



# Renewable Energy Zone (REZ) Transmission Planning Process

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Transmission Planning for a High Renewable Energy Future

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### Outline

- I. What is the Renewable Energy Zone (REZ) Transmission Planning Process?
- 2. Overview of the REZ Process
- 3. The REZ Toolkit



### What is a Renewable Energy Zone (REZ)?



A REZ is a geographical area that enables the development of profitable, cost-effective, grid-connected renewable energy (RE).

#### A REZ has:

- High-quality RE resources,
- Suitable topography and land-use designations
- Demonstrated interest from developers

All of these support cost-effective RE development.

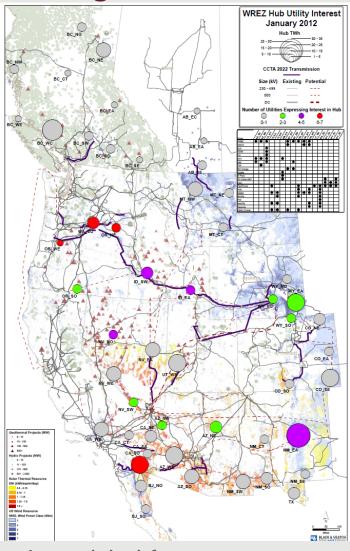




### What is the REZ Transmission Planning Process?

The REZ Transmission Planning Process is a proactive approach to plan, approve, and build transmission infrastructure connecting REZs to the power system.

- Helps to increase the share of solar, wind and other RE resources in the power system while maintaining reliability and economics.
- Focuses on large-scale wind and solar resources that can be developed in sufficient quantities to warrant transmission system expansion and upgrades.



REZs and transmission infrastructure to access zones – Western Renewable Energy Zones Initiative (Schwartz 2012)

### Why is the REZ Process Advantageous?

Traditional transmission planning may not align with RE development as decisions need to be made well in advance of RE generation development decisions.

Regulators need to see RE generator RE generator needs financing



Transmission needs regulatory approval

Financiers need to see transmission



5-10 years



10-20 years



0

20

#### **STEP I. PROCESS DESIGN & VISION STATEMENT**

#### STEP 2.

RENEWABLE ENERGY RESOURCE ASSESSMENT

#### Summary

Select areas with highest potentia

#### Output:

Study areas map and supply

- Assess resource
- Screen exclusion areas
- Identify the areas with the highest quality, developable resource

#### STEP 3.

CANDIDATI ZONES SELECTION

#### Summary:

Identify zones with highest probability of development

#### Output

Candidate zone map and supply curves (one per area)

- Gauge commercial interest
- Identify areas where high quality resources intersect with commercial interest

#### STEP 4.

TRANSMISSION OPTIONS
DEVELOPMENT

#### Summary:

Bundle candidate zones and conduct analyses of the option:

#### Output

Cost, benefit, and reliability impact for each transmission alternative

- Select scenario creation (bundling) methodology
- Conduct cost-benefit analysis of options
- Steady-state, dynamic stability,

#### STEP 5.

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FINAL
TRANSMISSION
PLAN DESIGNATION

#### Summary

Select transmission option according to pre-set criteria

#### Output

Final transmission order

 Select transmission option that best complies with predetermined criteria, including reliability standards, economic benefits, and environmental goals

**STEP 6.** TRANSMISSION SYSTEM UPGRADE

(Lee, Flores-Espino, and Hurlbut 2017)

### Step I - The Importance of Stakeholder Engagement

#### **LEAD ENTITY**

#### Initiaties and oversees the planning activity

Convenes relevant parties and ensures the process will meet the project vision—i.e., that transmission expansion and upgrades occur

#### TECHNICAL ADVISORY COMMITTEE (TAC)

### Guides and reviews the outputs of the working groups

Ensures the technical validity and relevance of the integrated clean energy transmission and generation planning analysis efforts

#### **WORKING GROUPS (WG)**

### ZONE IDENTIFICATION AND TECHNICAL ANALYSIS WG

Responsible for the identification of study areas and candidate zones

Identifies and validates candidate renewable energy zones

### TRANSMISSION AND GENERATION MODELING WG

Responsible for defining and analyzing new transmission and generation expansion and upgrade options

Conducts development and modeling of transmission system expansion and upgrade options

### General REZ Process Organizational Structure (Lee, Flores-Espino, and Hurlbut 2017)

### **Example REZ Process Decision Makers** and **Stakeholders**

| Decision Makers  | Stakeholders                                |
|--|---|
| Energy ministry or agency officials                        | RE developers                               |
| Environment ministry and other relevant ministry officials | Electric Utilities                          |
| Regulators   | Environment, resource, land use authorities |
| Power system planners                                      | Environment and other interest groups       |
| Transmission system operators                              | Non-governmental organizations              |
|  |   |





### **STEP I. PROCESS DESIGN & VISION STATEMENT** STEP 2. Summary: - Assess resource Select areas with highest potential RENEWABLE - Screen exclusion areas **ENERGY RESOURCE** Output: - Identify the areas with the highest Study areas map and supply **ASSESSMENT** quality, developable resource curves STEP 3. ZONES STEP 4. OPTIONS STEP 5. **STEP 6.** TRANSMISSION SYSTEM UPGRADE (Lee, Flores-Espino, and Hurlbut 2017)

Renewable Energy Zone (REZ) Transmission Planning Process: A

Guidebook for Practitioners – <u>www.nrel.gov/docs/fy17osti/69043.pdf</u>

9/6/2017

### **STEP I. PROCESS DESIGN & VISION STATEMENT** STEP 2. ENERGY RESOURCE ASSESSMENT STEP 3. Summary: - Gauge commercial interest Identify zones with highest CANDIDATE - Identify areas where high probability of development **ZONES** quality resources intersect with Output: commercial interest **SELECTION** Candidate zone map and supply curves (one per area) STEP 4. OPTIONS STEP 5. **STEP 6.** TRANSMISSION SYSTEM UPGRADE

RADE (Lee, Flores-Espino, and Hurlbut 2017)

### Step 3 - Screening Zones Based on Developer Interest

Areas with excellent RE resources may not be attractive to private developers.

