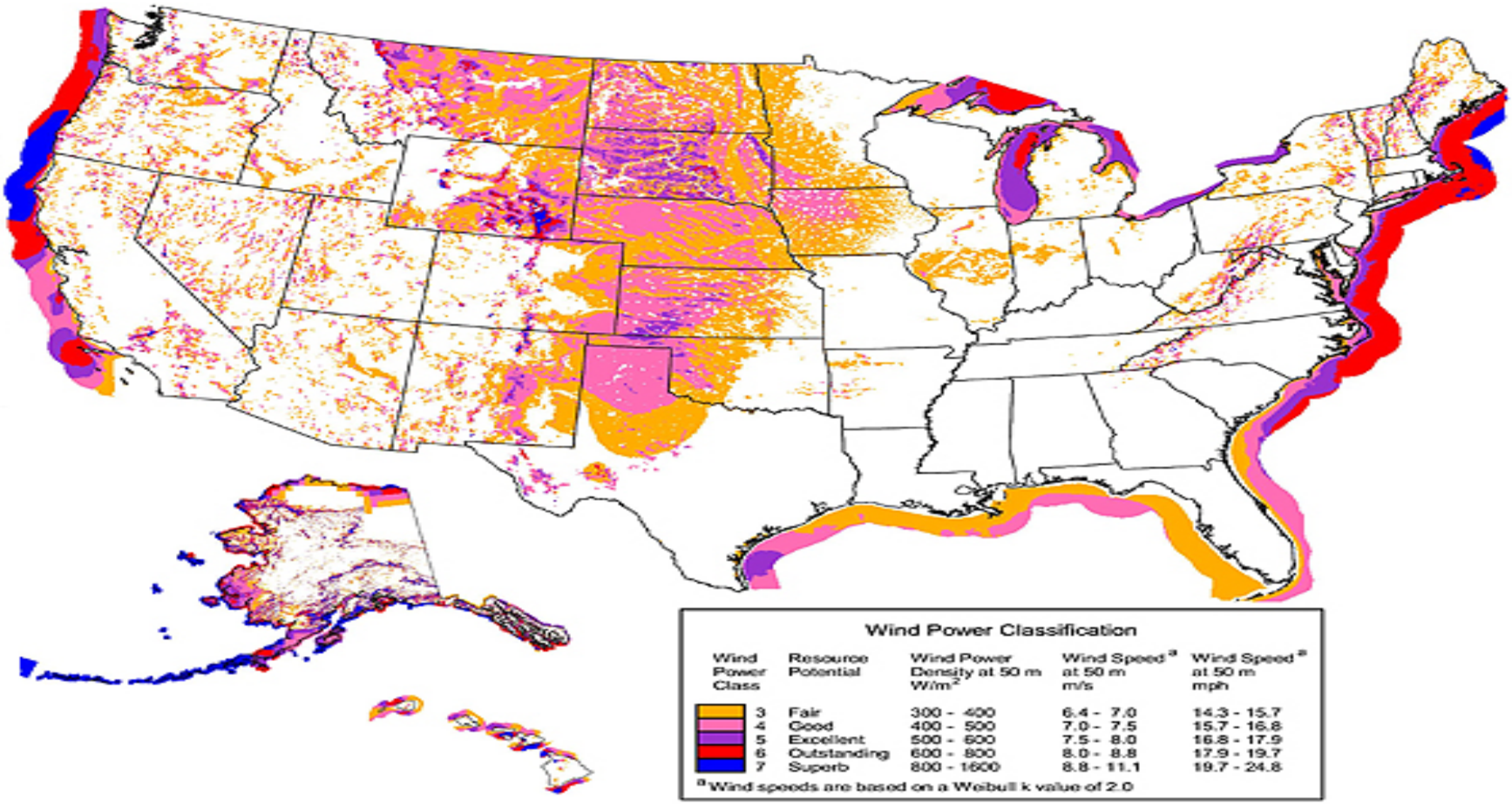
Artist Rendition of 14.8.2003 blackout, at time of voltage collapse



Renewable Requirements in the States – NOT A UNIFORM REQUIREMENT!



Wind Resources in the U.S.



