ORIENTATION PROGRAMME FOR THE ELECTRICITY REGULATORS

FROM JUNE 3RD TO JUNE 10TH 2010

Forum of Regulators (FOR) had organized an Orientation Programme for the Electricity Regulators to expose Chairperson's and Members of electricity regulatory commissions on the theory and practice of regulations in India as well as California, USA. The coordinator of the programme was IIM, Ahmedabad and programme comprised of:-

a. A three day module in India (at IIM, Ahmedabad) (3rd June to 5th June, 2010).

b. An international exposure visit (to San Francisco) (7th June to 9th June, 2010).

c. A total of 19 participants attended the orientation programme. The list of participants is enclosed at Annexure - I.

India Module (IIM, Ahmedabad)

(3rd June to 5th June, 2010).

- Outline of the programme at IIM, Ahmedabad is at Annexure – II.
- The sessions in general were highly interactive and the focus was on understanding theoretical concepts and possible challenges while applying in practice. Input in respect of international experiences was also discussed extensively.
- Brief outlines of various sessions covered during the programme are given here under :-

1. Regulatory Economics

The session covered the reasons for market failure and the need for regulations in certain sectors and situations. What is the objective of regulations in such cases or sectors and what are the regulatory instruments use to rectify market failure were discussed.

2. Electricity Markets – Basics, Design Issues and Practices in other countries

This topic covered various issues related with Electricity Markets and its Design aspects. In the restructuring of the sector, markets have been designed and created worldwide at the wholesale and retail level to promote efficiency through competition. These sessions were devoted to laying out the reasons and requirements for creating market and promoting competition and the international experiences in creating the markets in the sector.

3. Subsidies, USO and Distortion

This session was focused on discussing the implications of different forms of subsidies and USO obligations. While some of the ways in which subsidies are given do not affect efficient use and allocation, some other forms distort the consumption and/or investments.

4. Consumer Advocacy

The session was focused on what are the issues faced by consumer advocacy groups and the institutional barriers and constraints in protecting consumer interests.

5. NDPL' Experience in Distribution Reforms

The session covered the experiences of NDPL in improving AT&C losses in its license area and the operational and strategic steps taken by NDPL including the challenges faced by it in making the privatization successful from the point of loss reduction.

6. Regulatory Experiences from the Telecom Sector

Telecom sector has witnesses revolution in India and worldwide in last 15-20 years. This session was focused on what aspects of the sector, which policies and regulations helped or hindered this revolution in India and elsewhere.

7. System Operations Issues in Competitive Electricity Sector and International Experience

The role of system operator is critical in allowing non-discriminatory access to transmission networks and thus promoting competition. This session focused on the current challenges and issues for the system operations at different levels in India and the benchmark available from the international experiences.

International Module (San Francisco, USA)

(7th June to 9th June, 2010)

As a part of orientation programme for Electricity Regulators organized by IIM, Ahemdabad, all the 19 participants and 2 programme coordinators - Prof. S. Morris and Prof. A. Pandey from IIM, Ahemdabad visited San Francisco, USA to develop a perspective on reforms on electricity sector including renewal energy, DSM initiatives, electricity markets etc. The schedule of meeting during the visit is at Annexure-III.

The key stakeholders identified for the above purpose were:

- California Energy Commission (CEC)
- California Independent System Operator (CAISO)
- California Public Utilities Commission (CPUC)
- Utilities – Southern California Edison(SCE), Pacific Gas and Electric Company(PG&E), San Diego Gas & Electric (SDG&E)

Meetings with the above stakeholders were arranged with the help of Energy Division of Lawrence Berkeley National Laboratory (LBNL). Moreover, a meeting was also organized with academicians from LBNL on the issues of renewal energy (RE), Demand Side Management (DSM) as well as Energy Efficiency (EE).

1. Meeting with CEC Commissioner's :-

CEC is part of the state government of California and forecasts the consumption in the sector for planning. It also promotes initiatives towards use of renewable, low-carbon development and energy efficiency for the state. In the meeting, representative of CEC briefed the participants about renewal initiatives of California Govt. including RPS targets. The representatives also mentioned in brief about Integrated Energy Policy of CEC in reference to renewal energy.

2. Meeting at CAISO

CAISO is the system and wholesale market operator working under supervision of FERC but interfacing with local utilities and other players. The meeting explained the working of ISO and challenges in integrating RE resources particularly wind and solar. The representative of CAISO enumerated its role in developing a sustainable power grid using advance technologies to maximize Megawatts and minimize environmental impacts. The representative also explained in brief the issues related with scheduling methodology, markets elements etc.

3. Meetings with Utilities

The meeting with utilities comprised of discussion with PG&E, SDG&E and SCE. The utilities explained as to how they are working towards meeting stipulated target of 33% energy from renewable sources, their initiatives on energy efficiency and use of smart grid to flatten peak load.

PG&E initially gave and overview on renewal energy including associated challenges. Subsequently, the representative of PG&E also outlined various DSM and energy efficiency issues.

SDG&E emphasized on the planning aspects for energy efficiency to achieve safe, reliable, affordable and sustainable energy future.

The representative of SCE briefly introduced about its company and various energy efficiency policies being undertaken by them.

4. Meeting with CPUC

The representative of CPUC (the Californian regulator), explained their organization structure, procurement processes for the utilities for capacity based on renewable source, regulatory instruments to support RE and EE. The representative also mentioned about energy policies in California, statutory provisions including office of the rate payer advocates.

5. Meeting with LBNL

LBNL energy division explained the work it is doing to support DSM, EE and RE initiatives worldwide including in India in association with BEE and FOR. It discussed the study related with end use efficiency improvements in India mentioning about aggregate economic and carbon benefits. Regulated multi-state demand side management programme (RMSDP) and initiatives in respect of exploration of Resource and Transmission Expansion Decisions in the Western Renewable Energy Zone (WREZ), were also discussed. Moreover, a study on the initiatives taken in Mumbai, Maharashtra was also presented. LBNL also arranged and informal interaction with Mr. Robert Lieberman, an ex-commissioner to share his views about retail choice in USA.

Learning Experiences

IIM Module:

1. Module started with the basic regulatory economics giving theoretical concepts of need of market and presented a brief Regulatory History of USA covering Energy, Telecom, and Airlines. It helped to differentiate when the markets can work and when the markets are not likely to yield

appropriate results from the point of social welfare. It also gave an understanding the limits of regulatory effectiveness and the consequences of different types of economic regulatory instruments such as price cap, yardstick, and sliding scale or cost-of-service regulations. In the context of Electricity sector, a brief idea about various models of creating markets and introducing competition at the wholesale and retail level was given. Open access is a necessary requirement for the competition was explained. Effect of subsidies on the sector and its impact along with alternative means of subsidization were deliberated to develop an understanding on their effect on the demand and supply in the sector. Further it also gave a bird's eye view of the models used elsewhere in the world. It helped in understanding the issues required to be addressed to strengthen the nascent competition and markets in India.

2. Consumer advocacy issue was important from the point of view of Consumer role. The session on Consumer advocacy helped to understand the nature of consumer advocacy prevalent in India and the constraints faced by organizations such as Prayas and MGP.It also pointed out to regulators that a more rational consumer advocacy requires institutional framework and resources for effective functioning.

3. Role of Discom as major stake holders is crucial from the state perspective. Session by NDPL gave an idea about the nature of efforts undertaken by NDPL to reduce distribution losses. The privatization story of NDPL highlighted the operational and regulatory issues faced by the NDPL since privatization that helped or hindered in their efforts.

4. Telecom sector is flagship of regulatory success in Indian Infrastructure sector. The session on Experiences in Telecom Sector, helped to understand how the telecom sector became competitive, its brief history and the role played by the policies, regulator and technology in its development in India.

5. System operation is very crucial link in the Electricity sector. The Session on System operation was very informative. It explained the key pillars of system operations and the role it plays in the sector in terms of grid discipline, competition and development of the sector. It also highlighted the practical issues and challenges faced in India by the system operator(s) with a reference to international practices.

International Module (San Francisco, USA):

1. Meeting at CEC gave an idea about various policy initiatives taken by the Californian government on renewable energy, energy efficiency and on zero-carbon housing development. RPS is a popular energy policy tool in US having following benefits.
    - Long-term contracts with utilities help reduce risk for the developer and help secure financing
    - Larger economics of scale for renewable technologies brings down the cost
    - Environmental protection & public health – clean air, climate change
    - Hedging against volatile natural gas prices
    - Jobs, economic development
    - Lower prices due to competitive procurement process

    It mentioned that renewable portfolio standards (RPS) target of 33% in 2020 (from the present level of about 20%) is expected to provide 15.2% of total green house gas (GHG) reductions needed to meet AB32 goal of 1990 emissions levels by 2020. In addition to RPS, Western Renewable Energy Generation Information System (WREGIS) is a voluntary independent renewable energy registry and tracking system launched in June 2007 for Western Interconnection transmission area having following features.

- Uses verifiable renewable energy generation data
- Creates renewable energy certificates (WREGIS certificates)
- Accounts for transactions involving certificates
- Supports voluntary and regulatory markets for certificates

It was also gathered that retail sellers and renewable facilities participated in California's RPS are required to register with and use WREGIS. Public owned utilities can opt to use WREGIS to track their RPS energy. At present more than 335 companies are approved to be WREGIS account holders by June, 2010.

It also explained very briefly the process of forecasting demand for future used by CEC. The major challenges being faced were grid integration issues for renewable energy and associated environmental and transmission issues.

2. The discussions at CAISO were informal giving an idea about its background and working. The Board of Governors (Board) of CAISO is composed of five members appointed by the California Governor and confirmed by the California State Senate. It is a nonprofit public benefit corporation incorporated in May 1997, and is responsible for the operation of the long-distance, high-voltage power lines that deliver electricity throughout most of California (the California grid) and to neighboring control areas and states, as well as with Canada and Mexico. Its principal objective is to ensure the reliability of the California grid, while fostering a competitive wholesale market place for electrical generation and related services in California.

   It operates pursuant to tariffs filed with the Federal Energy Regulatory Commission (FERC).As the impartial operator of the grid, the not-for-profit CAISO also opens access to wholesale power markets designed to diversify resources and lower prices, and grants equal access to 25,526 circuit- miles of power lines. Every five minutes, the ISO forecasts the state's electricity demand, accounts for operating reserves and dispatches the lowest cost power plant unit to meet that demand while allocating space on the power lines. As the nerve center for the California power grid, the ISO matches buyers and sellers of electricity, facilitating nearly 30,000 market transactions every day to ensure enough power is on hand to meet demand. As the impartial grid operator, it has no financial interest in any market segment and makes sure diverse resource have equal access to the transmission network and markets used to fine- tune the flow of electricity. It operates day-ahead and hour-ahead markets for transmission congestion and ancillary services, operates a real-time market for balancing energy, and administers reliability-must-run (RMR) contracts. RMR contracts allow the Company access to power at contractually agreed-upon prices from generation units which, due to their location and other factors, must be operated at certain times to ensure the local transmission reliability. The Company also performs a settlement and clearing function by collecting payments from users of these services and making pass-through payments to providers of such services. Any market defaults are proportionately allocated to market participants based on net amounts due them for the month of default. It charges a Grid Management Charge (GMC) to market participants to recover the Company's operating costs, capital expenditures and debt service costs, and to provide for an operating reserve. The discussions also mentioned about the current challenges being faced such as grid integration of renewable energy sources as well as transmission constraints such as issues related with right of way.

3. The session with utilities helped in understanding the specific processes followed by the utilities for procurement of power over long-term through PPAs using RE sources. It also highlighted the challenges faced by utilities in transmission and in integration of RE power from their perspective. A brief idea about the Energy efficiency initiatives and incentives and the

DSM initiatives taken to flatten the load curve as undertaken by the utilities was also gathered. The reason of utilities supporting DSM is due to mitigation of impact of demand growth of infrastructure, better use of capital and energy efficiency being less expensive than new generation. Moreover, California's energy action plans (2003& 2005) place energy efficiency and demand response ahead of generation. On the issue of energy efficiency (EE) PG&E informed that their EE programs since 1976 have saved about 155 million MWH, saved customers about $24 billion. SDG&E informed that they are having following programs on energy efficiency and demand response :-

- Residential segment consisting of whole house retrofit, new construction, advance lighting etc.
- Commercial / Industrial segment consisting of retrofit incentives / rebates, new construction, small business direct install for EE and AC cycling for small customers for DR.

It was noted that issues related with EE were large up front capital investment is required and the party paying the energy bill is different than the party making the investment. The utilities also presented to visiting regulators a brief picture of different technologies such as rolling out plug-in electric vehicles and challenges therein.

4. Session with CPUC representative informed that the institution is almost 100 year old and regulates privately owned telecommunications, electric, natural gas, water, railroad, rail transit and passenger transportation companies. Five CPUC Commissioners are appointed for six year terms by the Governor, with confirmation by State senate. It acts both in a quasi legislative and quasi judicial capacity. It employs a staff of approximately 1000 professionals. The Division of Ratepayer Advocates (DRA) is unique which is an independent organization within CPUC. Director, DRA is appointed by Governor and 138 staff with the annual budget of about

$27.6M.Its mission is to obtain lowest possible rate for service consistent with reliable and safe service levels. It also advocates for customer and environmental protections.

It was mentioned during the meeting that on March 11, 2010, the CPUC established the structure and rules for a Tradable Renewable Energy Credits (TRECs) market which was stayed on 6th May, 2010.Its salient features are as under :-

- Use of TRECs for RPS compliance is initially limited to not more than 25% of an IOU's annual procurement obligation, this limitation sunset at the end of 2011.
- Interim price cap of $50 on TRECs used for RPS compliance by IOUs this price cap will sunset at the end of 2011.
- Participants must meet CPUC and WREGIS requirements as well as Energy Commission's RPS eligibility rules.
- RECs from facilities not serving California load treated as TRECs for RPS compliance beginning March 2010.

On the issue of energy efficiency, a brief overview of the California long term energy efficiency plan was given. Salient features of 2010-2012 programs are as under:-

- $3.8 billion in funding
- $3.13 billion for general energy efficiency programs
  - Three Year Savings Potential
  - 7,000 GWH, 1,500 MW,
    3 million tons of CO2e avoided
  - Equivalent to 3 large power plants
- $750 million for low income homes and appliances
- 18,000 – 20,000 new jobs

The demand response programs consist of dynamic pricing, incentive based DR programs, emergency trigged programs.

The issue of smart meters was also deliberated which are to be fully deployed by 2012 to increase the system efficiency and enable dynamic pricing and feedback. Major features of smart meters are as under :-

- Enhance operating efficiencies and savings
  - Auto meter reading, outage management, improved forecasting, theft reduction
- Support billing, customer support, outage management
- Interface with Direct Load Control communication technology
- Provide two-way communication with utility
- Provide customers with flexible access to usage data and prices
  - Understand usage patterns & their relationship to energy costs
- Track interval (e.g. hourly) usage data : measure, store, transmit
- Implement dynamic pricing

The meeting also helped to understand the regulatory process followed for procurement, transmission expansion, energy efficiency initiative incentives, attainment of targeted RE –based electricity and progress, issues and challenges being faced by the regulator.

5. Sessions by academicians from LBNL energy division helped in understanding the role being played by LBNL internationally by networking to promote EE and RE initiatives on technologies, specifications and regulations through analysis. From the discussions in respect of exploration of Resource and Transmission Expansion Decisions in the Western Renewable Energy Zone (WREZ), following was noted :-
   - Bus-bar costs are only one part of the problem : transmission and market value assumptions can also be important
   - Wind energy is the largest contributor toward a 33% RE target under starting point assumptions, but key uncertainties can shift the balance between wind and solar in the Southwest.

- Transmission investment to meet 33% RE with new WREZ resources estimated at $17-34 billion.
- Transmission costs are 10-19% of delivered cost of WREZ resources
- Availability of tradable RECs should be explicitly considered in more detailed transmission planning.

It also highlighted the nature of initiative taken by LBNL with Bureau of Energy Efficiency (BEE), India and Forum of Regulators (FOR) for EE. Initiatives taken by MSERC on energy efficiency in parts of Maharashtra were also discussed for the benefit of visiting regulators from other states of India.

Observations & Suggestions based on feedback of the participants:

Although, formal feedback on IIM Module would be sent by IIM-A separately, however based on debriefing session at San Francisco, following emerged, which may be kept in mind while designing the program next time.

- The duration of IIM module could be increased to about 4-5 days looking from the point of view its usefulness and depth of issues involved using appropriate case studies. There were some suggestions to explore the possibility of shifting the domestic module venue at New Delhi for everyone's convenience. That may require assessment of various factors such as selection of programme coordinator, convenience of faculty and associated cost etc. Similarly on the suggestion by some participants regarding some gap between Domestic as well as International module, the issue of multiple availability of participants of such a senior level at different locations may create an element of uncertainty. Alternatively, as a part of structuring the programme, a possibility could be explored to arrange the sessions from international experts in India for the interaction in the context of Indian power sector environment followed by foreign visit, as per requirements .

- For better structuring, the member Commissions may be involved through FOR during structuring process of the programme.
- A slightly longer lead time (at least a month) may be helpful in sequencing the sessions of guest speakers.
- The participants felt that the choice of California was good for DSM, EE and RE initiatives and a possibility may be explored to visit the place giving the exposure in the areas of competition, consumer choice or creation of larger markets spanning wider geographical areas.
- Interface between federal and state regulators is preferable subject to scheduling constraints.
- The participants felt that a visit to renewable energy plant or best DSM, EE practices or market operation as per the requirements may help them for better understanding of issues by acquiring firsthand experience.
- Though meeting with ISO was insightful however, if time had permitted the formal presentation by the ISO would have made working of wholesale markets, scheduling and the implementation of nodal prices clearer.

Logistics & Coordination issues

- It is felt that there should be at least two facilitators/coordinators from FOR to manage the group of regulators of about 20 persons who are the senior persons and sometime may need personal attention. It also affects the learning process of single facilitator/coordinator.
- Travelling in different class than the main group usually creates logistics/ coordination problems. It is therefore suggested that both facilitators/coordinators from FOR should be allowed travel in the same class along with participants to facilitate the logistics and better coordination.

Reference documents are attached.

