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Renewable Energy Zones in Queensland: A means to Integrate Transmission and Generation Infrastructure Development

by

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Outline of Discussion

- Introduction
- Renewable energy zones
- Benefits of REZs
- Associated Risks with REZ Process
- Closing Remarks

1.0 Economic Success - 21st Century

Five essential pillars for economic success in the 21st century:

- Highly educated and sophisticated population
- Highly developed technology
- Rich modern and highly productive agricultural base
- Rich base of energy-bearing materials
- Abundant supply of non-energy bearing materials

"The last century has demonstrated that every facet of human development is woven around a sound and stable energy supply regime."

Electricity: A Techno-economic concept

- Organization of society, national & social security: dependent on the availability of energy supplies
- Strong correlation: Per capita GNP ⇛ Per capita energy consumption ⇛ Standard of living
- Energy security is critical to national security
- Availability of electricity supplies is critical to national economic growth and development

Problem Statement – Grid Integration of RE

Barriers to Entry:

- Lack of suitable access to the grid hinders the deployment of RE projects on a large scale.
- Conventional fossil-fuel and nuclear power based generators have had easier access to the grid, often as part of the design project proposal.
- RE generators cannot transport their fuel to site and have to be located were the resource is available in reasonable quality.
- RE sites are often remotely located, making grid connection costs prohibitive

Challenges of Grid Integration of RE

- **Proximity vs Optimized location**: Priority is given to proximity to existing transmission infrastructure.
- **Transmission upgrade costs**: Connections remotely location from grid must bear costs of upgrades
- Prohibitive connection costs: disincentive to projects

Potential Solution

- **RE Clusters**: Several RE connections to cluster within a pre-defined location.
- **Single transmission corridor**: To service the area and shared cost approach amongst developers.
- **Infrastructure sharing**: Eliminates need for duplication of assets and exerts downward pressure on duplication of assets.

Objectives

- Share lessons learned from a Utility company
- Strategic positioning of a Utility's transmission network to accommodate large-scale RE developments.

Purpose

- Initiate dialogue on the subject
- Develop potential strategies to promote and manage RE integration

2.0 Renewable Energy Zones

A Renewable Energy Zone (REZ) is an area designated for the development of renewable energy generation projects.

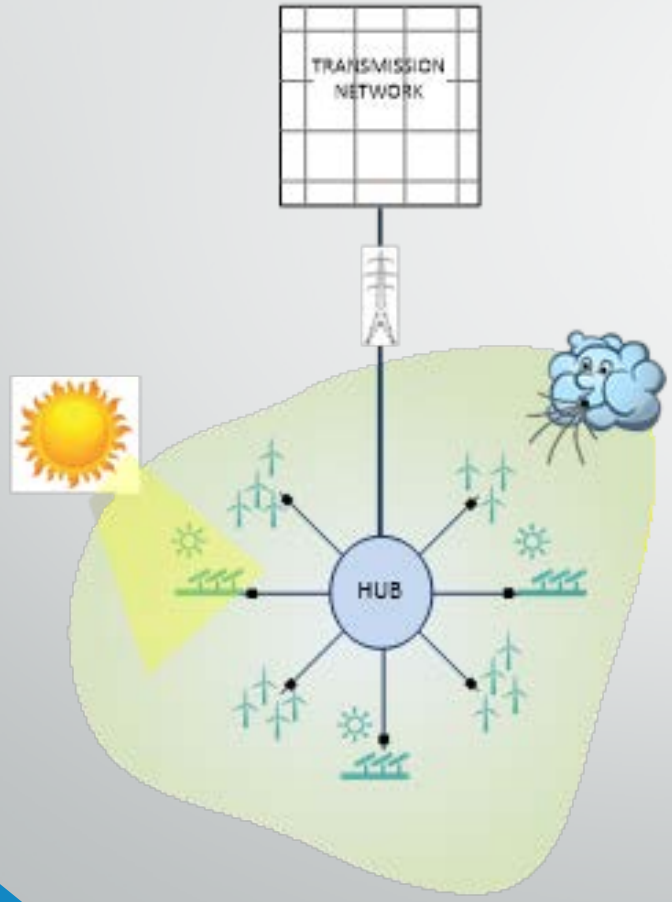

Fig 1: Hub & Spoke REZ Model.