EISPC

EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

The first of its kind…

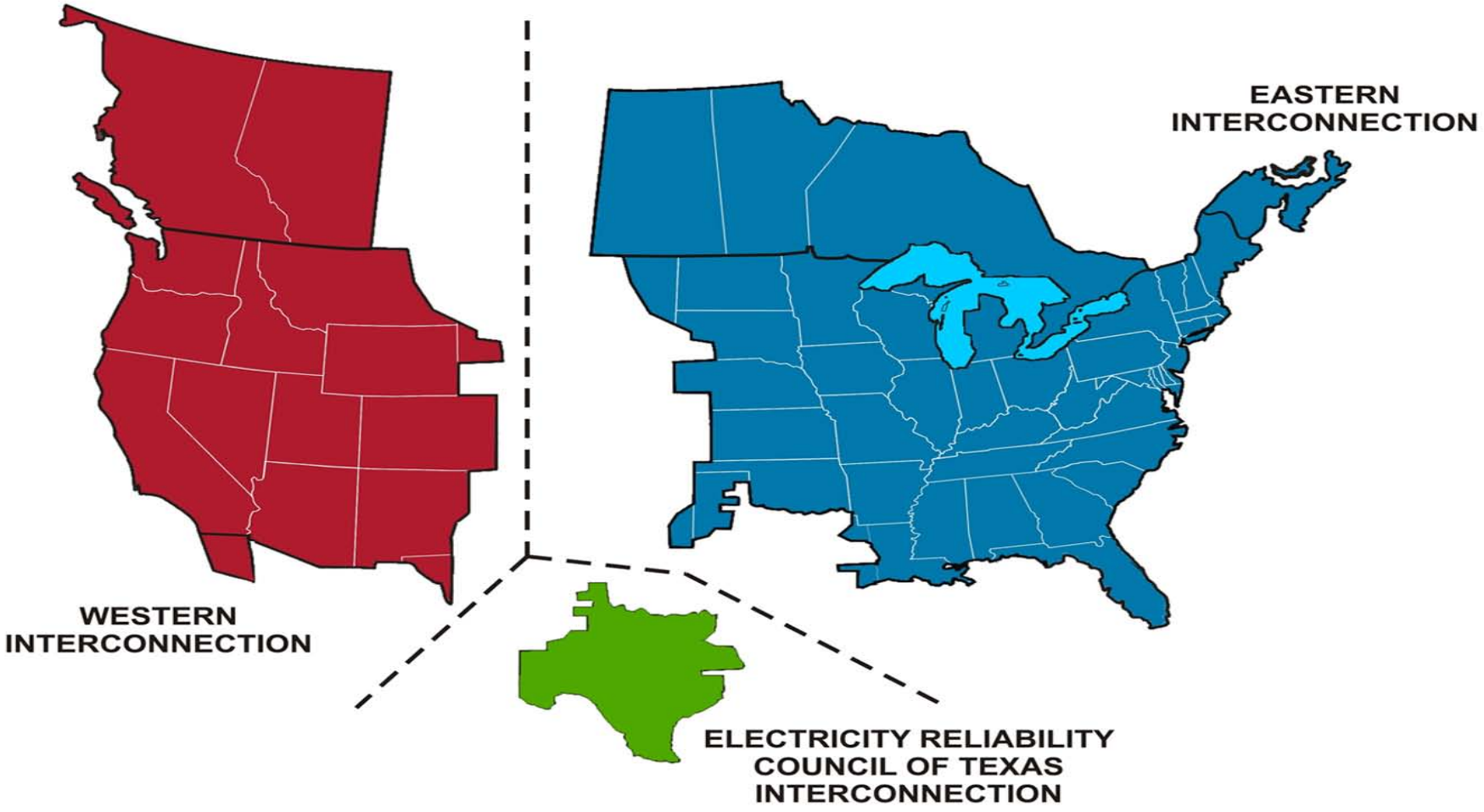
"The objective of this Funding Opportunity Announcement is to facilitate the development or strengthening of capabilities in each of the three interconnections in the lower 48 states of the United States, to prepare analyses of transmission requirements under a broad range of alternative futures and develop long-term interconnection-wide transmission expansion plans."