List of Participants		
S. No.	**Name of the Person**	**Designation**
1.	SRINIVASAN JAYARAMAN	Member, Central Electricity Regulatory Commission
2.	PRASAD RANJAN RAY	Chairperson, West Bengal Electricity Regulatory Commission
3.	DEY MANOJ	Chairperson, Chhattisgarh State Electricity Regulatory Commission
4.	KAPPALUMACKEL JOSEPH MATHEW	Chairperson, Kerala State Electricity Regulatory Commission
5.	SILVAMMA MARIA DESALPHINE	Chairperson, Jammu & Kashmir State Electricity Regulatory Commission
6.	MUTHYIAN DEENA DAYALAN	Member, Central Electricity Regulatory Commission
7.	MANDIKAL RAMAKRISHNAPPA SREENIVASA MURTHY	Chairperson, Karnataka State Electricity Regulatory Commission
8.	CHINTALA REDDI SEKHAR REDDY	Member, Andhra Pradesh Electricity Regulatory Commission
9.	ROHTASH DAHIYA	Member, Haryana Electricity Regulatory Commission
10.	KRISHNA RAO SRINIVASA RAO	Member, Karnataka Electricity Regulatory Commission
11.	CHANDRA SHEKHER SHARMA	Member, Madhya Pradesh Electricity Regulatory Commission
12.	BIJOY KUMAR MISRA	Member, Orissa Electricity Regulatory Commission
13.	VIRINDER SINGH BARRER	Member, Punjab State Electricity Regulatory Commission
14.	SURENDRA KUMAR MITTAL	Member, Rajasthan Electricity Regulatory Commission
15.	ANAND KUMAR	Member, Uttarakhand Electricity Regulatory Commission
16.	RAVINDER KUMAR SHARMA	Member, Joint Electricity Regulatory Commission for Goa and All UTs except Delhi
17.	SHARMA BHASKAR KUMAR	Member, Chhattisgarh State Electricity Regulatory Commission
18.	PRANAY KUMAR	Director (R&R), Ministry of Power
19.	AWSTHI PRABHAT KUMAR	Joint Chief (Finance), Central Electricity Regulatory Commission

Annexure -I

Outline of Programme for
Orientation Programme for the Electricity Regulators
June 3 – 5 2010, IIM Ahmedabad

<table>
<tr><td></td><td>Inauguration (0845 - 0945)</td><td>0945-1000</td><td>Session 1 (1000-1100)</td><td>Session 2-3 (1115-1305)</td><td>Session 4-5 (1430-1645)</td></tr>
<tr><td>3rd June 2010 (8:30 am to 8:45 am – registration)</td><td><u>Programme Inauguration</u>
Chief Guest: Mr. P K Mishra, Chairman GERC along with
Mr. Alok Kumar,
Secy CERC and Prof. B H Jajoo, Dean IIMA</td><td>Group Photograph session</td><td>Regulatory Economics-1
S. Morris</td><td>Customer Advocacy
Ashok Pendse
Mumbai Grahak Panchayat</td><td>NDPL's Experience in Distribution Reforms Ajai Nirula/Puneet Munjal, NDPL</td></tr>
<tr><td></td><td>Session 1 (0900-1015)</td><td colspan="2">Session 2 (1030-1145)</td><td>Session 3 (1200-1315)</td><td>Session 4 (1445-1600)</td></tr>
<tr><td>4th June 2010</td><td>Regulatory Economics-2

S. Morris</td><td colspan="2">Electricity Markets: Basics

Ajay Pandey</td><td>Market Design Issues and Electricity Markets in Other Countries
Ajay Pandey</td><td>Subsidies, USO and Distortions

Sebastian Morris</td></tr>
<tr><td></td><td>Session 1 (0900-1015)</td><td colspan="2">Session 2 (1030-1145)</td><td>Session 3 (1200-1315)</td><td>Session 4 (1445-1530)</td></tr>
<tr><td>5th June 2010</td><td>Regulatory Experiences from the Telecom Sector

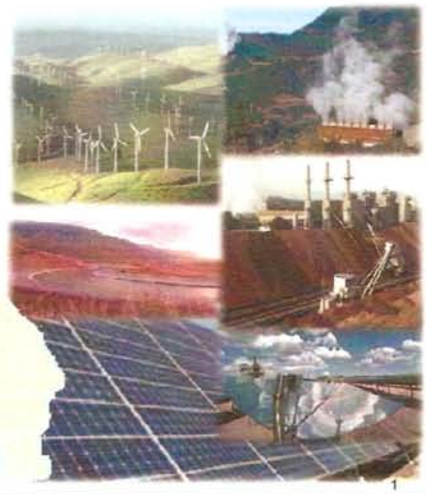
Rekha Jain</td><td colspan="3">System Operation Issues in Competitive Electricity Sector and International Experience
S. K. Soonee
PGCIL</td><td>Feedback and Briefing on International Component</td></tr>
</table>

June 6 – 10, 2010, San Francisco USA

	Forenoon (1000 to 1200)	**Afternoon (1400 to 1600)**
6th June 2010	Arrive in SFO	
7th June 2010	California Energy Commission – meeting with Commissioner Mr. Weisenmiller and staff. Location: 1516 Ninth Street, Sacramento, CA 95814. Lunch to be arranged.	California Independent System Operator - Facility tour and presentation from staff Location: Folsom, CA 95763 CAISO Contact: Brianna O'Neill
8thJune 2010	Meeting with LBNL staff Location: LBNL, Berkeley, CA. Lunch arranged by LBNL at meeting location.	CPUC (LBNL) Staff presentation Location: LBNL, Berkeley CA CPUC Contact: Michael Wheeler Evening Dinner arranged by LBNL (Contact Person: Ms. Barbara Adams)
9th June 2010	Utilities presentation (still to be confirmed) Location: LBNL, Berkeley CA. Followed by lunch hosted by LBNL at meeting location.	Rest/Shopping. De-briefing session followed by feedback session (International Module) – meeting room 8:00 pm to 10:00 pm
10th June 2010	Rest/Shopping. Lunch to be arranged.	Depart for SFO International Airport at 1345

Stay in US: Hilton San Francisco Financial District, 750 Kearny Street, San Francisco, CA 94108

California RPS Targets and the Energy Commission's Role in Achieving Success



Kate Zocchetti

Supervisor
Renewable Energy Office
California Energy Commission

June 7, 2010

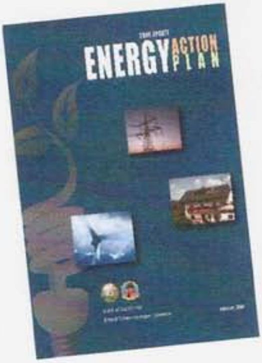
World Perspective – We're not alone!

Governments throughout the world are focusing energy policy strategy to address the following goals:

- Reduce and mitigate climate change impacts (pollution, GHG)
- Support economic growth & competitiveness
- Strengthen energy security by reducing dependence on oil
- Eliminate fuel poverty by diversifying with environmentally-friendly resources

CA's Energy Policy Relies on a *Loading Order*

California's *Energy Action Plan* defined a loading order to address the state's increasing energy needs



1. Energy efficiency and demand response
2. ***Renewable energy** and **distributed generation***
3. Clean fossil-fueled sources and infrastructure improvements

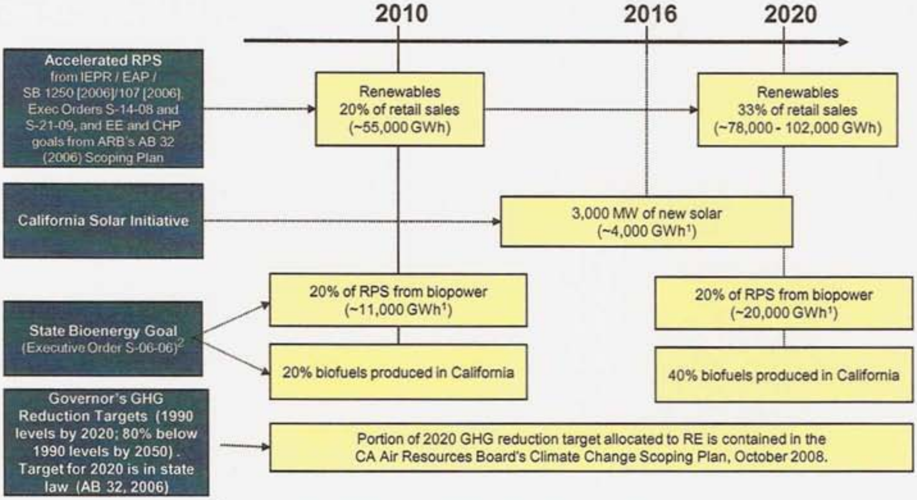
This strategy benefits CA by reducing CO_2 emissions and diversifying energy sources.

CA's Advocacy for Renewable Energy

California has made electricity generation from renewable resources a priority since the 1970s

- The 1970s oil crises gave rise to concerns over dependency on fossil fuels and resulted in the passage of federal legislation, the Public Utility Regulatory Policies Act (PURPA) of 1978, which provided guidelines to support growth of nonutility power producers. In California, many of these independent generators were renewable. PURPA was aggressively implemented in the early 1980s.
- From its peak in the early 1990s, renewable generation declined amid market uncertainties.
- In 1996, AB 1890 placed a surcharge on electricity sold by investor-owned utilities to be used to fund public interest programs, including renewable energy.
- The Energy Commission designed the **Renewable Energy Program**, a financial incentive mechanism to support renewable development in a market environment.
- This method for supporting renewables, however, was impacted by the energy crisis of 2000 and 2001 and led to the creation of a **Renewables Portfolio Standard** in 2002.

Summary of CA Renewable Energy Policies



[1] Assumes average capacity factors are 15% for solar and 90% for biopower.
[2] Executive Order S-06-06 can be downloaded at http://gov.ca.gov/index.php?/print-version/executive-order/183/.
Note: The roadmap also considered detailed policy guidance as stated in the IEPR.

California ARB GHG Reduction Plan Sees Key Role for Renewable Energy

ARB 32 Scoping Plan
Recommended Actions for Electricity Sector

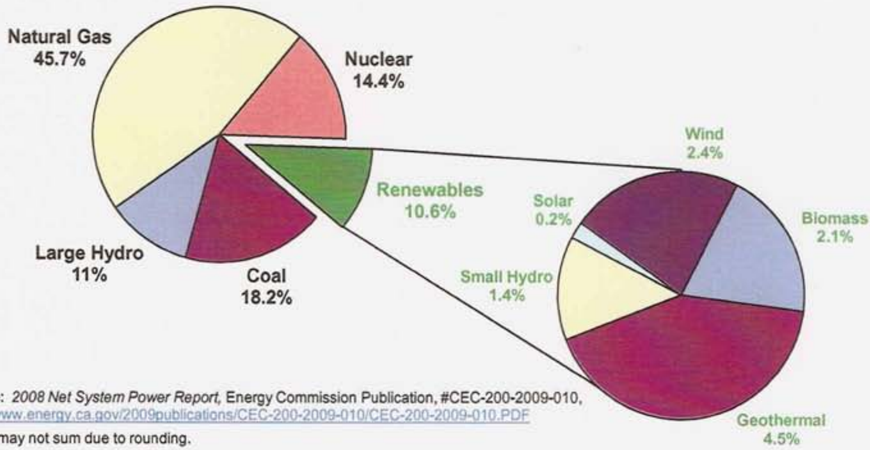
MEASURE	GHG REDUCTIONS (MMTCO2E)
Energy Efficiency	**15.2**
(32,000 GWh of Reduced Demand) • Increased Utility Energy Efficiency Programs • More Stringent Building & Appliance Standards • Additional Efficiency and Conservation Programs	
Combined Heat and Power	**6.7**
Increase Combined Heat and Power Use by 30,000 GWh	
Renewables Portfolio Standard	**21.3**
Achieve a 33% renewables mix by 2020	
Million Solar Roofs	**2.1**
(Including California Solar Initiative, New Solar Homes Partnership, and solar programs of publicly owned utilities) • Target of 3000 MW Total Installation by 2020	
TOTAL	**45.3**

- In November 2008, Gov. Schwarzenegger's Executive Order S-14-08 raised California renewable energy goals to 33% by 2020.
- In September 2009, Executive Order S-21-09 directed ARB, under its AB 32 authority, to work with the California Public Utilities Commission, California Independent System Operator, and Energy Commission to adopt regulations by July 31, 2010, consistent with the 33% renewable energy target established in Executive Order S-14-08.
- **RPS target of 33% is expected to provide 15.2% of total GHG reductions needed to meet AB 32 goal of 1990 emissions levels by 2020.**

Green House Gas

California's Generation Mix in 2008

Includes In-State Generation and Estimated Energy Imports



Source: *2008 Net System Power Report,* Energy Commission Publication, #CEC-200-2009-010, http://www.energy.ca.gov/2009publications/CEC-200-2009-010/CEC-200-2009-010.PDF

Totals may not sum due to rounding.

For daily renewable energy generation in CA ISO area, see http://www.caiso.com/green/renewrpt/DailyRenewablesWatch.pdf

Energy Commission Work Related to Renewable Energy

- All four divisions of the Energy Commission work on renewable energy.
  - Siting of thermal power plants 50 MW and larger and transmission planning for renewable energy.
  - Policy development and implementation, including eligibility and verification for the RPS; incentive programs for existing biomass, small-scale wind, and new solar homes; actions to address barriers to expansion of renewable energy; and climate change policy related to renewable energy.
  - Analysis of changes needed to electricity system to integrate high levels of renewable energy.
  - Public Interest Energy Research, including smart grid, storage, renewable energy-based secure communities, mitigation of environmental impacts of renewable energy.
- Collaboration/cooperation within the Energy Commission and with other agencies at the state, local, and federal level.
- Experts and stakeholders help inform our work through advisory committees, siting case hearings, public workshops, and support services contracts.

CA's Innovative
Renewable Energy Program

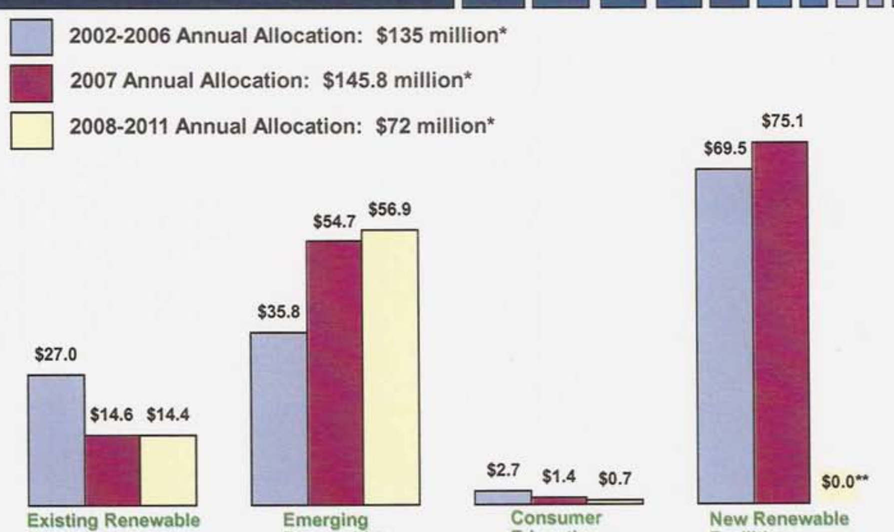
Long-term goal of a fully competitive and self-sustaining California renewable energy supply

Existing Renewable Facilities Program	Emerging Renewables Program	Consumer Education Program	New Renewable Facilities Program

The REP is legislatively mandated to:

- Optimize public investment and ensure that the most cost-effective and efficient investments in renewable resources are vigorously pursued.
- Increase the quantity of California's electricity generated by renewable resources, while protecting system reliability, fostering resource diversity, and obtaining the greatest environmental benefits to the state.
- Identify and support emerging renewable energy technologies with the greatest near-term commercial promise that merit targeted assistance.

Renewable Energy Program Funding 2002 - 2011



*The total amount collected each year is adjusted annually at a rate equal to the lesser of the annual growth in electric commodity sales or inflation, as defined by the gross domestic product deflator.

**Projected 2008-2011 annual allocation would have been approximately $77.9 million.

Senate Bill 1

One Million Solar Roofs in California by 2016!

SB 1 enacts Governor Schwarzenegger's *Million Solar Roofs* Initiative

- SB 1 (2006) includes both the CPUC's CSI program and CEC's New Solar Homes Partnership (NSHP).
- SB 1 includes municipal utilities that the CPUC does not oversee.
- Requires production homebuilders of 50+ homes to offer solar as an option for new homes starting in 2011.

- Adds energy efficiency improvements as a condition to receiving an incentive for roof-top solar energy.
- Raises the cap on net metering—a program that allows solar customers to get an electric bill credit for excess power generated by their solar system—from 0.5% of a utility's total load to 2.5% enabling ~500,000 new solar system owners into the net metering program.

Senate Bill 1

Solar incentive programs under SB 1 and Governor Schwarzenegger's *Million Solar Roofs* Program

California Solar Initiative	New Solar Homes Partnership	Solar Initiative Programs
CPUC Program	*CEC Program*	*POU Programs*
Commercial, Industrial, Existing Residential	New Residential Construction	Varies According to POU
$2 Billion*	**$400 Million**	**$784 Million**

*Additional $100 Million for Solar Thermal and Solar Water Heaters plus $50 Million for Solar R&D

New Solar Homes Partnership

The NSHP intends to create a sustainable market for solar homes and gain builder commitment to install solar energy systems.

- High-performing solar systems on highly efficient residential construction
- 400 MW installed capacity by the end of 2016
- Solar energy systems on 50% of new homes by end of program
- Self-sufficient solar industry
- One-time, up-front incentive
- Incentives decline as megawatt targets are reached.
- Incentives decline to zero over 10 years.

New Solar Homes Partnership

Seal represents an NSHP home

RESULTS AS OF DECEMBER 2009:

- 880 applications received for 8,922 solar systems.
- Residential solar installations totaling 2,105 represent 5.13 MW of renewable capacity bringing total disbursements to $14.4 million.