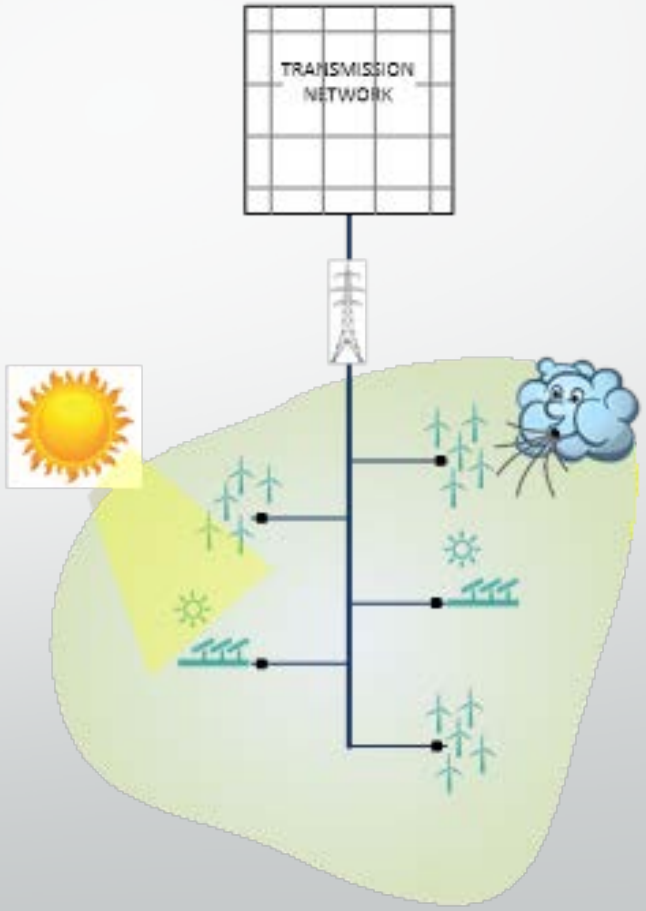

Fig 2: Multiple Spur REZ Model

Grid Integration of RE

Some key requirements:

- Availability of high quality RE resources – solar, wind energy.
- Suitable land profile – elevation, size and listing.
- Access to electricity transmission infrastructure.
- Stronger developer interest
- Attractive environment – government incentive schemes, renewable energy targets, favourable policy framework, reducing cost of technology.

A REZ is a proactive planning solution which exploits the "economy of scale" principle to enable remotely located RE developments to access the high voltage transmission network efficiently and affordably.

Grid Integration of RE - Pros and Cons

Some challenges:

- Quality of energy resource.
- Resource and network capacity mismatch.
- Innovative connection options – least cost
- Integrated services – telecoms and protection signalling.
- Special protection schemes
- Land aggregation
- Line compensation and network support.

"A REZ is an enabler of high quality renewable energy generation."

Grid Integration of RE- Pros and Cons / Contd.

Some challenges:

- Connection voltages.
- Standardization of connection requirements.
- Economies of scale
- Multiple dispersed RE generator connections – impact reliability and create a system that is complex to manage.

"A REZ addresses most of these challenges by positioning the transmission network to accept new connections, thus serving as an enabler of high quality renewable energy generation."

3.0 Benefits of Renewable Energy Zones

A Renewable Energy Zone (REZ) is an area designated for the development of renewable energy generation projects.

- Based on cost-sharing
- Eliminates scheming to obtain a grid access point.
- Overcomes the difference in timescales associate with developing transmission and RE generation.
- The REZ concept motivates proactive planning of new transmission to attract new RE generation investments.

"A REZ is an enabler of high quality renewable energy generation."

Benefits to Utility Company

- Controlled deployment.
- Centralized system control.
- Variability management and reduced intermittency.
- Business development.

"A REZ is an enabler of high quality renewable energy generation."

Benefits to Developer

- Optimal developments – maximizing access to highest quality resource.
- Improved capacity.
- Staged development – low cost land facilitates future site expansion capacity and good ROI.
- Greater technical efficiency.
- Market access. – creates potential for generators to operate unconstrained, improved ROI.

"A REZ is an enabler of high quality renewable energy generation."

Benefits to Customers

- Energy costs – low marginal cost of RE.
- Improved aesthetics.

Benefits to Governments

- Assist in achieving RE targets.
- Employment opportunities.

"A REZ is an enabler of high quality renewable energy generation."

4.0 Associated Risks and the REZ Development Process

Associated Risks:

- Inadequate participation the scheme by developers gaming.
- Inability to secure suitable land within a zone to support several RE project developments.
- Lack of government support or frequent policy changes.
- Bureaucratic delays that compromise timescales.
- A lack of transmission redundancy – single point of failure – trigger curtailment within the REZ when transmission is not available.
- Distributed systems may prove to be more effective in managing variability, in the absence of efficiently dispersed REZs.

Summary of the REZ Development Process

1. Establish the applicable REZ funding mechanism.
2. Survey low cost, high quality RE resource locations across the State:
    (a) Within a predetermined envelop around existing transmission infrastructure.
    (b) With land profiles (slope, size, elevation, cultural/heritage, public acceptance) suitable for hosting several large scale renewable energy projects.
    (c) With achievable easement and access to a high capacity transmission substation.
3. Present a shortlist of locations to interested parties to identify areas with strong interest, one (or more) of which will notionally be selected for further development.
4. Offer capacity within the selected area/s to investors on a competitive basis.
5. Obtain funding commitment and necessary approvals to commence construction of a high capacity HV transmission line into the designated zone.
6. Invite developers to secure funding and progress their own project developments within the designated zone.

Closing Remarks

The paper provides further details:

- Funding mechanism
- REZ location assessment criteria
- Comparison of charges for connecting REZ to the grid – with an illustrative example (UK National Grid)

Closing Remarks

- The primary benefit of renewable energy parks is the economy of scale:
  - Shared leasing cost of land for installation of generating plants
  - Shared cost of connectivity infrastructure.
- Grid owners - REZ offers the benefit of implementing standardized connection equipment.
- Better control of voltage level
- Improved power quality and network stability.
- Reduced maintenance costs due to fewer connection points.
- Savings in operating costs can be passed onto end-users: improve access to grid electricity for more communities.

Thank you