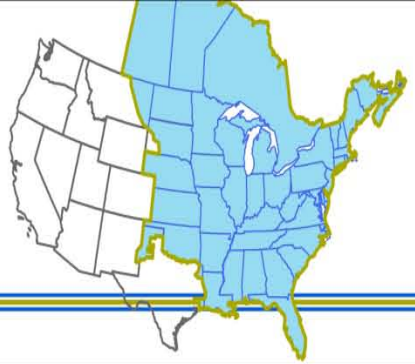
Department of Energy, Funding Opportunity Announcement DE-FOA0000068

EISPC

EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

North American Electric Reliability Corporation Interconnections





EISPC

EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

EISPC (aka "Ice Pick") – What is it?

- *Eastern Interconnection States , DC, Canada*
- *2 Representatives per State*
- *Interconnection-wide Resource Planning*
- *Interconnection- Wide Transmission Planning*
- *1/3 of Stakeholder Steering Committee*
- *Studies and Whitepapers*

EISPC

EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

TWO TEAMS IN PLANNING EFFORT

Engineering Team (EIPC)

- Planning Authorities =
  - Regional Transmission Organizations (RTO)
  - Transmission Owners
- Run models and prepare the transmission plans
- Stakeholder Committee – provides strategic advice

Policymakers Team (EISPC)

- State representatives—Commissioners, Governors' Reps., SEOs, Environmental Agencies
- Provide inputs to modelers through Stakeholder Committee
- Conduct Studies
- Prepare Whitepapers

EISPC

EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

EISPC TASKS

1. **Coordinate with SSC and EIPC Engineering Team**:
   - ***Identify 8 hypothetical Futures/72 Sensitivities***
   - ***Select 3 hypothetical Scenarios for grid design***
   - ***Provide input on grid planning and design***
   - ***Participate in the Stakeholder Steering Committee***
2. **Conduct Studies to Inform Future Transmission Actions and State Decision-Making (including a study of Energy Zones in the States in the EI)**
3. **Prepare Whitepapers to Inform Decision-Making**

EISPC

EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

Eight Futures+72 Sensitivities= 80 Transmission Scenario Options

1. **Business as Usual**
2. **Carbon Policy –Top-Down Implementation**
3. **Carbon Policy –State/Local Implementation**
4. **Aggressive EE/DR/DG/Smart Grid**
5. **Federal RPS – National Implementation**
6. **Federal RPS – State/Regional Implementation**
7. **Nuclear Resurgence**
8. **Combined Federal Climate and Energy Policy**

All Futures contain environmental components, including the EPA Rulemaking

EISPC

EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

Three Transmission Build-Out Scenarios

1. **Business as Usual (Future 1)**
2. **Combined Federal Climate and Energy Policies (Future 8)**
3. **National RPS Policy/Regional Implementation (Future 6)**

(Sensitivities from these Futures chosen to address specific variables. The three Scenarios encompass the information from the rest of the Futures.)

EISPC

EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

Studies – to Date

1. Energy Zones—State-by-State Potential
2. State-by-State Potential for DSM
3. State-by-State Potential for Energy Storage
4. State-by-State Potential for DG
5. Identify Locations for New/Uprated Nuclear
6. State-by-State Assessment of Sm. Generation
7. Assessment for Coal Development with CCS
8. State-by-State Potential for Fast-Start Gen.
9. Assessment of Other Carbon Reduction Steps
10. Assessment of Gas/Other Fuel Prices

EISPC

EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

Whitepapers – to Date

1. Energy Values Impacted Resource Selection
2. Market Structures Impacting Resource Choice
3. Financial Implications of PPAs
4. Inventory Gov. Policies Impacting Transm.
5. Incentives/Disincentives for Energy Develop.
6. PHEV: Identify Potentials and Implications
7. Evaluate Local vs. Remote Generation
8. Economic Uncertainties for emerging tech.
9. Smart Grid: Identify Potential and Impacts
10. Aspects of existing RPSs—"off ramps"
11. RPS Fuels/ Technologies Inclusions

EISPC

EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

Clean Energy Zones Study

- Mandated by DOE FOA
- Clean energy resources: Renewables, Clean Coal, Nuclear (incorporate EE/DR info)
- Identify energy resource potential in EI States
- Identify laws, policies, practices impacting States' resource development
- Results include (layered) mapping tool