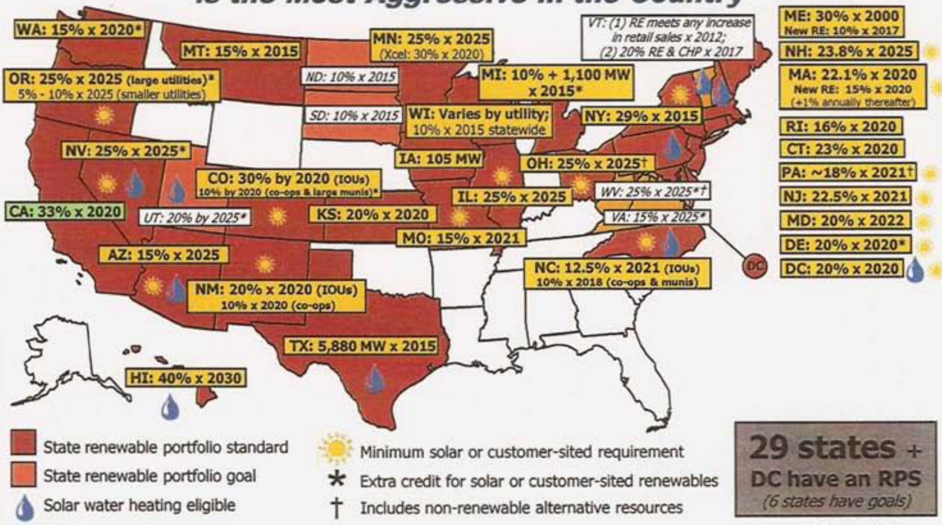
Renewables Portfolio Standard Nationwide

In the United States, an RPS is a popular energy policy tool

- A Renewables Portfolio Standard (RPS) requires that a minimum (and growing) percentage of **renewable generation** be included in the electricity mix.
- The benefits of an RPS include:
  - Long-term contracts with utilities help reduce risk for the developer and help secure financing
  - Larger economies of scale for renewable technologies brings down the cost
  - Environmental protection & public health – clean air, climate change
  - Hedging against volatile natural gas prices
  - Jobs, economic development
  - Lower prices due to competitive procurement process

State Renewables Portfolio Standards

California's RPS Goal for New Renewable Generation is the Most Aggressive in the Country



DSIRE: www.dsireusa.org

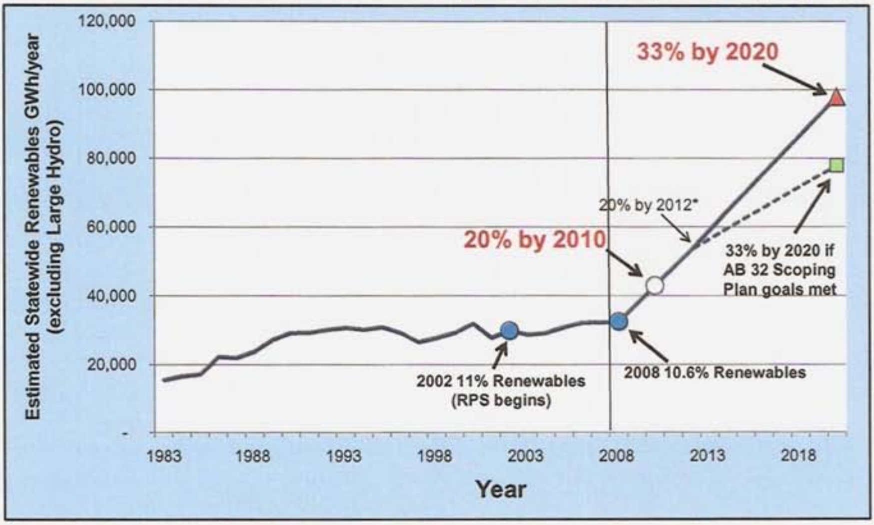
April 2010

California's Renewables Portfolio Standard

- RPS signed into law in 2002 assigning roles to Energy Commission, CPUC, and requiring retail sellers to procure 20% renewable energy by 2010.
- Publicly owned utilities set their own RPS goals recognizing the intent of the legislature to attain a target of 20% of California retail sales of electricity from renewable energy by 2010.
- Governor Schwarzenegger's Executive Orders set further goal of 33% renewable energy by 2020.

RPS procurement compliance is measured in terms of electricity delivered, not signed contracts.

California's Renewable Energy Goals



20% by 2010 and 33% by 2020 goals **based on retail sales.**

2002 11% Renewables and 2008 10.6% Renewables **based on generation.**

*Report assuming 20% by 2012: www.energy.ca.gov/2009publications/CEC-200-2009-011/CEC-200-2009-011.PDF

IOU, ESP, and CCA RPS Implementation

CEC ROLE

- **Certify renewable facilities as eligible for the RPS**
- **Design and implement an accounting system to track and verify RPS compliance**
- **Distribute Supplemental Energy Payments (Legislation deleted CEC authority to award SEPs and transfers administrative responsibility to CPUC)**

CPUC ROLE

Oversight of IOU procurement:

- **Approve procurement plans**
- **Set baselines and targets**
- **Develop market price referent**
- **Develop least-cost-best-fit process to evaluate bids**
- **Set rules for flexible compliance**
- **Standardize contract terms**
- **Approve/ reject contracts**
- **Ensure RPS competitiveness**
- **Administer above-market funds**

Oversight for other "retail sellers"

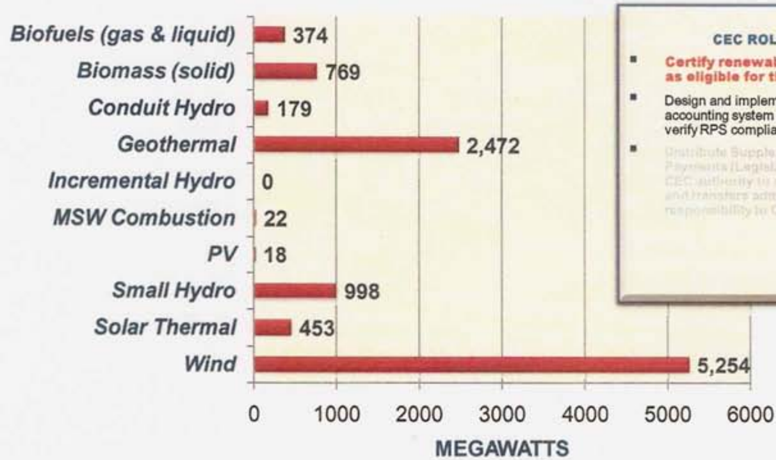
IOU, ESP, and CCA RPS Eligible Technologies

- Biodiesel
- Biomass
- Conduit hydroelectric
- Digester gas
- Fuel cells using renewable fuels
- Geothermal
- Hydroelectric (incremental generation from efficiency improvements)
- Landfill gas
- Municipal solid waste (limited)
- Ocean wave, ocean thermal, tidal current
- Photovoltaic
- Small hydroelectric (30 MW or less)
- Solar thermal electric
- Wind

These technologies also provide most of the POU RPS energy.

CEC RPS Certification

Facilities certified as RPS eligible represent more than 10,260 MW of capacity.*



CEC ROLE

- **Certify renewable facilities as eligible for the RPS**
- Design and implement an accounting system to track and verify RPS compliance
- Distribute Supplemental Energy Payments (Legislation deleted CEC authority to award SEPs and transfers administrative responsibility to CPUC)

*Includes only the percent of capacity certified as RPS eligible.
Data as of April 2010.

What is the Western Renewable Energy Generation Information System?

WREGIS tracks renewable generation to help ensure the credibility of the "green" value of renewable electricity

- WREGIS is a **voluntary**, **independent** renewable energy registry and tracking system for the Western Interconnection transmission area
  - Uses verifiable renewable energy generation data
  - Creates renewable energy certificates (WREGIS certificates)
  - Accounts for transactions involving certificates
  - Supports voluntary and regulatory markets for certificates
- WREGIS was launched in June 2007

CEC ROLE

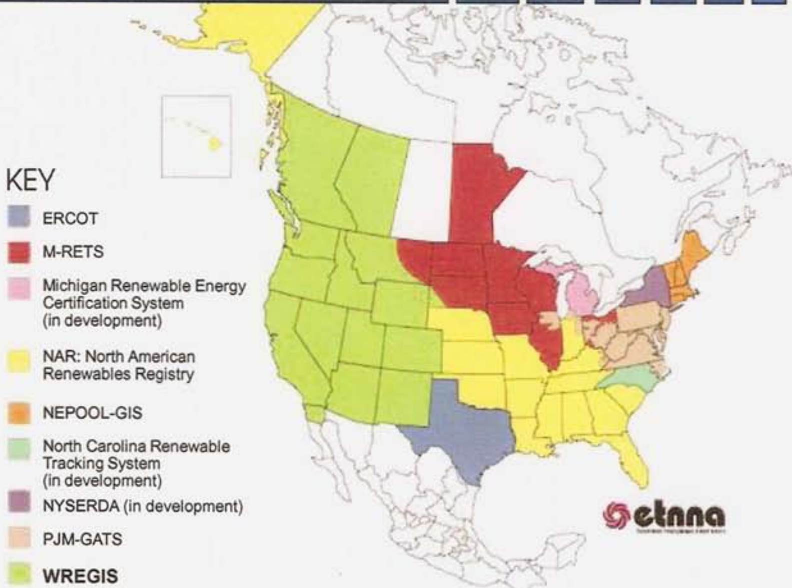
- Certify renewable facilities as eligible for the RPS
- **Design and implement an accounting system to track and verify RPS compliance**
- Distribute Supplemental Energy Payments (Legislation deleted CEC authority to award SEPs and transfers administrative responsibility to CPUC)

- Retail sellers and renewable facilities participating in California's RPS are required to register with and use WREGIS. POUs can opt to use WREGIS to track their RPS energy.

RESULTS as of June 2010:

- ➡ **More than 335** companies and **over 1,400** generators are approved to be WREGIS Account Holders.
  includes outside CA

Attribute Tracking Systems



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IOU, SMJU, and ESP Progress Toward 20% by 2010 RPS

Retail Seller	2001	2003	2004	2005	2006	2007	2008
PG&E	8.9%	12.4%	11.6%	11.9%	11.9%	11.4%	11.9%
SCE	14.9%	17.9%	18.3%	17.4%	16.1%	15.7%	15.5%
SDG&E	1.0%	3.7%	4.3%	5.2%	5.3%	5.2%	6.1%
SMJUs Combined	0.0%	4.6%	4.0%	4.4%	5.0%	6.6%	10.2%
ESPs Combined	*	*	*	0.7%	1.5%	6.6%	**
TOTAL STATEWIDE	**10.5%**	**10.4%**	**10.2%**	**10.7%**	**10.9%**	**10.7%***	**10.6%**

*No ESP claimed sales of renewable generation in 2001, and no ESP data was collected for years 2003 and 2004.
**ESPs' 2008 procurement data redacted from their *March 2009 Compliance Reports* submitted to the CPUC.

- The CPUC did not set RPS targets for the SMJUs until 2007.
- Totals may not sum due to rounding and all data is subject to change.

Sources:

1. IOUs, SMJUs, and ESPs data from the *March 2009 RPS Compliance Reports* filed with the CPUC. Percentages calculated based on same year total retail sales except for SDG&E's 2008 percentage, since they redacted 2008 bundled retail sales in their March 2009 RPS Compliance Report. Consequently, SDG&E's 2008 percentage was calculated using 2007 total retail sales. Data for 2006, 2007, and 2008 has not been verified by the Energy Commission.
2. Total statewide percentages include generation data from the three large IOUs, ESPs, SMJUs, and local POUs. The data source for the Total Statewide percentages in 2001 is the 1997-2008 California Electricity Generation database located at energyalmanac.ca.gov/electricity/index.html. [mk1] The source for Total Statewide percentage for 2007 is the Energy Commission's *2008 Net System Power Report*, www.energy.ca.gov/2009publications/CEC-200-2009-010/CEC-200-2009-010-CMF.PDF.
3. Other than data for 2007, Total Statewide percentages for years 2003 through 2008 were compiled from data from the respective year's *Net System Power Report*.

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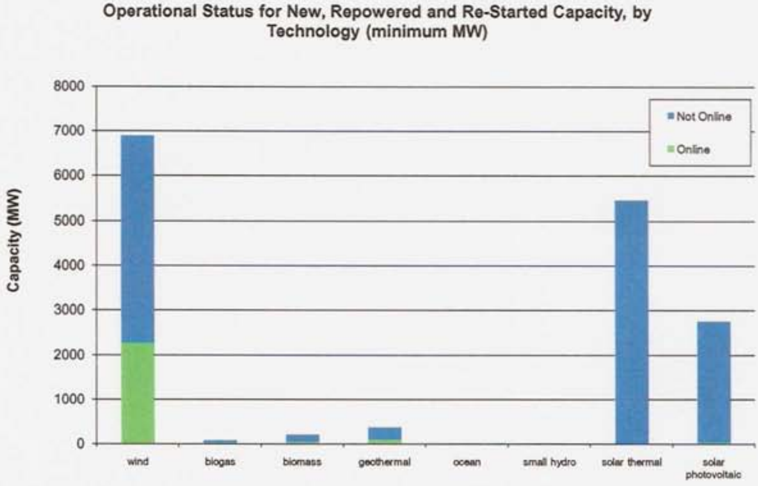
IOU RPS Projects: Solar and Wind Dominate Contracts Signed Since 2002



Source: California Energy Commission, Database of IOU Contracts for Renewable Generation, April 2010 update, www.energy.ca.gov/portfolio/IOU_CONTRACT_DATABASE.XLS

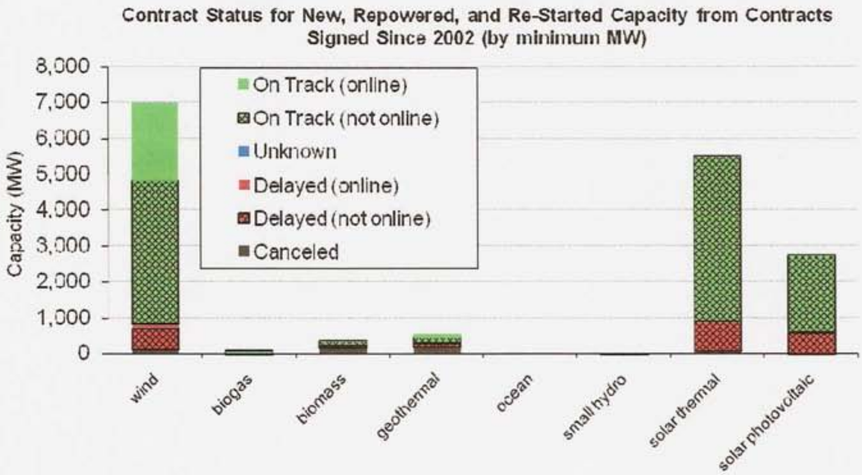
Signed IOU RPS Contracts by Technology
Capacity and Projected Deliveries

Contracts are executed as a result of utility solicitations while others are negotiated bilaterally, separate from the RPS solicitation process.

	PG&E (MW)	SCE (MW)	SDG&E (MW)	Total (MW)	Total Projected Deliveries (GWh)
Wind	1,721 – 1,746	2,846 – 3,648	991 – 1,171	5,558 – 6,565	16,720 – 19,301
Biogas	17 – 107	15 – 26	28	60 – 162	449 – 1,271
Biomass	149 – 169	36	87	272 – 292	1,972 – 2,136
Geothermal	747 – 786	385 – 845	60	1,192 – 1,691	8,533 – 12,550
Ocean	0	0	0	0	0
Small Hydro	2	22 – 110	5	28 – 117	106 – 385
Solar Thermal	2,562	2,394 – 3,256	349 – 949	5,306 – 6,768	14,176 – 17,422
Solar PV	1,545	561 – 574	0	2,106 – 2,119	6,000 – 6,032
TOTAL	**6,744 – 6,917**	**6,258 – 8,496**	**1,520 – 2,300**	**14,522–17,713**	**47,956 – 59,097**

Source: California Energy Commission, Database of IOU Contracts for Renewable Generation, December 2009 update, www.energy.ca.gov/portfolio/IOU_CONTRACT_DATABASE.XLS. Totals may not sum due to rounding.

IOU RPS Projects at Risk for Delay or Failure may affect Delivery Goals



Source: California Energy Commission, Database of IOU Contracts for Renewable Generation, April 2010 update, www.energy.ca.gov/portfolio/IOU_CONTRACT_DATABASE.XLS

Tradable Renewable Energy Credits Allowed for CA RPS Compliance

Tradable RECs can provide greater compliance flexibility, procurement efficiency, and potentially lower costs

On March 11, 2010, the CPUC established the structure and rules for a TRECs market. The CPUC stayed this decision on May 6, 2010.

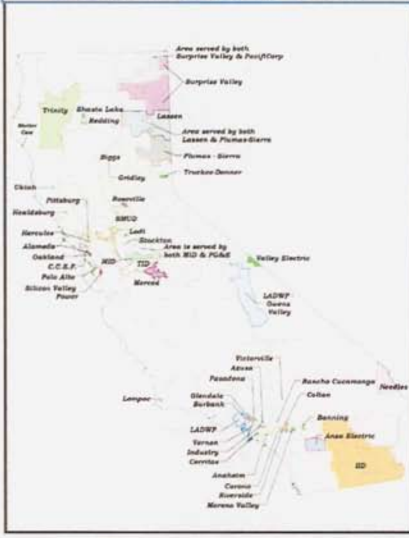
- Use of TRECs for RPS compliance is initially limited to not more than 25% of an IOU's annual procurement obligation; this limitation sunsets at the end of 2011.
- Interim price cap of $50 on TRECs used for RPS compliance by IOUs; this price cap will sunset at the end of 2011.
- Participants must meet CPUC and WREGIS requirements as well as Energy Commission's RPS eligibility rules.
- RECs from facilities not serving California load treated as TRECs for RPS compliance beginning March 2010.

Source: CPUC, March 2010

POUs: About ¼ of California's Electricity

California's Electric Investor-Owned Utilities (IOUs)

California's Publicly Owned Electric Utilities



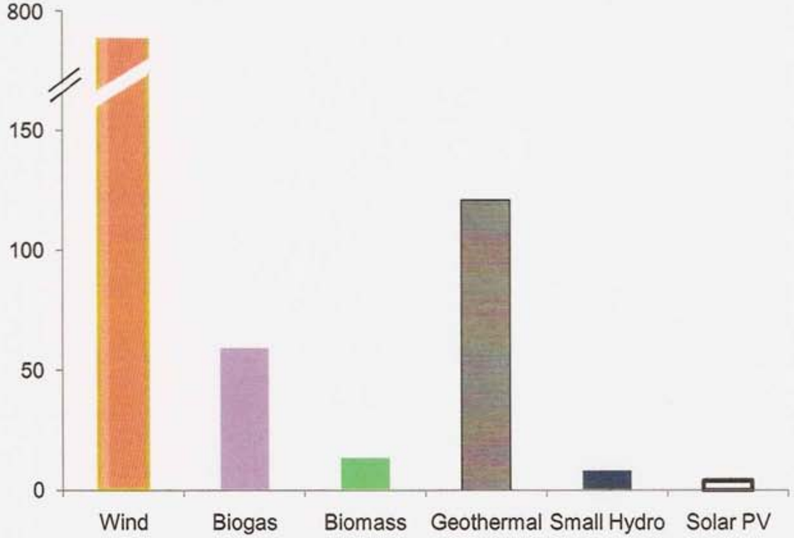
POUs' RPS Targets and 2008 Procurement

POUs report past and projected procurement of renewable energy to the Energy Commission.