In this step developers demonstrate their interest in the screened areas to ensure that the candidate REZs are commercially attractive for development.



Examples of commercial interest and financial commitment (Lee, Flores-Espino, and Hurlbut 2017)

Pending or signed interconnection agreements

Leasing agreements

Letters of credit

Interconnection studies by a transmission owner or grid operator

Other indications deemed appropriate by the regulatory authority





### **STEP I. PROCESS DESIGN & VISION STATEMENT** STEP 2. ENERGY RESOURCE ASSESSMENT STEP 3. ZONES STEP 4. Summary: - Select scenario creation (bundling) Bundle candidate zones and methodology **TRANSMISSION** conduct analyses of the options **OPTIONS** - Conduct cost-benefit analysis of options Output: DEVELOPMENT - Steady-state, dynamic stability, Cost, benefit, and reliability impacts production cost, and reliability analysis for each transmission alternative STEP 5. **STEP 6.** TRANSMISSION SYSTEM UPGRADE

(Lee, Flores-Espino, and Hurlbut 2017)

### **STEP I. PROCESS DESIGN & VISION STATEMENT** STEP 2. ENERGY RESOURCE ASSESSMENT STEP 3. ZONES STEP 4. OPTIONS STEP 5. Summary: - Select transmission option that best Select transmission option complies with predetermined criteria, FINAL including reliability standards, economic according to pre-set criteria **TRANSMISSION** benefits, and environmental goals PLAN DESIGNATION Output: Final transmission order **STEP 6.** TRANSMISSION SYSTEM UPGRADE

(Lee, Flores-Espino, and Hurlbut 2017)

### Step 5 – Designation of a Transmission Plan

The appropriate authority designates the final transmission plan to be implemented.

### This designation includes:

- A geographic description of the REZs
- Identifies major transmission improvements to cost-effectively deliver electricity
- Identifies who will pay for the improvements
- Updates any estimates on the maximum generation capacity in the REZs



REZs and new transmission infrastructure to access zones
- Texas Competitive Renewable Energy Zones (CREZ)
(Hurlbut, Chernyakhovskiy, and Cochran 2016)





## **STEP I. PROCESS DESIGN & VISION STATEMENT** STEP 2. ENERGY RESOURCE ASSESSMENT STEP 3. ZONES STEP 4. OPTIONS STEP 5. **STEP 6. TRANSMISSION SYSTEM UPGRADE**

(Lee, Flores-Espino, and Hurlbut 2017)

### Renewable Energy Zones (REZ) Toolkit

Online platform with information and tools to aid practitioners in successfully deploying the REZ Process around the world.

#### Toolkit Resources for REZ:

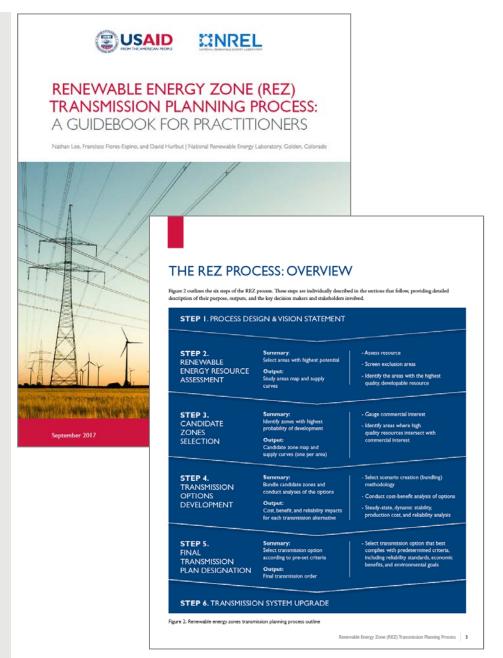
- Process guidebook for practitioners www.nrel.gov/docs/fy17osti/69043.pdf
- Technical assistance for the REZ Process
- Learning and training sections
- Topical quick-reads and in-depth resources
- Tools, templates and exercises





# REZ Process: A Guidebook for Practitioners

- Helps power system planners, key decision makers, and stakeholders apply the REZ process to integrate transmission expansion planning and RE generation planning
- Presents an organizational structure an effective, stakeholder inclusive REZ
   Process
- Details each step of the REZ process from identifying a vision to transmission upgrades
- Based on the Texas Competitive Renewable Energy Zones (CREZ) initiative and may be modified based on each country's or application's unique circumstances.



www.nrel.gov/docs/fy17osti/69043.pdf

### Key Takeaways on the REZ Process and REZ Toolkit

- The REZ Process is a transmission planning process. It is not (just) a mapping exercise to develop an RE resource atlas.
- 2. Successful implementation of the REZ Process enables integrated transmission and RE generation development to harness the best and most developable RE resources and deliver the lowest possible cost electricity from renewable generation.
- 3. The REZ Toolkit offers resources and technical assistance to help practitioners understand and implement the REZ Process.