EISPC

EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

Tasks Completed to Date

- **Futures/Sensitivities modeled**
- **Three Transmission "Build-out" Scenarios chosen**
- **Studies and Whitepapers Continue**

EISPC

EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

Timeline for Remaining Tasks

- **Futures/Sensitivities Report – Dec. 2011**
- **Transmission "Build-Outs" – Dec. 2012**
  - ***Selected 3 Build-Out Scenarios – Sept. 2011***
  - ***Finalize Inputs/Assumptions – Dec. 2011***
- **Studies and Whitepapers – up to Dec. 2012**

Federal Funding Ends on September 31, 2013

EISPC

EASTERN INTERCONNECTION STATES' PLANNING COUNCIL

Questions?

EASTERN INTERCONNECT PLANNING COLLABORATIVE

Renewable Generation Perspectives

Resource Expansion Futures

1. "Business as Usual"
   - This Future assumes that present trends continue into the future based on historical indices.
2. Federal Carbon Constraint: National Implementation
   - This future assumes full compliance with the Clean Air Act, Clean Water Act, and significant near term reduction in CO2 and other pollutants such as SO2, NOx, and mercury. This Future assumes congress legislates and the EPA implements regulations that result in no less than 42% reduction in CO2 by 2030 economy-wide, and 80% reductions in CO2 economy-wide by 2050.

Resource Expansion Futures

3. Federal Carbon Constraint: State and Regional Implementation
   - This future assumes the same goals as defined in Future 2, except "Super-Regions" will be designated to encourage selection of local resources first.
4. Aggressive Energy Efficiency, Demand Response, Distributed Generation and Smart Grid
   - This Future's overall energy demand is drastically reduced through energy efficiency, demand response, and distributed generation. Both the peak and energy demand forecasts are reduced by 1%/yr from the BAU reference case. Demand response is assumed to be at the full participation level in the FERC 2009 study. The full participation level assumes advanced metering infrastructure (smart grid) universally deployed.

Resource Expansion Futures

5. National RPS: Top Down Implementation
   - This future assumes a national Renewable Portfolio Standard (RPS) is established requiring each load serving entity to obtain 30% of its electricity from renewable resources by 2030.
6. National RPS: State and Regional Implementation
   - This future assumes the same goals as defined in Future 5, except Super-Regions will be designated to encourage selection of local resources first to attempt to meet the goals.

Resource Expansion Futures

7. Nuclear Resurgence
   - This future assumes there will be a significant number of nuclear facilities developed in the Eastern Interconnect including the extension of existing plant life and the construction of new large facilities. Small modular nuclear facilities included in a sensitivity run.
8. Combined Federal Climate and Energy Policy Future
   - This future appears to be a combination of Futures 2 and 5, yet there are subtle differences. Future 2 carbon goals are 42% reduction by 2030 and 80% reduction by 2050. This Future's carbon goals are slightly more aggressive. This future specifies that the electricity sector is responsible for 60% of the total emission reductions. This future assumes the same RPS goals as defined in Future 5.

Some of the concerns on assumptions

- Low Natural Gas Prices
- High Capital Costs for Wind
- Averaging of wind capacity factors
- Low contribution to reserve percentages
- Artificial ceiling on variable generation %
- Hurdle rates and other major limits imposed on transfers
- NEEM region model not reflective of transmission constraints
- Lack of detail in transmission and grid operations models
- Inconsistent inputs from region to region (e.g., planning authorities differed on assumed forced builds)
- Inability to co-optimize transmission and generation

Results Reflect the Need for Renewables

- Five Futures have increases in Wind Development
- Futures involving carbon reductions
- Futures implementing a national RES
- Business as Usual case shows significant wind development when more reasonable natural gas costs or renewable capital costs are used

BAU Base Case

	2010	2015	2020	2030	Total
Wind	18.7	22.2	12.1	14.8	67.8

BAU Low Load Growth
(incremental GW)

Resource	2010	2015	2020	2030	Total
Hydro	44.6	0	0	0	44.6
On-Shore Wind	18.7	22.2	10.2	3.7	54.8
Off-Shore Wind	0	0.5	0	1.1	1.6
Other Renewable	3.6	2.3	2.7	4	12.6