	2008	Target			2008	Target	
Anaheim	6.3%	20%	2015	Redding	27.7%	20%	2017
Burbank	1.3%	33%	2020	Riverside	9.3%	33%	2020
Glendale	13.9%	20%	2017	Roseville	18.3%	20%	2017
Imperial	7.9%	30%	2020	SMUD	19.7%	33%	2020
LADWP	7.2%	35%	2020	SVP	27.8%	20%	ongoing
Modesto	11.5%	20%	2017	Turlock	4.4%	20%	2017
NCPA	38.0%	various		Vernon	1.7%	20%	2017
Pasadena	13.2%	20%	2017				

Sources: California Energy Commission, Staff Assessment of POU Resource Adequacy and Electricity Resource Plans, presentation by Jim Woodward, August 6, 2009.
SMUD data: SMUD website, Community and Environment, www.smud.org/en/community-environment/climate-change/pages/index.aspx

POU RPS Contracts with Target Online Dates of 2009-2015 (MW)

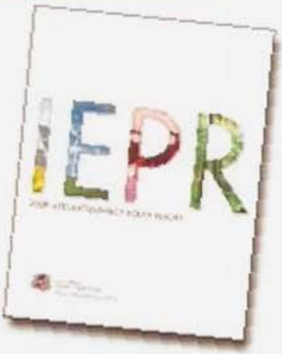


Source: California Energy Commission, Database of POU Contracts for Renewable Generation, December 2008
http://www.energy.ca.gov/2008publications/CEC-300-2008-005/index.html

Integrated Energy Policy Report

The Energy Commission's IEPR forms the foundation for state policy and decisions on energy issues.

- Begun in 2003, odd-numbered years full report with an update in even-numbered years
- Provides an overview of energy trends and issues facing CA
  - Energy supply, demand, pricing, reliability, and efficiency
  - Impacts on public health and safety, the economy, the state's resources, and the environment



2009 Integrated Energy Policy Report
Major Challenges for Renewable Development

- Difficulty integrating large amounts of renewable energy into the electricity system.
- Uncertainty on timeline for meeting RPS goals.
- Environmental concerns with development of renewable facilities and associated transmission.
- Difficulty securing project financing.
- Delays and duplication in siting processes. Time and expense of new transmission development.
- Cost of renewable energy in fluctuating energy market.
- Maintaining state's existing baseline of renewable facilities.

Source: *2009 Integrated Energy Policy Report, Commission Final Report*, December 2009, http://www.energy.ca.gov/2009_energypolicy/index.html

2009 IEPR
Key Recommendations for Renewable Energy

- Continue the cooperative work among state agencies to implement a 33% renewable policy that applies to all load serving entities and retail providers.
- Reduce regulatory uncertainty with legislation to codify the 33% renewable target.
- Implement measures to accelerate permitting of new renewables and associated transmission.
- Address barriers to the expansion of biopower, including regulatory hurdles and project financing, and encourage R&D to reduce costs for biomass conversion, biopower technologies, and environmental controls.
- Identify solutions to integrate increasing levels of energy efficiency, smart grid infrastructure, and renewable energy while avoiding surplus generation.

Source: *2009 Integrated Energy Policy Report, Commission Final Report*, December 2009, http://www.energy.ca.gov/2009_energypolicy/index.html

Additional Information

***California Energy Commission Web sites*:**

- Renewable Energy Program
  www.energy.ca.gov/renewables/index.html
- Renewables Portfolio Standard
  www.energy.ca.gov/portfolio/index.html
- Integrated Energy Policy Reports
  http://www.energy.ca.gov/2009_energypolicy/index.html
- Proposed Renewable Energy Projects for California
  http://www.energy.ca.gov/33by2020/documents/index.html
- GoSolar California
  www.gosolarcalifornia.org

***California Public Utilities Commission Web site*:**

Renewables Portfolio Standard
www.cpuc.ca.gov/PUC/energy/electric/renewableenergy/index.htm

***Air Resources Board Web site*:**

ARB's Climate Change Program
www.arb.ca.gov/cc/cc.htm

Energy Policy in California

June 8, 2010 LBNL Briefing

California Public Utilities Commission
Office of Commissioner Dian M. Grueneich
Theresa Cho, Chief Of Staff
Michael Wheeler, Energy Advisor

www.cpuc.ca.gov

Public Utilities Commission

- Regulation of privately owned electric and natural gas companies
  - 75-80% of California electricity demand – 236,000 GWh 50,000 MW (2008)
  - Sets rates, determines revenue requirements, approves electricity generation portfolios
- Mission Statement: The California Public Utilities Commission serves the public interest by protecting consumers and ensuring the provision of safe, reliable utility service and infrastructure at reasonable rates, with a commitment to environmental enhancement and a healthy California economy.

Structure and Administration

Divisions:

- Commissioners
- Executive Office
- Communications
- Energy
- Water
- Consumer Protection and Safety
- Consumer Service and Information
- Administrative Law Judges
- Legal
- Policy and Planning
- Information and Management Services

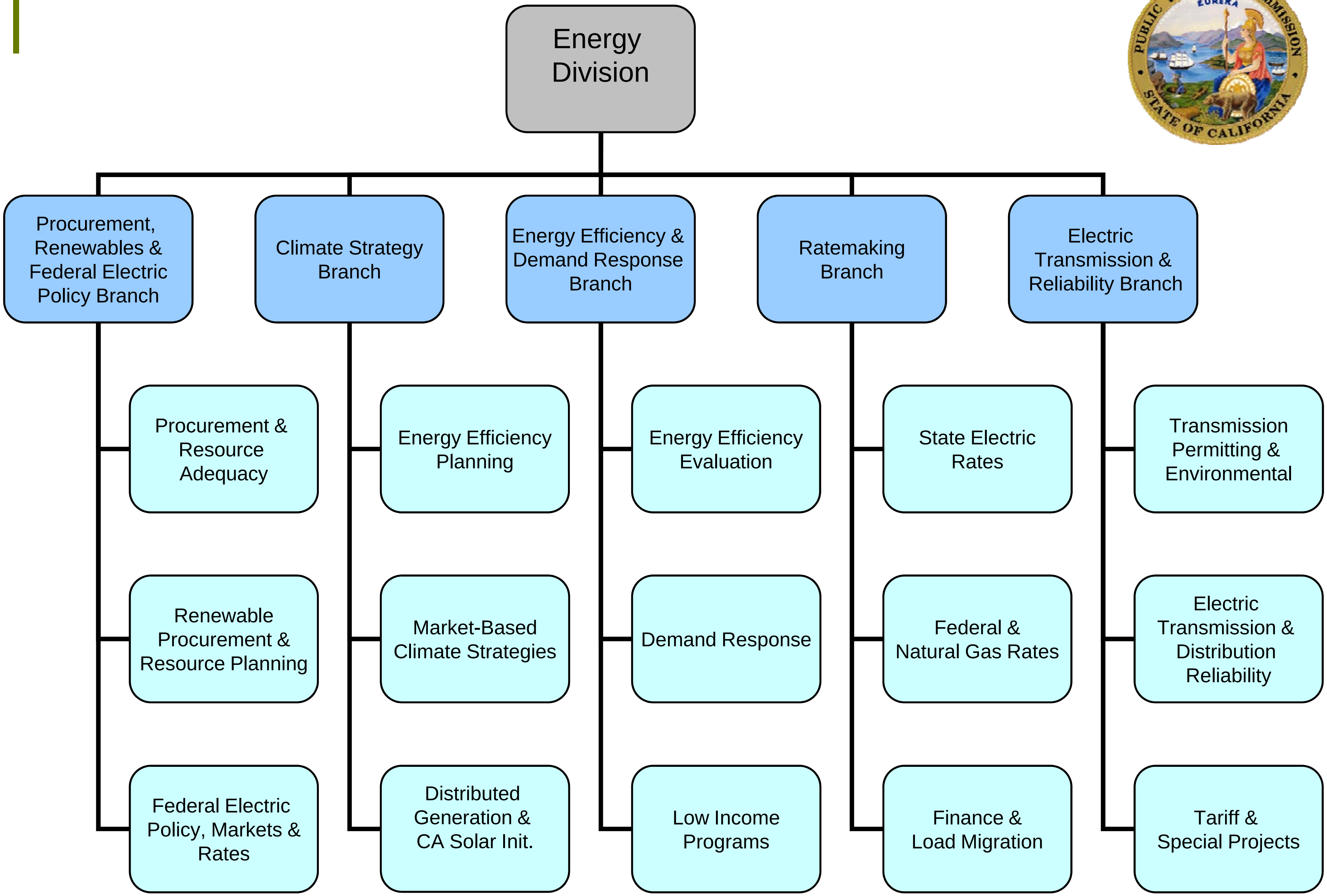
Division of Ratepayer Advocates:

- Independent Organization within CPUC
- DRA Director appointed by Governor
- Annual Budget of $27.6 M
- 138 Staff

"Our statutory mission is to obtain the lowest possible rate for service consistent with reliable and safe service levels. In fulfilling this goal, DRA also advocates for customer and environmental protections. "

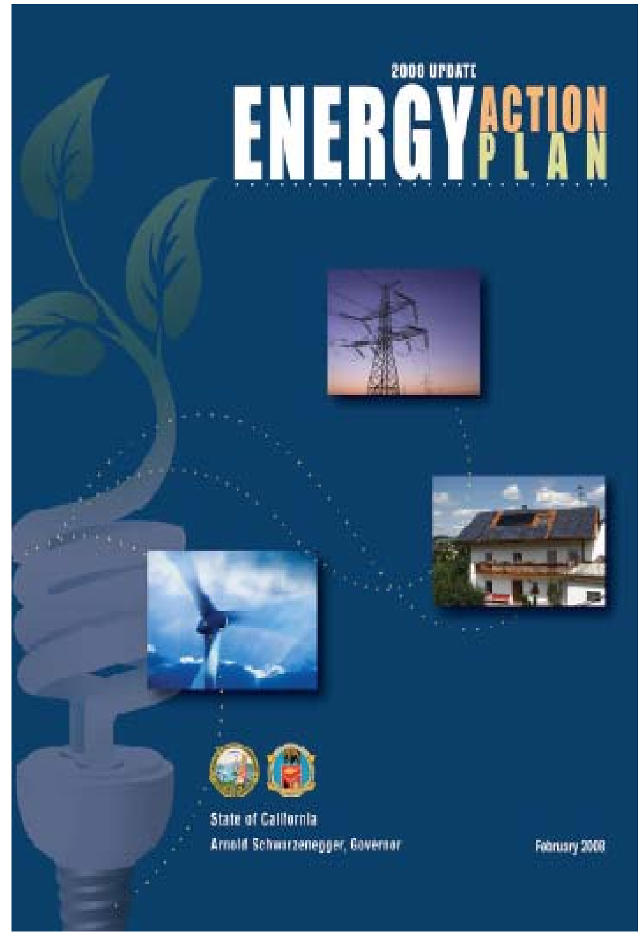
http://www.cpuc.ca.gov/PUC/aboutus/orgcharts.htm

http://www.dra.ca.gov/dra/


Energy Division
Procurement, Renewables & Federal Electric Policy Branch
Climate Strategy Branch
Energy Efficiency & Demand Response Branch
Ratemaking Branch
Electric Transmission & Reliability Branch
Procurement & Resource Adequacy
Renewable Procurement & Resource Planning
Federal Electric Policy, Markets & Rates
Energy Efficiency Planning
Market-Based Climate Strategies
Distributed Generation & CA Solar Init.
Energy Efficiency Evaluation
Demand Response
Low Income Programs
State Electric Rates
Federal & Natural Gas Rates
Finance & Load Migration
Transmission Permitting & Environmental
Electric Transmission & Distribution Reliability
Tariff & Special Projects

Loading Order of Preferred Electricity Resources

1. All cost-effective energy efficiency
2. Demand response
3. Renewable energy and distributed generation;
4. Cleanest available fossil-fueled resources: Emissions Performance Standard of 1,100 lbs CO_2 /MWh for new baseload generation



Integrated Resource Planning

- Biennual Long Term Procurement Plans – Utilities submit proposed plans for review and approval by CPUC
- Bottoms-up approach for 10 year resource plans
  - **CEC develops, with CPUC input, 10 year forecast of demand**
  - **Utilities required to develop plans based on forecast *minus***
    1. All Cost Effective Energy Efficiency +
    2. Demand Response Goals +
    3. Renewable energy mandate +
    4. Distributed Generation +
    5. Existing fossil and nuclear generation and imports –
    6. retirements = **Net short resources**
  - Utilities authorized to purchase electricity up to the net short

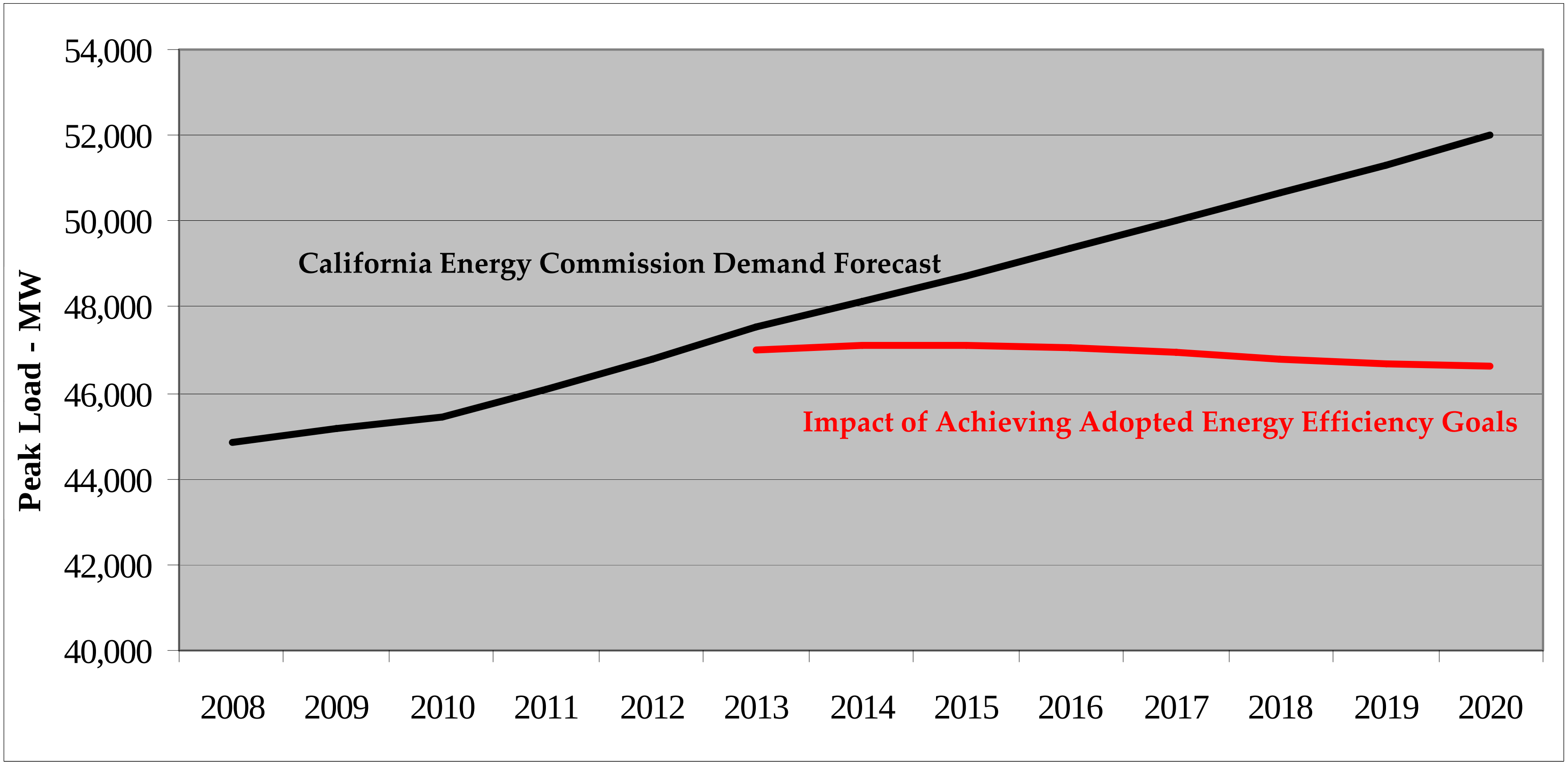
Recommended Reduction Measures	Reductions Counted Towards 2020 Target	
	(MMTCO2E)	Percentage of 2020 Target
REDUCTIONS FROM CAP AND TRADE PROGRAM	**34.4**	**19.8%**
REDUCTIONS FROM COMPLEMENTARY MEASURES	**112.3**	**64.5%**
California Light-Duty Vehicle Greenhouse Gas Standards	31.7	18.2%
Low Carbon Fuel Standard	15	8.6%
Regional Transportation-Related GHG Targets*	5	2.9%
Vehicle Efficiency Measures	4.5	2.6%
Goods Movement (Electrification at Ports, Efficiency)	3.7	2.1%
Medium/Heavy Duty Vehicles (Aerodynamics, Hybridization)	1.4	0.8%
High Speed Rail	1	0.6%
Transportation Sector sub-total		***35.8%***
Energy Efficiency (Building/appliance standards, new programs, CHP, Solar Water Heating)	26.3	15.1%
Renewable Portfolio Standard (33% by 2010)	21.3	12.2%
Million Solar Roofs	2.1	1.2%
Industrial Measures (sources under cap-and-trade program)	0.3	0.2%
Electric and Gas sub-sectors		***28.7%***
REDUCTIONS FROM UNCAPPED SOURCES/SECTORS	**27.3**	***15.7%***
High Global Warming Potential Gas Measures	20.2	11.6%
Sustainable Forests	5	2.9%
Industrial Measures (sources not covered under cap and trade; Oil and Gas, Transmission)	1.1	0.6%
Recycling and Waste (landfill methane capture)	1	0.6%
TOTAL REDUCTIONS COUNTED TOWARDS 2020 TARGET	**174**	

California's Greenhouse Gas Emission Reduction Strategies

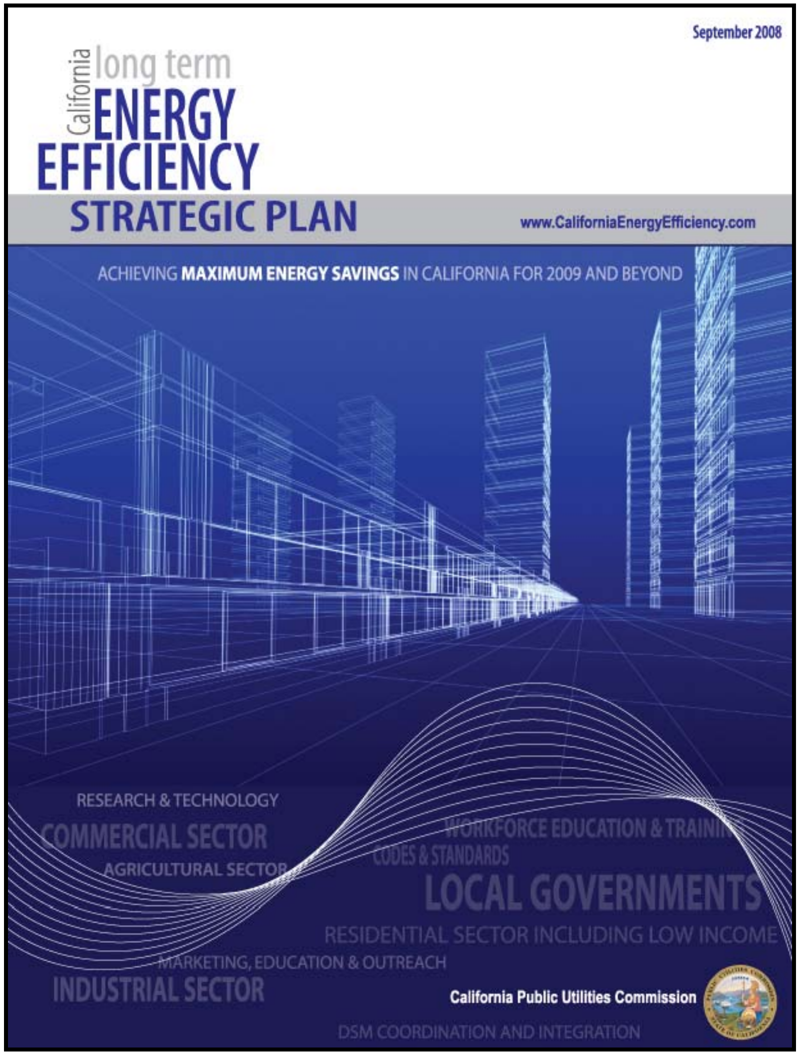
California's Global Warming Solutions Act Mandates 1990 Levels by 2020

California Air Resources Board Scoping Plan, December 2008, Table 2.

