Grid Operators view of Feed-In Tariffs

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California Independent System Operator Mission

For the benefit of our customers, we:

- Operate the grid reliably and efficiently
- Provide fair and open transmission access
- Promote environmental stewardship
- Facilitate effective markets and promote infrastructure development

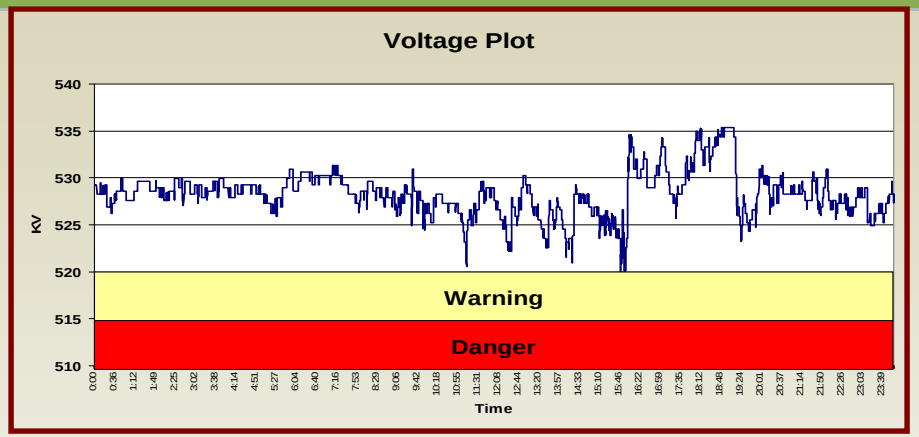
All through the provision of timely and accurate information.

We do not negotiate power purchase agreements or set prices for energy or take ownership delivery of energy.

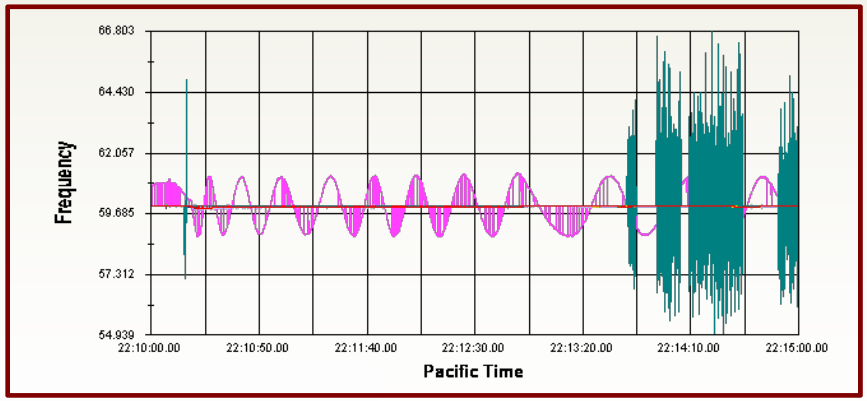
Our role is to ensure grid reliability and to implement state policies that encourage the development of renewable resources.

Key Grid Operations Metrics

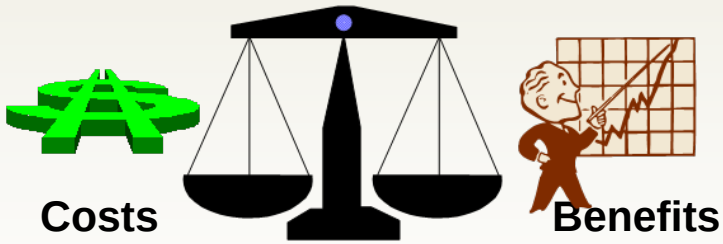
Thermal Limits & Veg. Mgmt of ROW



Voltage Stability Limits



Transient Stability Limits



Transmission Plans & Congestion Costs

- **Reliability Criteria and Studies**
- **Economic Criteria and Studies**

CAISO neither supports nor opposes the concept of feed-in tariffs

- Feed-in tariffs or “Standard Offer Agreements” have been used in California, Canada, Germany, Spain, Demark and proposed in Taiwan.
- Depending on the set price for energy, they can simulate investment in renewable resources.
- The June 2008 KEMA report for the CEC on “Exploring Feed-in Tariffs for California” provides an excellent discussion of the pros and cons and some of the issues.

Ontario Power Authority's Standard Offer Program

OPA's Standard Offer Program for Wind Energy

Quick Facts for Wind Energy Projects	
SOP price paid	11.08 cent/kWh
Inflation Index	20% of the contract price increases by the Consumer Price Index
On-peak rate	not eligible
Capital Cost (est)	$2,000 to $2,750 per kW installed
Average lead time	3 to 4 years
Environmental	None for < 2 MW Environmental Screening for all projects > 2 MW
Other permits	Municipal permits Navigation Canada Transport Canada Possible official plan and zoning amendments Possible by-law changes Building permits Property tax reclassification
Connection	OEB License LDC Connection Agreement ESA Certification

"Ontario's Renewable Energy Standard Offer Program (RESOP) has exceeded all expectations - achieving an excess of 1,000 megawatts of contracted projects - surpassing the 10-year target for renewable energy in the first year of the program!"