BAU Lower Renewables Costs
(higher than current real costs for onshore wind)

Resource	2010	2015	2020	2030	Total
Hydro	44.6	0.0	0.0	0.0	44.6
On-Shore Wind	18.7	22.2	15.2	52.1	108.2
Off-Shore Wind	0.0	0.5	0.8	3.0	4.2
Other Renewables	3.6	2.3	3.0	3.6	12.6

BAU Extra Low Cost
(most realistic for current onshore wind costs)

Resource	2010	2015	2020	2030	Total
Hydro	44.6	0.0	0.0	0.0	44.6
On-Shore Wind	18.7	22.2	41.2	37.7	119.8
Off-Shore Wind	0.0	0.5	1.0	2.7	4.2
Other Renewable	3.6	2.3	3.0	3.6	12.6

BAU Higher Gas Prices

Resource	2010	2015	2020	2030	Total
Hydro	44.6	0.0	0.0	0.0	44.6
On-Shore Wind	18.7	22.2	13.4	37.3	91.6
Off-Shore Wind	0.0	0.5	0.0	1.1	1.6
Other Renewable	3.6	2.3	3.2	4.5	13.7

Carbon Reduction Future OL 75% (more limited transfers)

Resource	2010	2015	2020	2030	Total
Hydro	44.6	0.0	1.5	5.4	51.5
On-Shore Wind	18.7	22.2	99.8	171.9	312.6
Off-Shore Wind	0.0	0.5	0.0	1.1	1.6
Other Renewable	3.6	2.3	3.3	3.7	12.9

Carbon Reduction Future F2 OL 25% (less limited transfers)

Resource	2010	2015	2020	2030	Total
Hydro	44.6	0.0	1.2	5.9	51.7
On-Shore Wind	18.7	22.2	115.3	159.1	315.4
Off-Shore Wind	0.0	0.5	0.0	1.1	1.6
Other Renewable	3.6	2.3	3.3	4.8	14.0

Increasing Transfer Capability Moves Wind to Higher CF Locations

OL 75 (MORE LIMITED TRANSFERS)

MAPP_CA	302
MAPP_US	5,741
MISO_IN	42,179
MISO_MI	2,600
MISO_MO-IL	13,685
MISO_W	62,170
MISO_WUMS	7,798

OL 25 (LESS LIMITED TRANSFERS)

MAPP_CA	302
MAPP_US	7,770
MISO_IN	0
MISO_MI	2,127
MISO_MO-IL	5,900
MISO_W	110,587
MISO_WUMS	1,000

SPP Wind Locations

OL 75 (MORE LIMITED)

Nebraska	16,673
SPP_N	58,892
SPP_S	41,058

OL 25 (LESS LIMITED)

Nebraska	26,806
SPP_N	66,900
SPP_S	44,311

Regional Implementation of Carbon Reduction (Future 3)

Resource	2010	2015	2020	2030	Total
On-Shore Wind	18.7	22.2	57.1	99.4	197.4
Off-Shore Wind	0.0	0.5	0.0	1.1	1.6
Other Renewable	3.6	2.3	3.3	3.8	13.0
New HQ/Maritimes	0.0	0.0	0.0	4.6	4.6

National RES (Future 5)

Resource	2010	2015	2020	2030	Total
On-Shore Wind	18.7	22.2	35.9	139.7	216.5
Off-Shore Wind	0.0	0.5	0.0	1.1	1.6
Other Renewable	3.6	2.3	3.2	4.3	13.4
New HQ/Maritimes	0.0	0.0	1.4	4.1	5.5

National RES Regional Implementation (Future 6)

Resource	2010	2015	2020	2030	Total
On-Shore Wind	18.7	22.2	40.4	78.0	159.3
Off-Shore Wind	0.0	0.5	0.0	38.0	38.5
Other Renewable	3.6	2.3	16.0	15.0	37.0
New HQ/Maritimes	0.0	0.0	0.5	0.0	0.5

Selection of Scenarios for Transmission Build-out

Two of the Futures have significant Wind Build-out.

Issues exist with the Future as modified with the sensitivities used.

Use of DC lines was ignored in the selection of the generation during phase one but it is supposed to be a solution tool in phase two.

The impact of this study remains to be seen.