Achieving Adopted Energy Efficiency Goals Will Significantly Reduce Peak Load Growth



Source: CEC, January 2010



The California Long Term Energy Efficiency Strategic Plan

www.californiaenergyefficiency.com

Making Energy Efficiency a Way of Life in California

Implementing the Strategic Plan: 2010-2012 Programs

- $3.8 billion in funding
- $3.13 billion for general energy efficiency programs
  - Three Year Savings Potential:
  - ◆ 7,000 GWH ◆ 1,500 MW ◆ 150 MMTherms

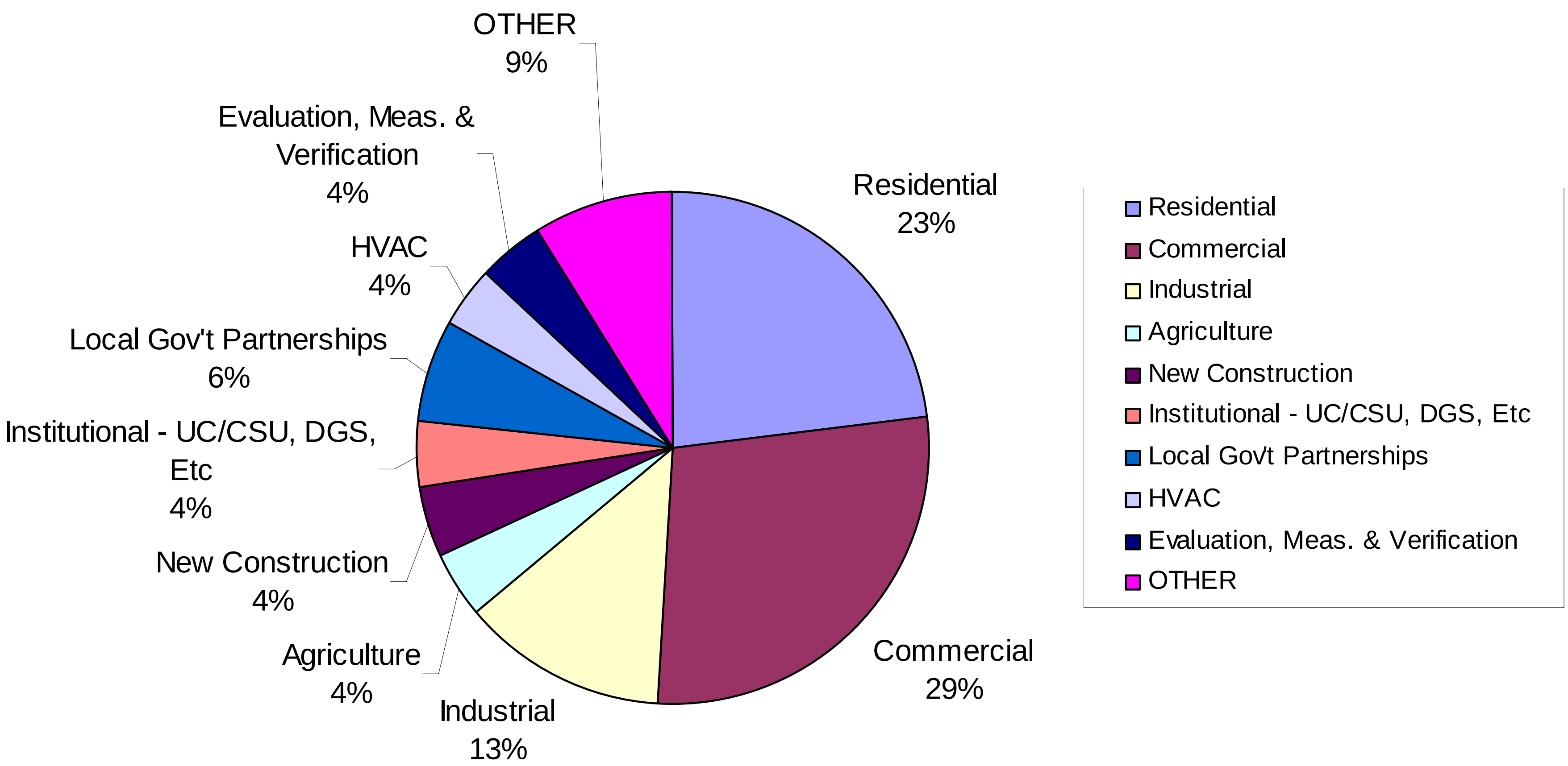
    3 million tons of CO2e avoided
  - Equivalent to <u>3</u> large power plants
- $750 million for low income homes and appliances
- 18,000 – 20,000 new jobs

Program Highlights

- 12 Statewide Programs
- Statewide Education Campaign to Create Behavior Change
- Web Portal for Efficiency Professionals
- Continuous Energy Improvement Programs for Industry
- Advanced Lighting Technologies
- Review of Best Practices for Measurement and Verification

Achieving market transformation through adoption of utility programs by the market or state codes and standards

Energy Efficiency
2010-2012 Programs



LONG-LASTING Energy Savings in Buildings

- Cal SPREE (Statewide Program for Residential Energy Efficiency) - $116 million
- Commercial and Government Benchmarking - $7 million
- Advanced Lighting programs – $89 million
- Zero Net Energy New Construction - $175 million
- Comprehensive HVAC program
- Commercial and Institutional On-Bill Financing
- Training for Building and Appliance Contractors, Architects, Owners, Managers, and Inspectors

Existing Commercial Buildings

- **Audits –** "do-it-yourself", Integrated, and Retro-commissioning (RCx) audits.
- **Calculated Incentives** – Incentives plus technical and design assistance for customized energy efficiency/DR projects for retrofit and Retro-Commissioning (RCx) projects.
- **Deemed Incentives -** encourage the adoption of "proven" (but not widely employed) emerging technologies and measures, including technical consultation.
- **Continuous Energy Improvement -** Corporate-wide energy management services, including analysis, benchmarking, long-term goal setting, project implementation support, performance monitoring, and energy management certification tools. Includes non-energy resource integration, such as greenhouse gas reduction, water conservation strategies, and regulatory compliance.
- **Direct Install –** No cost small business retrofits.
- **Benchmarking Integration** - IOUs required to benchmark all facilities that enter any of the commercial programs.

Demand Response Programs

	Programs	July 2003	August 2009
Dynamic Pricing	Default for industrial and commercial by 2012	0 MWs	192 MWs
Incentive Based DR Programs	Moving to wholesale markets	0 MWs	900 MWs
Emergency-triggered Programs	AC cycling and Interruptible load	1,485 MWs	2,161 MWs

Approximately 5% of Peak Load

Smart Meters:
Full Deployment by 2012

Increase System Efficiency

- Enhance operating efficiencies and savings
  - Auto meter reading, outage management, improved forecasting, theft reduction
- Support billing, customer support, outage management
- Interface with Direct Load Control communication technology

Enable dynamic pricing & feedback

- Provide two- way communication with utility
- Provide customers with flexible access to usage data and prices
  - Understand usage patterns & their relationship to energy costs
- Track interval (e.g., hourly) usage data: measure, store, transmit
- Implement dynamic pricing

Distributed Generation Programs

Facility Capacity (MW)	NEM Tariff	Self-Gen Incentive*	California Solar Initiative**	Solar Water Heaters**
0– 1.5	Yes	Yes (eligible for NEM)	Yes (eligible for NEM)	NA
1.5–20	No	Up to 5MW	NA	NA
≥ 20	No	No	NA	NA

* Eligible technologies are wind, fuel cells, storage, biogas
** Participants required to complete energy efficiency audit to receive incentives.

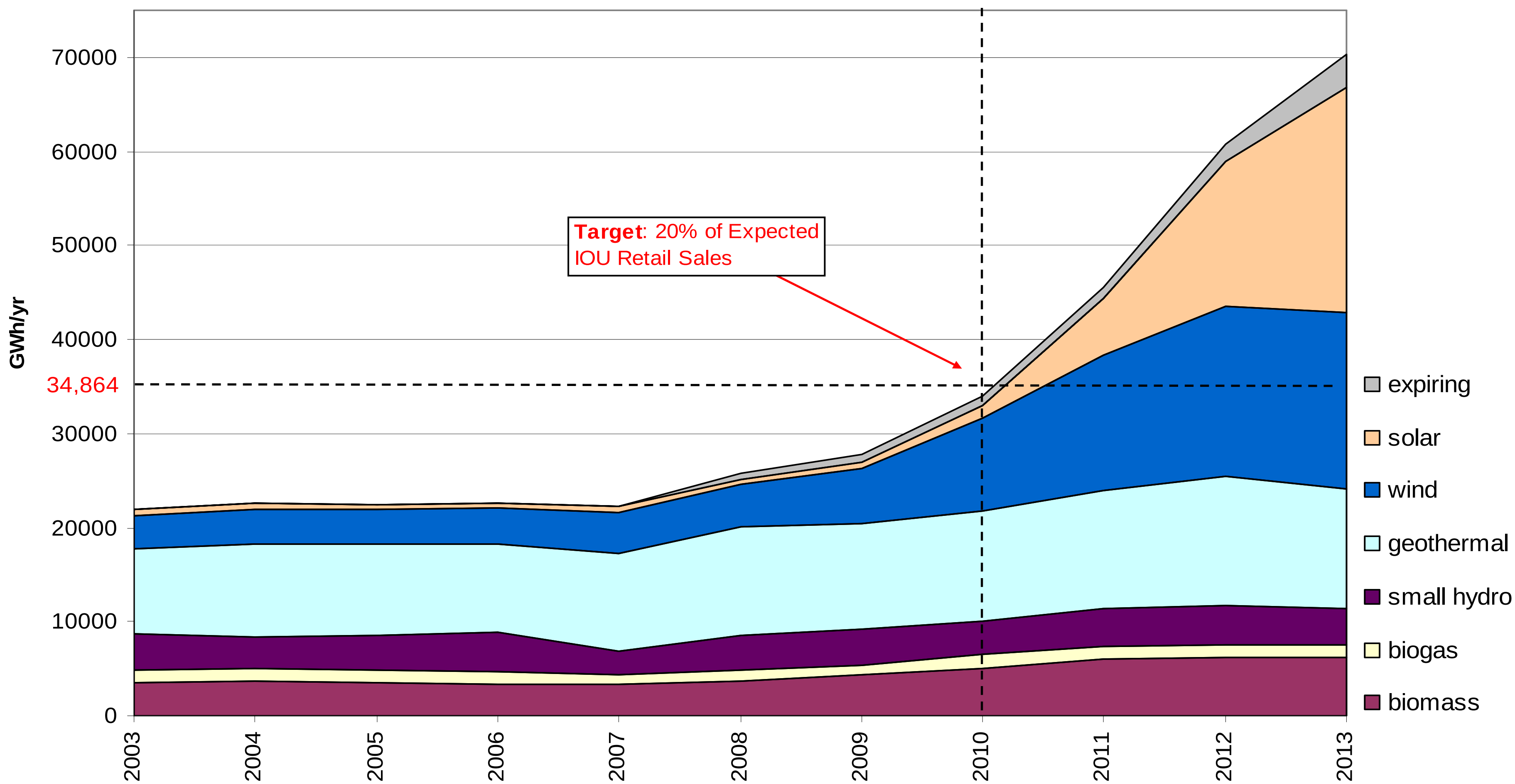
http://www.cpuc.ca.gov/PUC/energy/DistGen/
http://www.pge.com/tariffs/tm2/pdf/ELEC_RULES_21.pdf

Feed-In Tariffs

- Small Renewable Generators
  - Available to all renewable resources up to 3 MW
  - Excess power or full buy/sell
  - Cannot also participate in CSI, Self-Generation Incentive, RPS or net metering programs
  - Tariff based on the "market price referent"
  - 500 MW cap

- Combined Heat & Power Units
  - Excess generation from units up to 20 MW
  - Efficiency standards set by Energy Commission
  - Fixed cost + variable natural gas cost + TOD + location bonus

Renewable Energy Portfolio Standard 20% by 2010



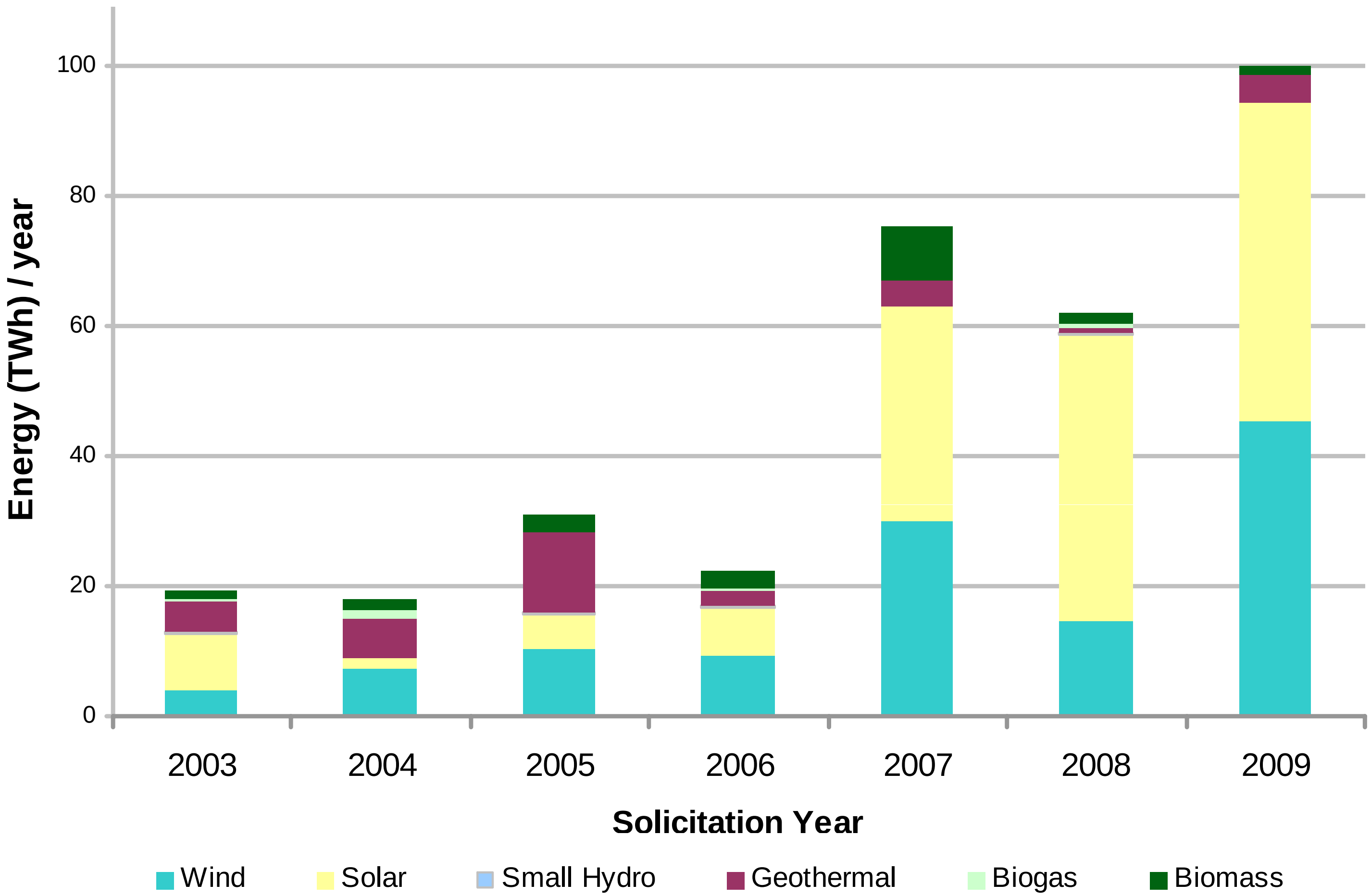
RPS Program Implementation

- Renewable Energy Resources - biomass, solar thermal, photovoltaic, wind geothermal, fuel cells, < 30 MW hydro, digester gas, solid waste, landfill gas, wave, ocean thermal, or tidal.
- Annual Procurement Plans and Requests for Offers
  - Independent Third Party Evaluator for Bids
  - Least Cost/Best Fit criteria
  - Contract price negotiated between buyer and seller
  - Market Price Referent Benchmark
  - 1 % increase in annual procurement each year
- Contract Terms
  - Contracts for 10, 15, or 20 years are most common
  - Short term contracts are also allowed, subject to certain limitations

Market Price Referent (MPR)

- MPR is the levelized cost of a new 500 MW CCGT on a net-present value (NPV) basis.
  - Installed capital costs, fixed and variable operations and maintenance costs, natural gas fuel costs, cost of capital, and environmental permitting and compliance costs.
  - Adjusted for the value of different products by applying time-of-delivery factors
- Set annually
- Statutory limit on above MPR costs of $773 million for RPS procurement
- Per Se reasonableness test
- Used to set feed-in tariff levels