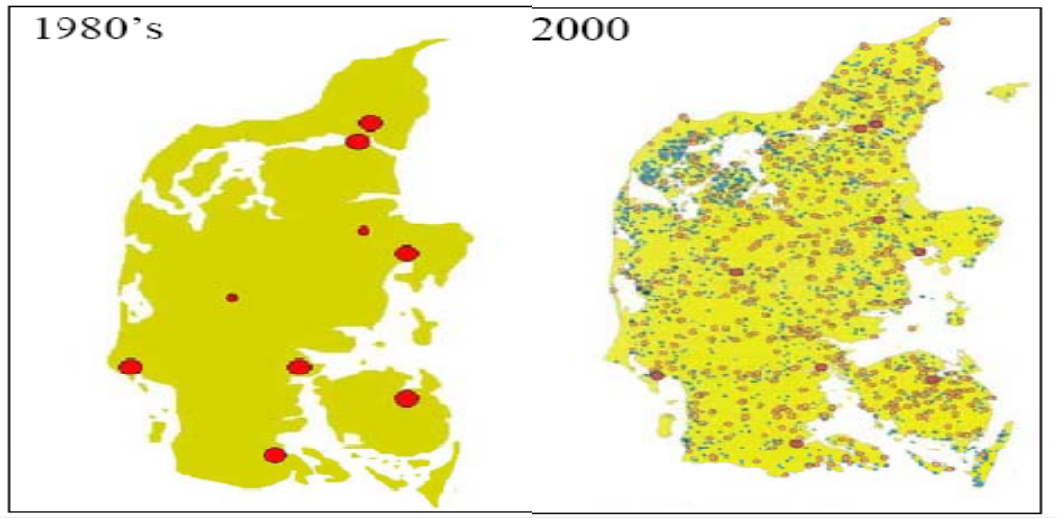
Current and future applications from micro-scale generators (up to 10 kilowatts) and small, farm-based biomass projects up to 250 kilowatts, will also continue to be processed under the existing rules. All other applications will be processed after the revised rules and contracts have been released (September 2008).

Germany – Feed-in Tariffs

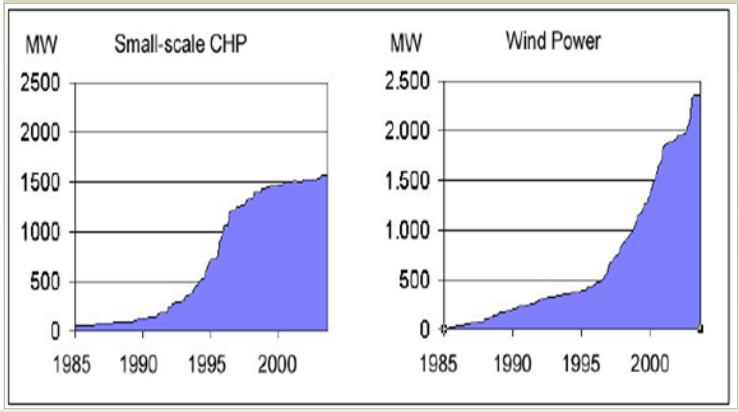
- **Feed-in electricity tariffs** have been introduced in Germany to encourage the use of new energy technologies such as wind power, biomass, hydropower, geothermal power and solar photovoltaic's. Each technology is eligible for a different feed-in rate. The aim is to meet Germany's renewable energy goals of 12.5% of electricity consumption in 2010 and 20% in 2020. The policy also aims to encourage the development of renewable technologies, reduce external costs, and increase security of energy supply.

- In 2005, 10 per cent of electricity in Germany came from renewable sources and 70 per cent of this was supported with feed-in tariffs. The average level of feed-in tariff was €0.0953 per kWh in 2005 (compared to an average cost of displaced energy of €0.047 kWh). The total level of subsidy was €2.4 billion, at a cost per consumer of €0.0056 per kWh (3 per cent of household electricity costs).[1] The tariffs are lowered every year to encourage more efficient production of renewable energy.