RPS Bids by Fuel Type



Source: California Public Utilities Commission, 1st Quarter 2010

Magnitude of 33% RPS is Significant

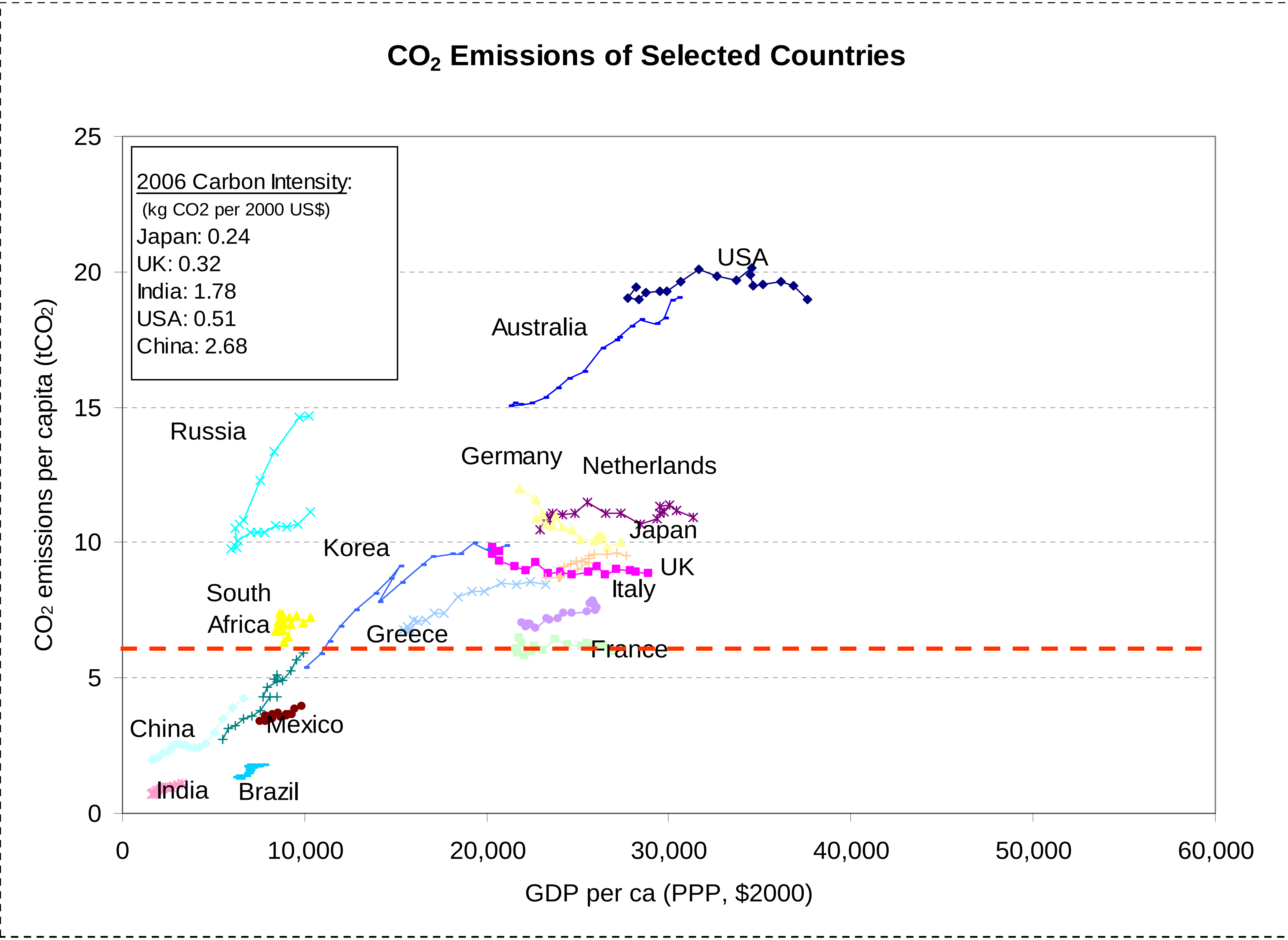
- 20% in 2020 scenario with mainly in-state resources:
  - Energy
    - 35 TWh of new renewables, in addition to existing 27 TWh
  - Transmission
    - 4 new major transmission lines at cost of $4 billion

- 33% in 2020 scenario with mainly in-state resources:
  - Energy
    - 75 TWh of new renewables
  - Transmission
    - Further transmission expansion

End-use Efficiency Improvements in India: Aggregate Economic and Carbon Benefits

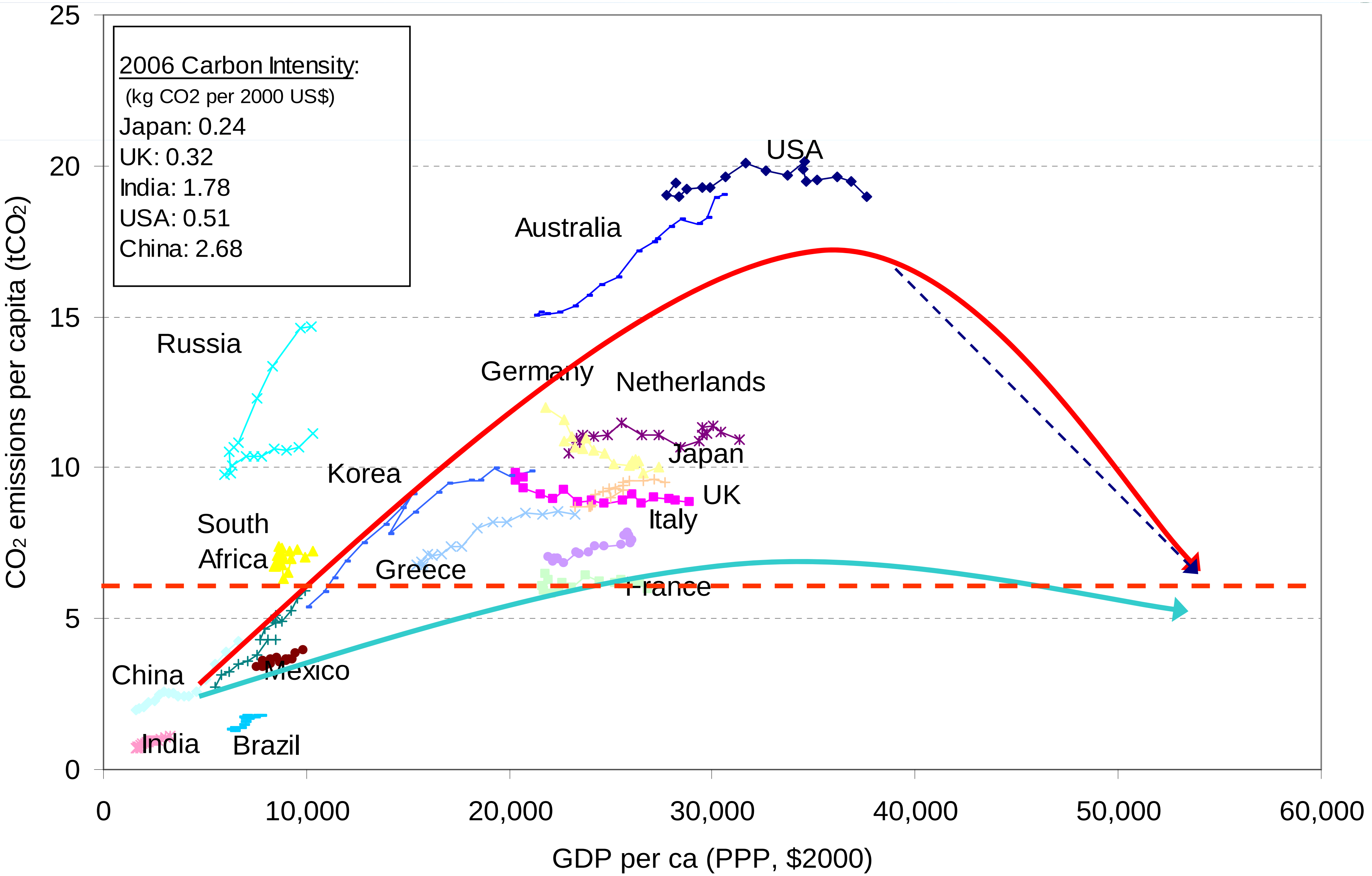
India Central and State
Electricity Regulatory Commissioners
9 June 2010

Jayant A. Sathaye
Senior Scientist and
Head, International Energy Studies
Lawrence Berkeley National Laboratory, Berkeley, CA



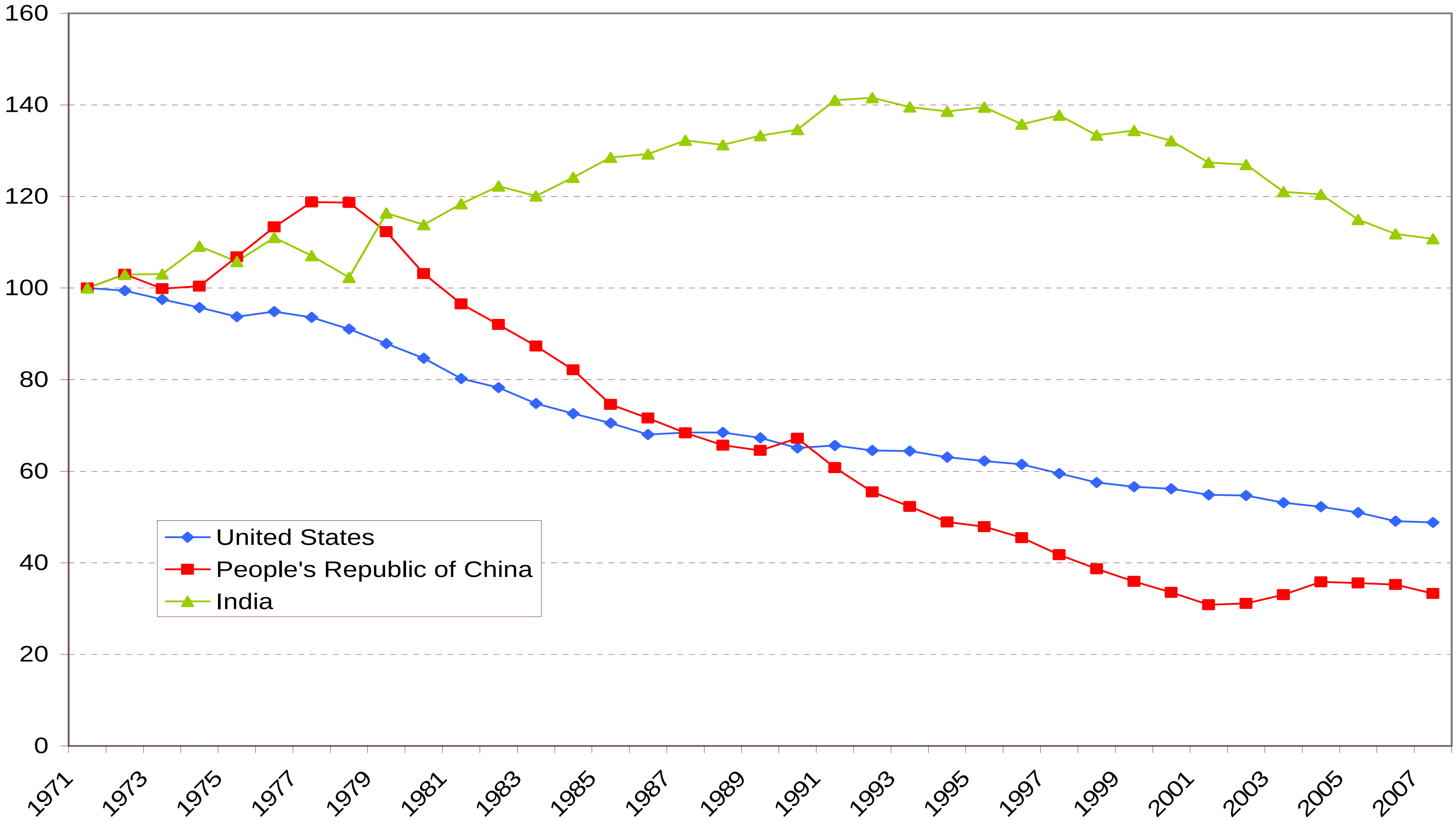
CO2 Emissions of Selected Countries
2006 Carbon Intensity:
(kg CO2 per 2000 US$)
Japan: 0.24
UK: 0.32
India: 1.78
USA: 0.51
China: 2.68
USA
Australia
Russia
Germany
Netherlands
Japan
Korea
UK
Italy
South Africa
Greece
France
China
Mexico
India
Brazil
CO2 emissions per capita (tCO2)
GDP per ca (PPP, $2000)
0
5
10
15
20
25
0
10,000
20,000
30,000
40,000
50,000
60,000

CO_2 Emissions of Selected Countries



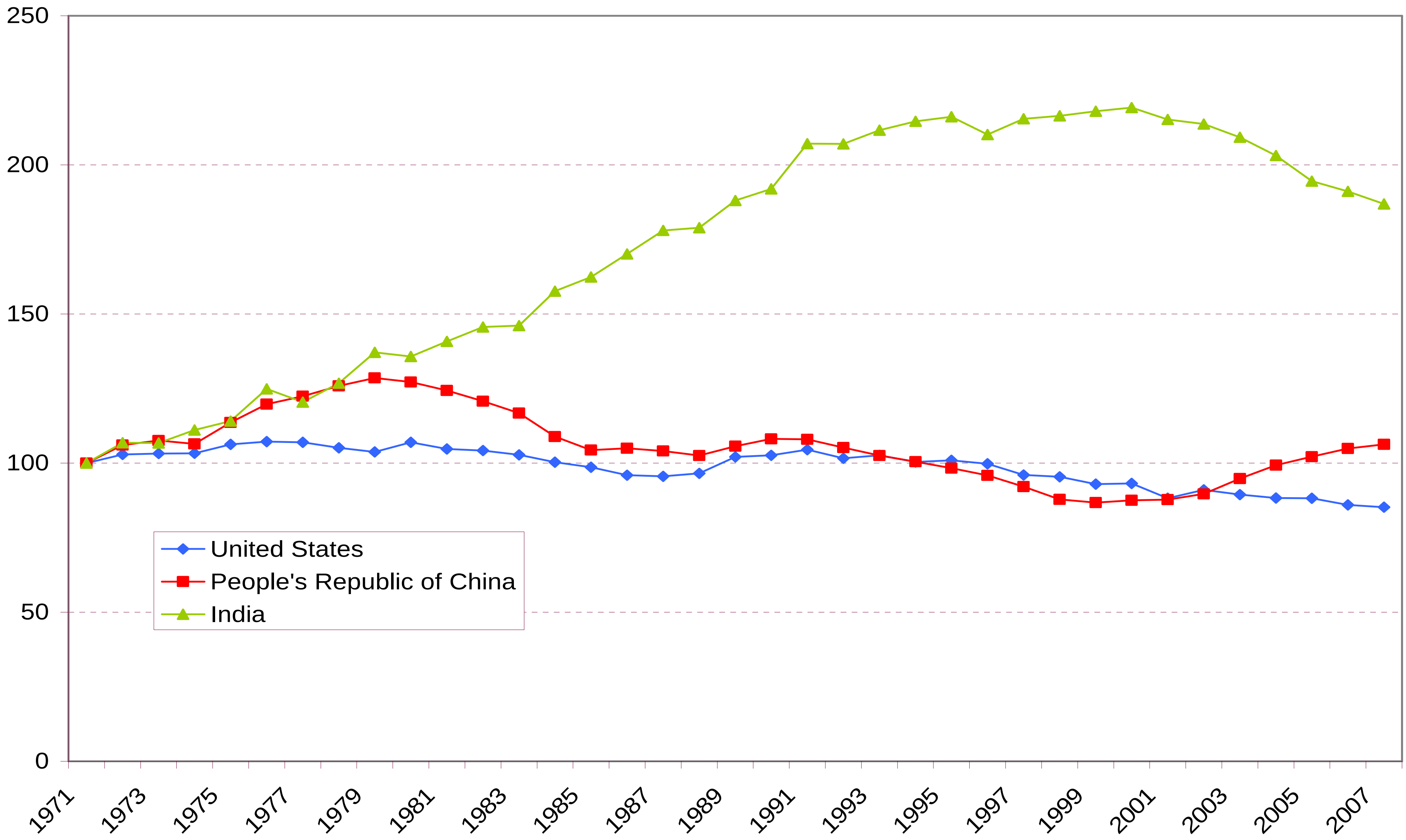
Primary Energy Supply /GDP

(PJ/2000 US $; Excl. traditional biomass; Indexed to 1971=100)



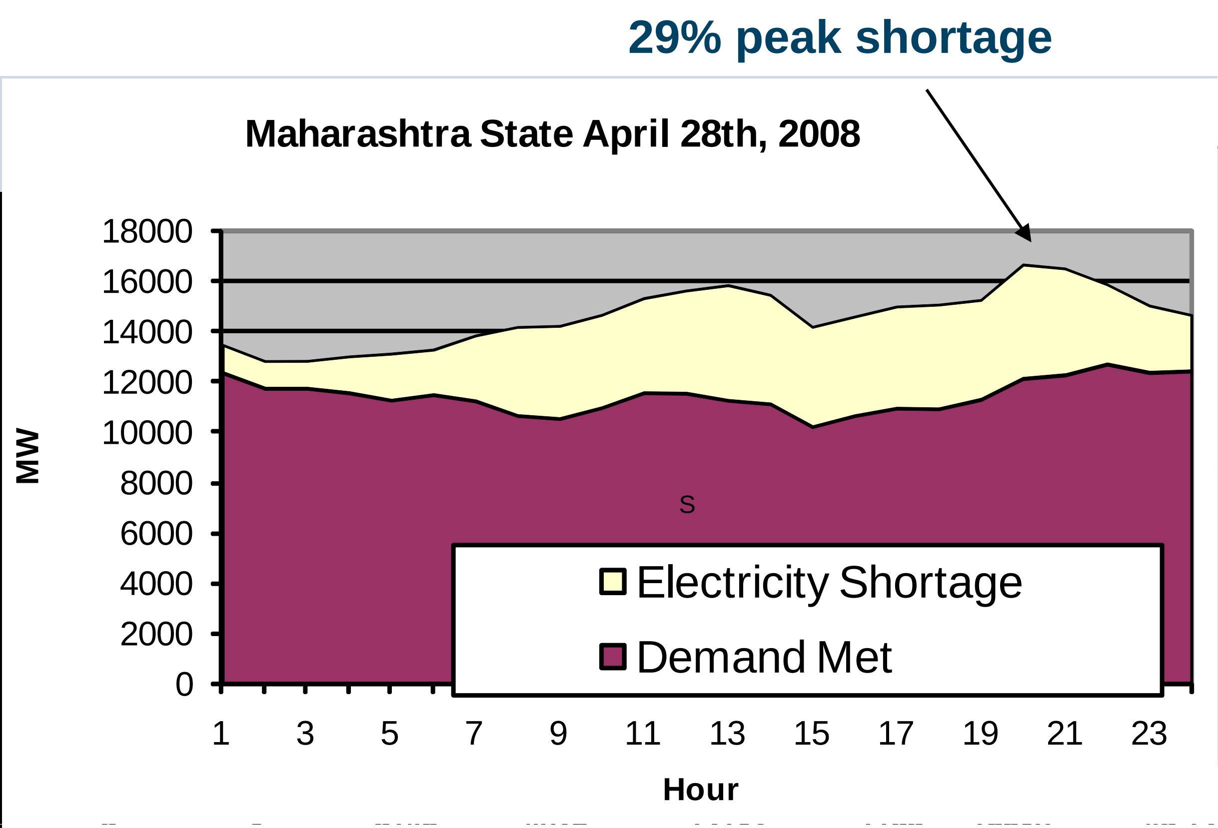
Electricity Generation/GDP

(kWh / 2000 US $) (Indexed: 1971=100)

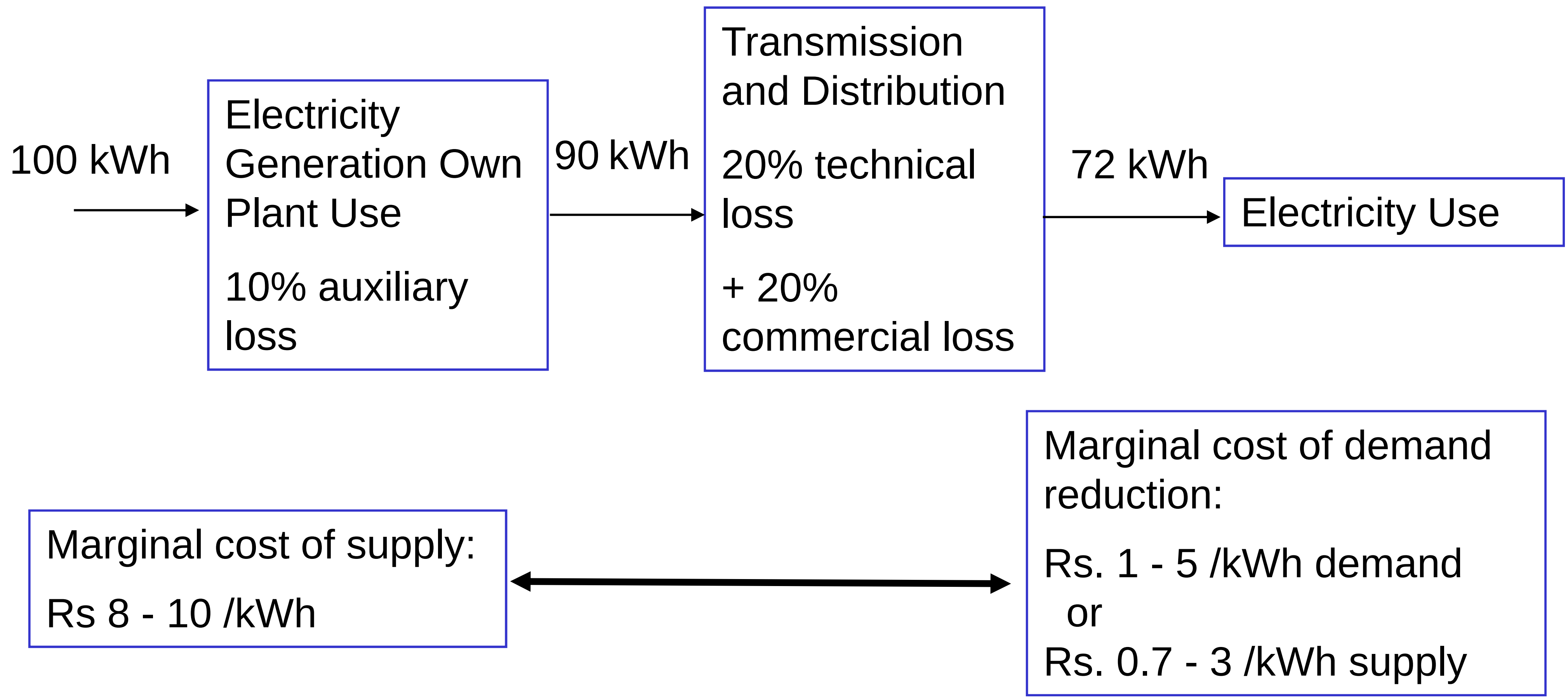


Chronic Electricity Shortages

National Scale: Peak Power Deficit – 12%;
Electricity Deficit – 8%



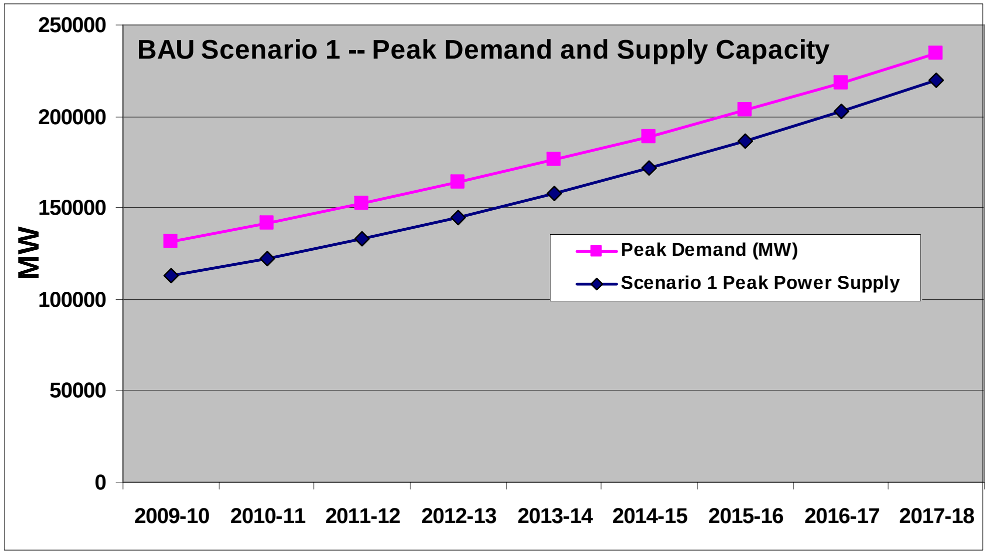
New Supply and Demand-side Efficiency Return on Investment: Typical India Values

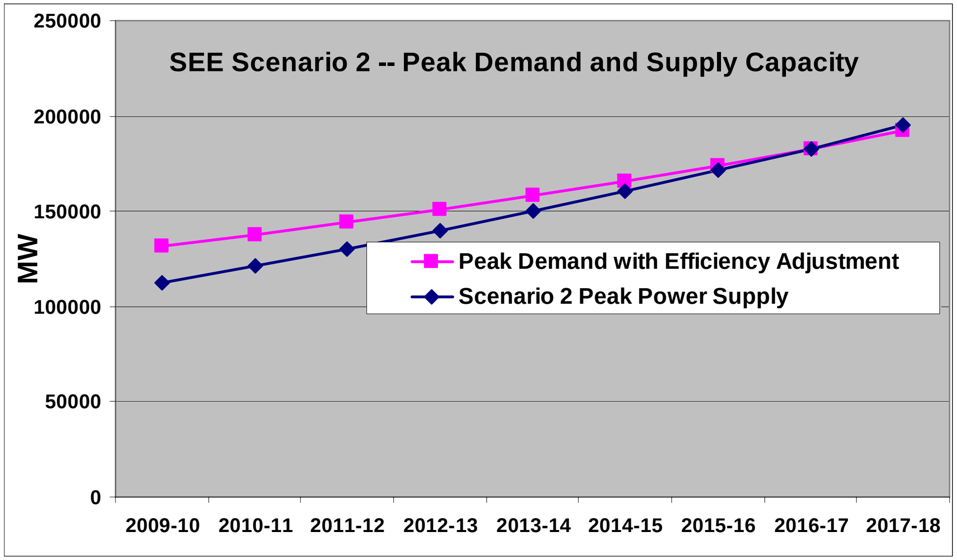


Efficient Use: Lower cost and shorter construction lead time than new supply

BAU Scenario 1: Invest in supply capacity, but shortage continues

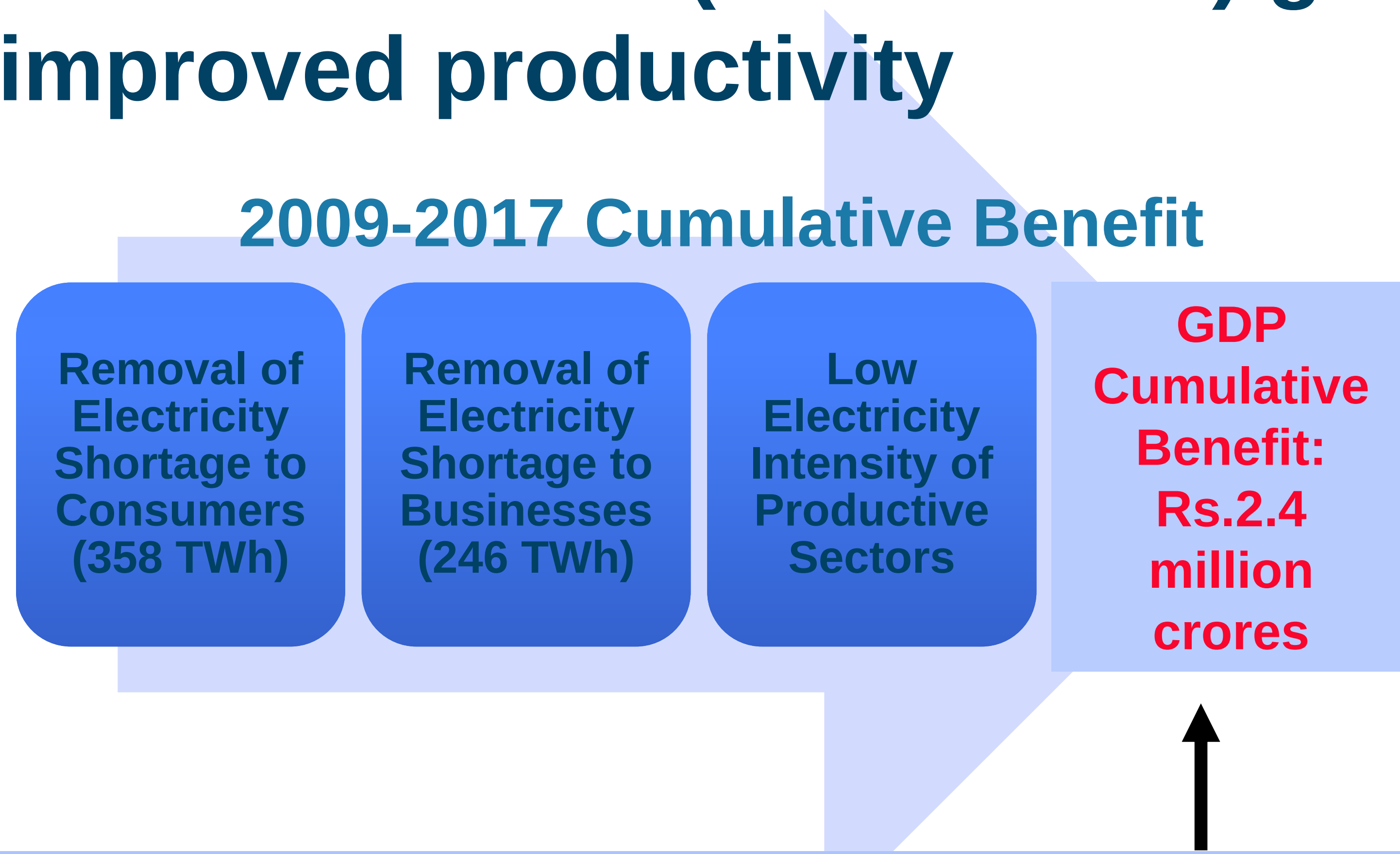
EE Scenario 2: Invest in efficiency, eliminate shortage by 2016 – plus bonus …





	BAU Scenario	EE Scenario
2017	6% Deficit	2% Surplus
Capex (2009-2017)	Rs. 390 thousand crores	Rs. 380 thousand crores (incl. efficiency options)
Efficiency Options		Lighting, fans, refrigerators, motors, agricultural and municipal water pumping

Macroeconomic “bonus” from efficiency: Rs.2.4 million crores ($500 billion) growth from improved productivity



Excluding > 50% of businesses that have generator sets and inverters.

Plus ….

- Carbon reduction bonus:
  312 million metric tonnes CO_2 reduced (cumulative) 2009-2020

- Reduced import of coal and natural gas – Rs. 42.3 thousand crores (US $9 billion)

- **State-level DSM programs**
  - US ~20 states; India ~ 5 states
- **Multi-state DSM program**
  - RMSDP – Regulated Multi-state Demand Side Management Program under consideration in India
- **International or global programs**
  - Under consideration in India, US, ++

Exploration of Resource and Transmission Expansion Decisions in the Western Renewable Energy Zone (WREZ) Initiative

Andrew Mills, Amol Phadke, and Ryan Wiser

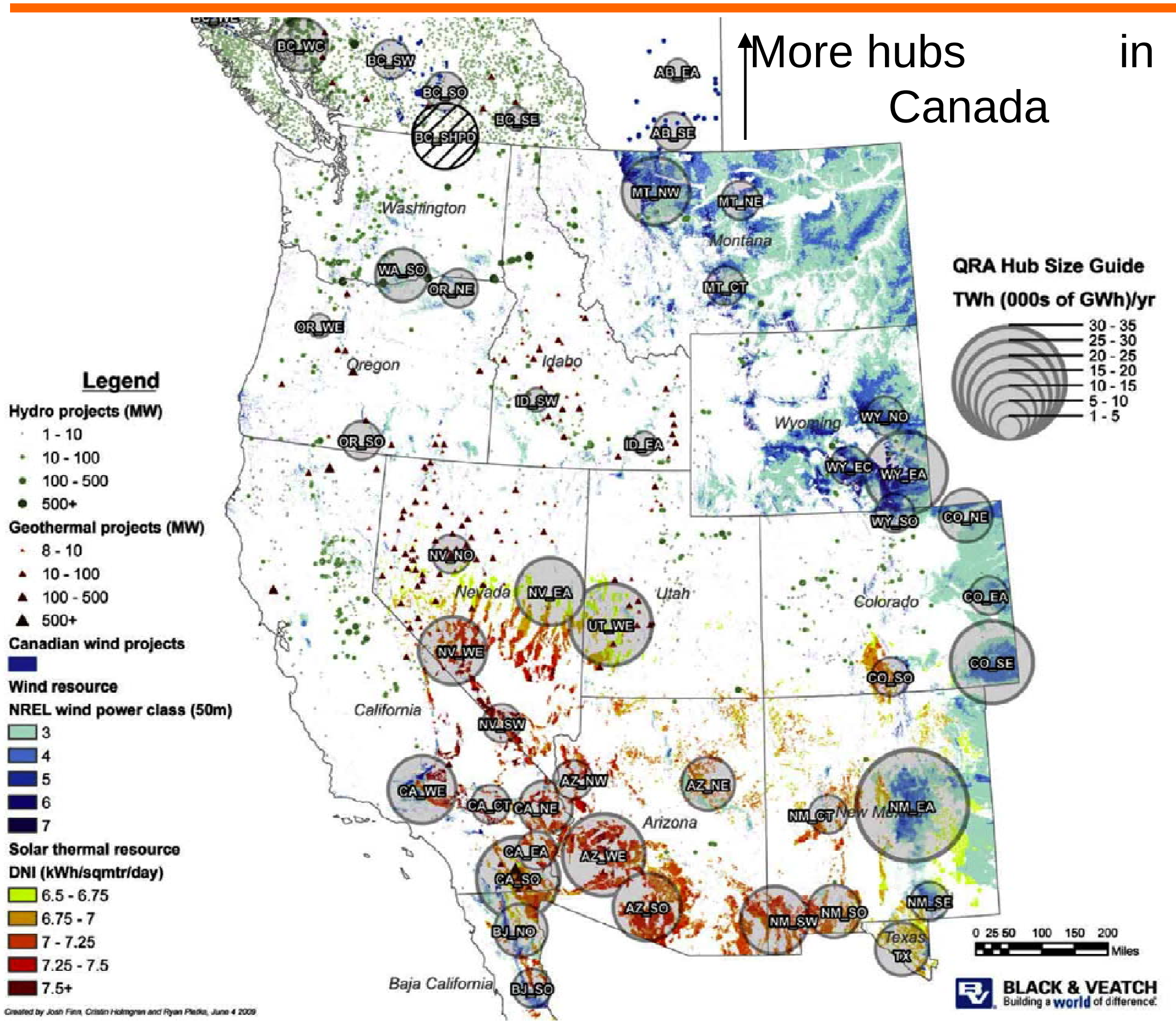
Lawrence Berkeley National Laboratory

This analysis was funded by the U.S. Department of Energy, Office of Electricity Delivery and Energy Reliability, Permitting, Siting and Analysis Division

Resource and Transmission Expansion Decisions in WREZ: Presentation Outline

1. **Motivation and Scope**
2. **Summary of Key Findings**
3. **Framework for Comparing WREZ Resources**
4. **Results**
   a) Impact of Level of Renewable Energy (RE) Demand
   b) Base Case: WECC-wide 33% RE Delivered to Each Load Zone
   c) Alternative Scenarios with 33% RE Delivered to Each Load Zone
   d) Alternative Scenarios with Tradable Renewable Energy Credits
5. **Conclusions and Future Research**

WREZ Hubs



- Participants: State, Provincial, and Federal agencies, renewable energy developers, tribal interests, utility planners, and environmental groups
- 55 WREZ hubs identified in WECC
- Each hub accesses sufficient resources to justify new 500 kV transmission line

Project Overview

Motivation: The WREZ Initiative identified renewable resource hubs composed of environmentally preferred, high quality resources sufficient to justify building new high-voltage transmission

- Which WREZ renewable resources might be economically attractive for meeting aggressive renewable energy (RE) targets in the West?
- What transmission might need to be built to access those resources? Who should cooperate in developing the transmission?
- What factors contribute to the costs of meeting renewable energy targets?