The Danish experience has been positive



Rapid change is possible



- In 1996, Danish government set 1500 MW goal for wind by 2005, a level surpassed by 2000
- Government has set new goal of 5500 MW of wind, equivalent to 50% of total electricity demand in Denmark
- Almost all of the wind turbines in Western Denmark are <1 MW, relatively small compared to multi-megawatt wind turbines installed in other parts of the world
- Many wind resources were developed through cooperatives of landowners or farmers, each owning a small number of turbines
- The addition of wind generation and combined heat and power (CHP) plants transformed Denmark's power system from a central grid in the 1980s to a distributed grid by 2000
- By 2003, generating capacity had grown to double peak electricity consumption

The keys to success in Europe

- Demark is linked to Scandinavian countries and they can take advantage of the large amount of hydro generation resources in Norway and Sweden.
- European frequency control standards are significantly less stringent than the NERC standards in North America.
- The four grid operating companies in Germany all share the regulation burden for wind generation variability.
- Forecasting of wind generation in Demark and Germany and Spain is more accurate due to the weather patterns and geography of the areas.
- The Public accepts wind generation facilities all over the landscape and off-shore

Will it work in California?

- Feed-in Tariffs or “Standard Offer Agreements” would very likely stimulate the installation of wind and solar generation facilities. How much will depend on the price.
- The public should expect to see the proliferation of wind generators on many properties – home owners, commercial buildings, school districts, farms, hill tops, etc.
- Parking lots will have shade for all the cars as they will be covered with a canopy of PV panels
- PV panels will cover most roof tops, commercial buildings and probably cover the aqueduct

To make it work in California requires major investments in the electric infrastructure

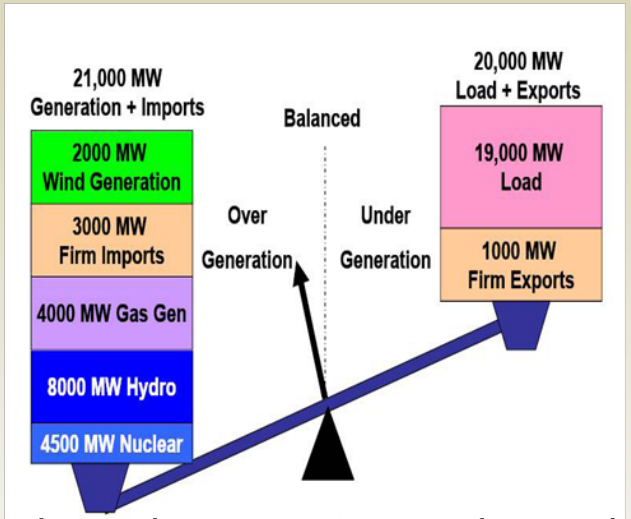
- Distribution networks have to be redesigned and upgraded to handle the generation resources
- Investments in Smart Grid technology vital
  - Separate metering required for renewables so producers can be paid for energy production
  - Develop the concept of “freeway entrance ramp metering lights” for the distribution grid to handle the congestion of the distribution facilities
  - Intelligence needed to forecast local energy production and to determine the potential need for reserves to serve load
  - New voltage control and power quality controls
  - Provision for Plug-In Hybrid Vehicles and other energy storage

To make it work in California requires major investments in the electric infrastructure

- Transmission networks have to be redesigned and upgraded to handle the generation resources
  - Majority of new renewables will be in Southern California Edison's area and new transmission will be essential to move the power to customers
- New investments in energy storage technology – new pump storage plants, battery facilities, flywheels, CAES
- New investments in regulation resources to control frequency so operators can meet NERC control standards
- New investments in information systems to have visibility of the changes renewable generation production so reliability can be maintained
- More quick start generating units required – hydro and gas fired

Typical Oversupply Conditions - CAISO

- Light load conditions – loads around 22,000 MW or less,
- All the nuclear plants on-line and at maximum production,
- Hydro generation at high production levels due to rapid snow melt in the mountains,
- Long start thermal units on line and operating at their Pmin levels because they are required for future operating hours,
- Other generation in a “Must Take” status, QF, or required for local reliability reasons, and
- Wind generation at high production levels.



Imbalance between Generation and Load

Feed-in tariffs will likely encourage more wind generation that will increase the problem of over generation at night. Future night time loads critical to absorb off peak wind generation energy production – PHEV for example

Pricing structure for renewables in standard offer agreement will have consequences

- Price should value energy production that matches loads
  - Solar systems that produce maximum energy during hot afternoons and serve A.C. Loads are more valuable than wind generation production at 2 AM
    - Reward renewables that “fit” load profiles
  - Solar systems in Fresno have more value than solar in Pacifica
    - Geographic location is important
  - Renewables in load centers have more value than renewables hundreds of miles away as losses are reduced and transmission investments are reduced.
- Fixed prices for renewables potentially increases the cost of energy to consumers

Additional considerations

- Do we really have a barrier with negotiating contracts?
  - Major barriers appear to be Land use permits, construction permits and construction of transmission
- All units that are 1 MWs or larger connected to the transmission network will still require an interconnection study
- Interconnection standards, real-time production data, dispatch control, energy forecasting and scheduling will still be required.
- A standard offer agreement for renewables that are 20 MW or larger does not appear to provide any clear advantages.
- It certainly will increase the complexity and risk of setting the “right” price for different types of renewables by having the government versus the market determining the value