Scope: Examine at a screening-level the sensitivity of least-cost **WREZ resource** selection, required transmission expansion, and costs of meeting aggressive Western RE targets to different assumptions and policy decisions

- *How do resource selection and transmission expansion decisions change with assumptions and changes in policies?*
- *What are the important assumptions or factors that should be explicitly considered in more-detailed resource and transmission planning forums?*

Framework for Comparing WREZ Resources: The WREZ Model

Bus-Bar Cost ($/MWh)

+

Transmission Cost ($/MWh)

+

Integration Cost ($/MWh)

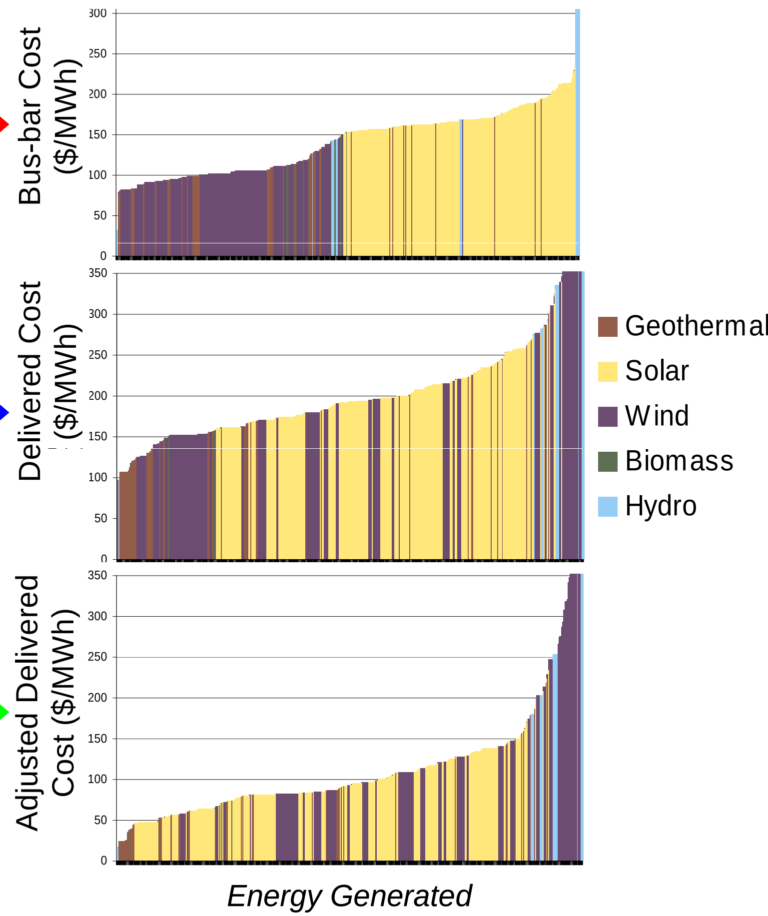
-

Capacity Value ($/MWh)

-

TOD Energy Value ($/MWh)

Renewable Resource Ranking for Southwest Load Zone:



- WECC load is divided into 20 load zones
- Most economically attractive resources have the lowest adjusted delivered cost
- Limited, high quality resources are allocated to the load zone with the highest economic benefit of procuring that resource

Assumptions

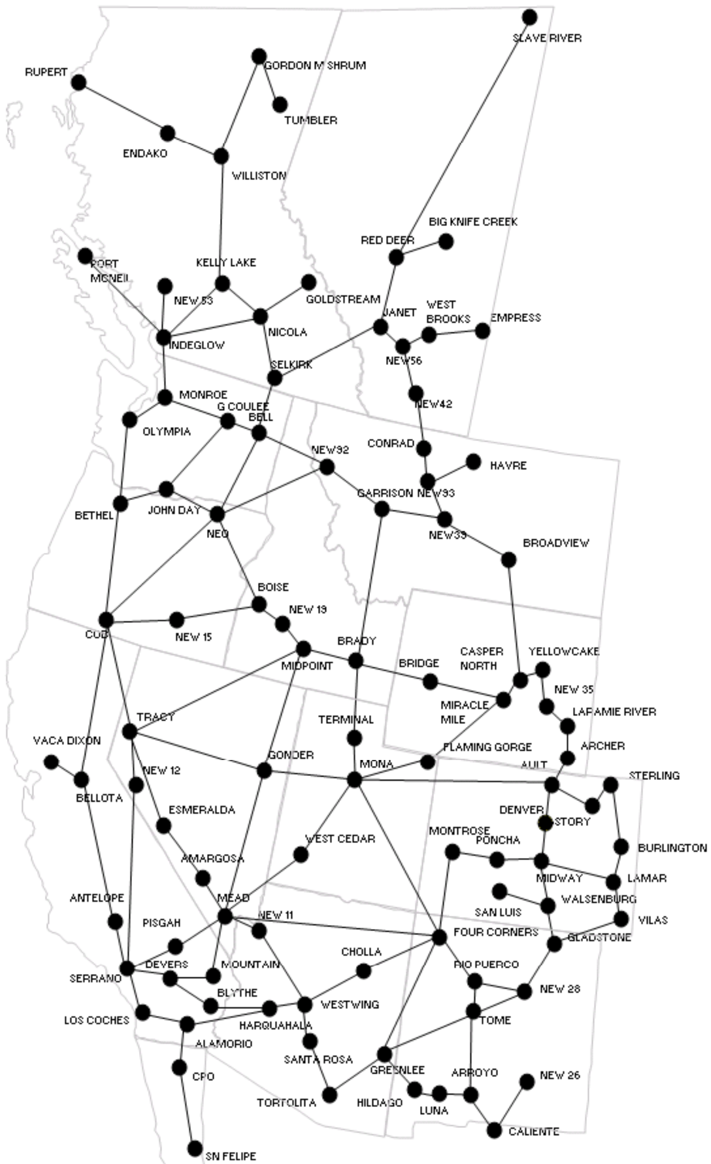
- Bus-bar costs vary by technology and resource quality
  - Costs include capital and interconnection costs
  - Assumed 30% ITC for all U.S. resources
- Transmission costs depend on distance from resource to load zone
  - WREZ resources assumed to require new transmission capacity
  - Distance based on existing rights-of-way
  - Transmission costs allocated by pro-rata share of 500 kV
- Market value adjustment factors vary by technology and load combination

Bus-bar Costs Vary By Technology and Resource Quality

Renewable Technology	Total Capital Cost ($/kW)		Capacity Factor		Bus-Bar Cost with Starting Point Assumptions ($/MWh)	
	Energy-Weighted Median	(10th; 90th Percentile)	Energy-Weighted Median	(10th; 90th Percentile)	Energy-Weighted Median	(10th; 90th Percentile)
Hydro	4,263	(1,106 ; 9,818)	50%	(39% ; 51%)	128	(27 ; 376)
Biomass	3,659	(3,515 ; 3,824)	85%	(85% ; 85%)	115	(109 ; 147)
Geothermal	5,064	(4,355 ; 5,901)	80%	(80% ; 90%)	92	(78 ; 108)
Wind	2,418	(2,396 ; 2,469)	31%	(28% ; 39%)	92	(73 ; 121)
Wet Cooled Solar Thermal with Storage	7,473	(7,465 ; 7,556)	38%	(30% ; 40%)	163	(155 ; 193)
Wet Cooled Solar Thermal without Storage	5,174	(5,165 ; 5,352)	27%	(21% ; 29%)	169	(161 ; 212)
Dry Cooled Solar Thermal with Storage	7,674	(7,665 ; 7,756)	36%	(29% ; 37%)	175	(170 ; 201)
Fixed PV	4,576	(4,565 ; 4,690)	25%	(22% ; 26%)	156	(150 ; 179)

Starting point assumptions from WREZ model include 30% Investment Tax Credit (ITC) for all U.S. resources, a 15-year debt term for all non-solar technologies, and a 25-year debt term for solar technologies; Base solar technology assumed to be wet-cooled solar thermal with storage

Transmission Costs Depend on Distance from Resource to Load Zone



- All WREZ resources are assumed to require new transmission capacity
- Transmission distance is largely based on following existing rights-of-way
- Starting point transmission costs are allocated assuming a pro-rata share of a single circuit 500 kV line
- Transmission utilization is assumed to equal capacity factor of renewable resource
- Transmission losses are 0.7% per 100 miles
- Transmission cost of 500 kV line total an assumed $1,564/MW-mi

Market Value Adjustment Factors Vary by Technology and Load Combination

	TOD Energy Value Assuming $65/MWh Average Marginal Production Cost ($/MWh)		Capacity Value Assuming $156/kW-yr Resource Adequacy Cost ($/MWh)		Integration Cost ($/MWh)	Market Value Adjustment ($/MWh)
Technology	Median	(10th; 90th Percentile)	Median	(10th; 90th Percentile)	Assumption	Median
Hydro	65.4	(60.9 ; 72.7)	21.7	(5.0 ; 35.4)	N/A	87.0
Biomass	65.0	(65.0 ; 65.0)	17.8	(17.8 ; 17.8)	N/A	82.8
Geothermal	64.4	(63.7 ; 65.0)	13.5	(11.1 ; 20.0)	N/A	77.9
Wind	63.4	(55.7 ; 70.8)	9.7	(5.8 ; 25.7)	5.0	68.1
Wet Cooled Solar Thermal with Storage	71.0	(69.5 ; 73.5)	38.5	(13.7 ; 43.7)	N/A	109.5
Wet Cooled Solar Thermal without Storage	69.0	(67.7 ; 71.4)	30.2	(8.8 ; 40.5)	2.5	96.7
Dry Cooled Solar Thermal with Storage	70.9	(69.4 ; 73.3)	36.1	(14.7 ; 41.3)	N/A	106.9
Fixed PV	68.3	(67.6 ; 70.3)	22.7	(15.6 ; 30.0)	2.5	88.5

TOD energy value is based on correlation of renewable generation profile and marginal production costs at load zone. ***Capacity value*** is based on renewable generation during top 10% of load hours at load zone. ***Integration costs***–the costs to manage variability and uncertainty–are technology specific and are based on previous wind integration studies.

Advantages and Disadvantages of WREZ Model and Framework

Advantages:

- Simple and transparent
- Broadly accessible: Excel-based
- User can quickly define own input assumptions
- Screening tool identifies factors that should be carefully evaluated in more detailed analysis
- Appropriate tool for understanding policy decisions
- Tool incorporates main drivers of economic attractiveness

Disadvantages:

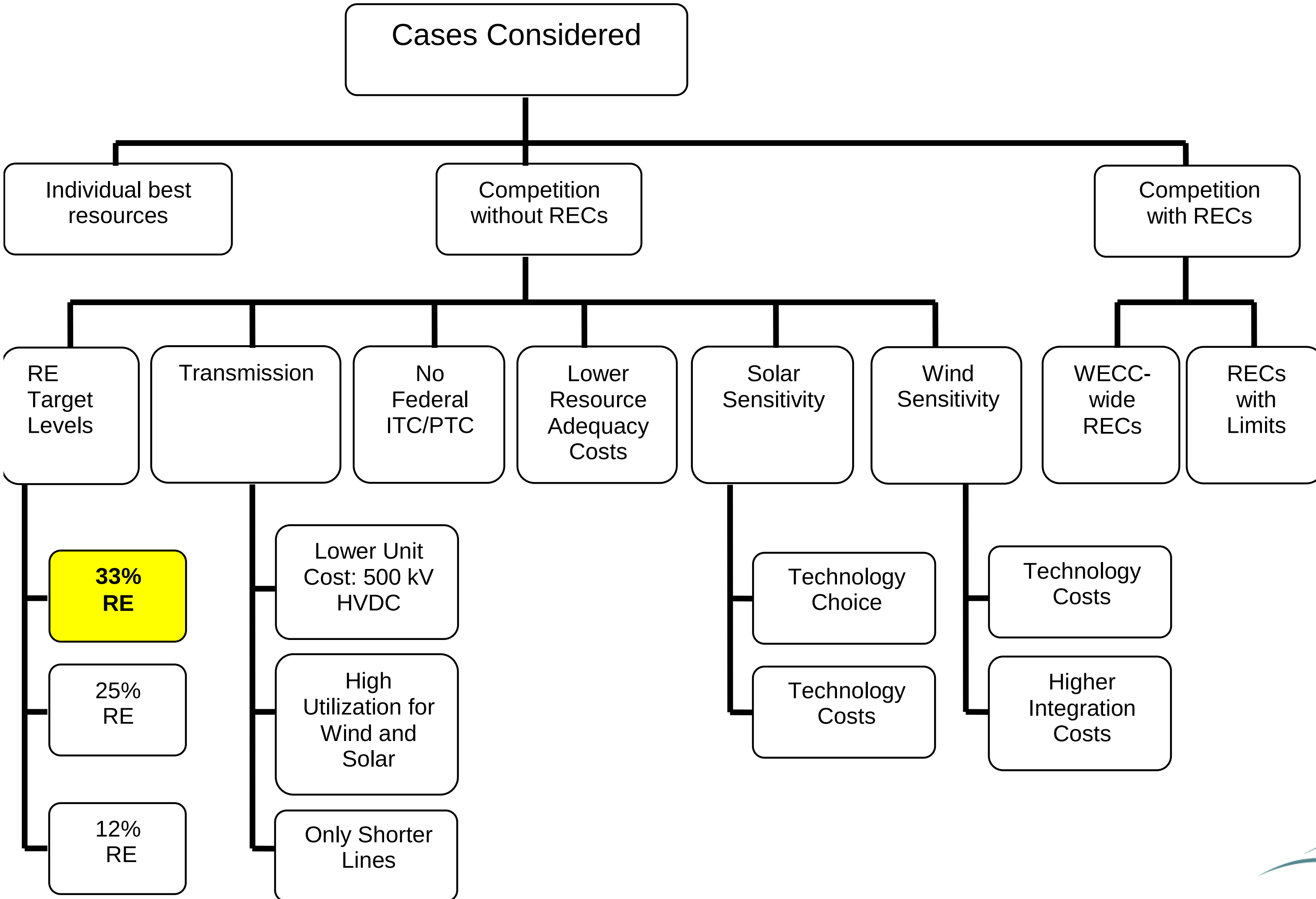
- Renewable resource database only characterizes resources in WREZ hubs
- Pro-rata allocation of transmission costs ignores lumpiness of transmission
- Market value adjustment factors do not change with renewable penetration level (particularly important for TOD energy and capacity value)
- Assumes no existing transmission capacity and allocates full cost of new transmission to renewable resources

Increasing RE Targets Increases Costs and Required Transmission Investment

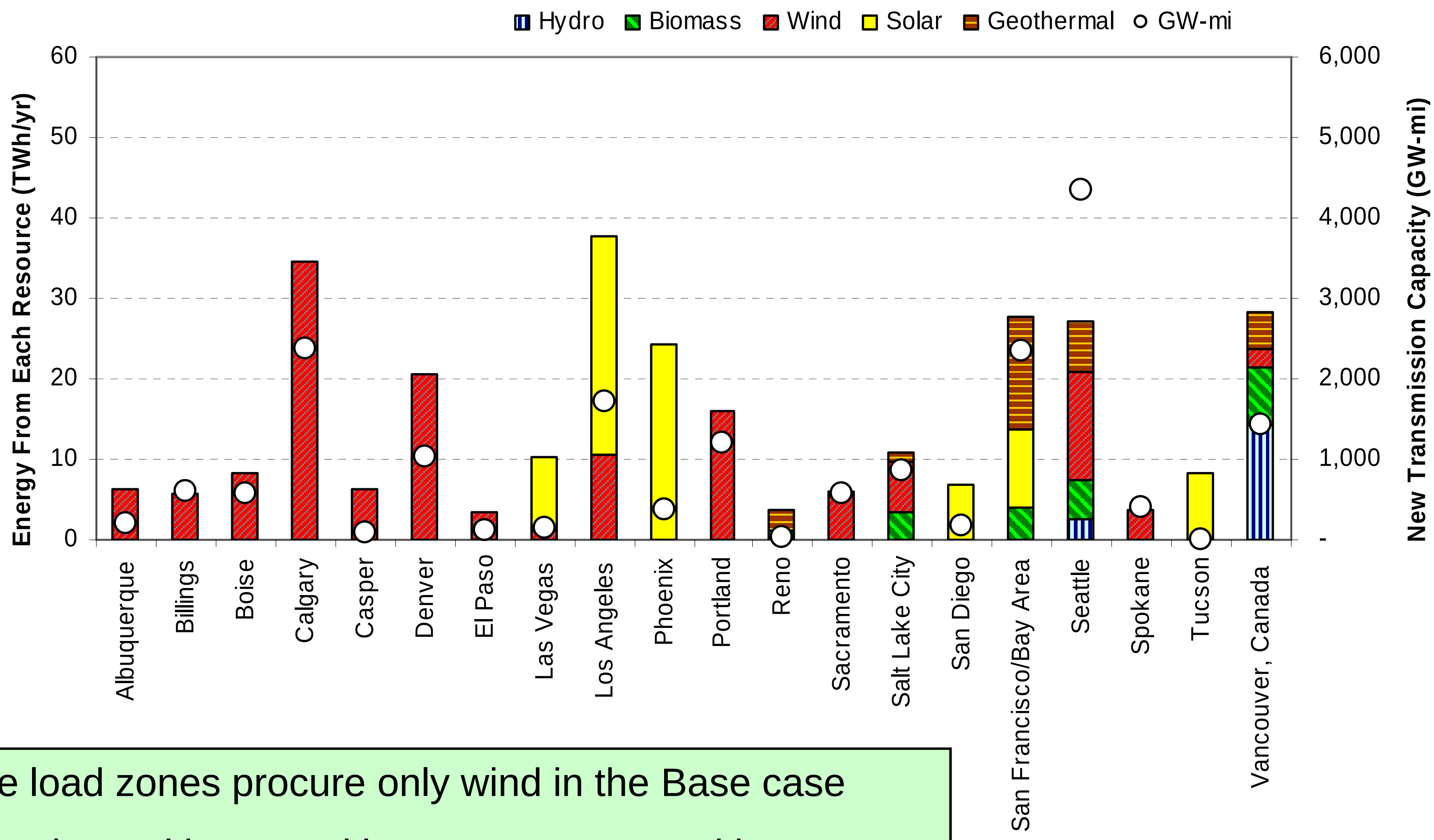
Impact		12% Renewables	25% Renewables	33% Renewables
		(GW)	(GW)	(GW)
Resource Composition	Wind	13.2	36.1	48.2
	Solar	0.0	13.7	25.0
	Hydro, Biomass, Geothermal	5.5	8.9	10.4
Costs	Average Adjusted Delivered Cost ($/MWh)	23.6	37.2	43.2
Transmission Expansion	Transmission Investment ($ Billion)	5.9	17.0	26.3
	Transmission and Losses Cost (Percentage of Delivered Cost)	16%	14%	15%

- Wind is the largest source of incremental RE when target increases from 12% to 25%
- Equal amounts of wind and solar (wet-cooled solar thermal with thermal storage) are added when western RE target increases from 25% to 33%
- Increasing the RE target from 12% to 33% WECC-wide increases the average costs of RE by $20/MWh
- Transmission investment costs are substantial, but are only about 15% of delivered cost at all RE target levels

WREZ Model Used to Examine Several Cases Centered Around 33% RE Target

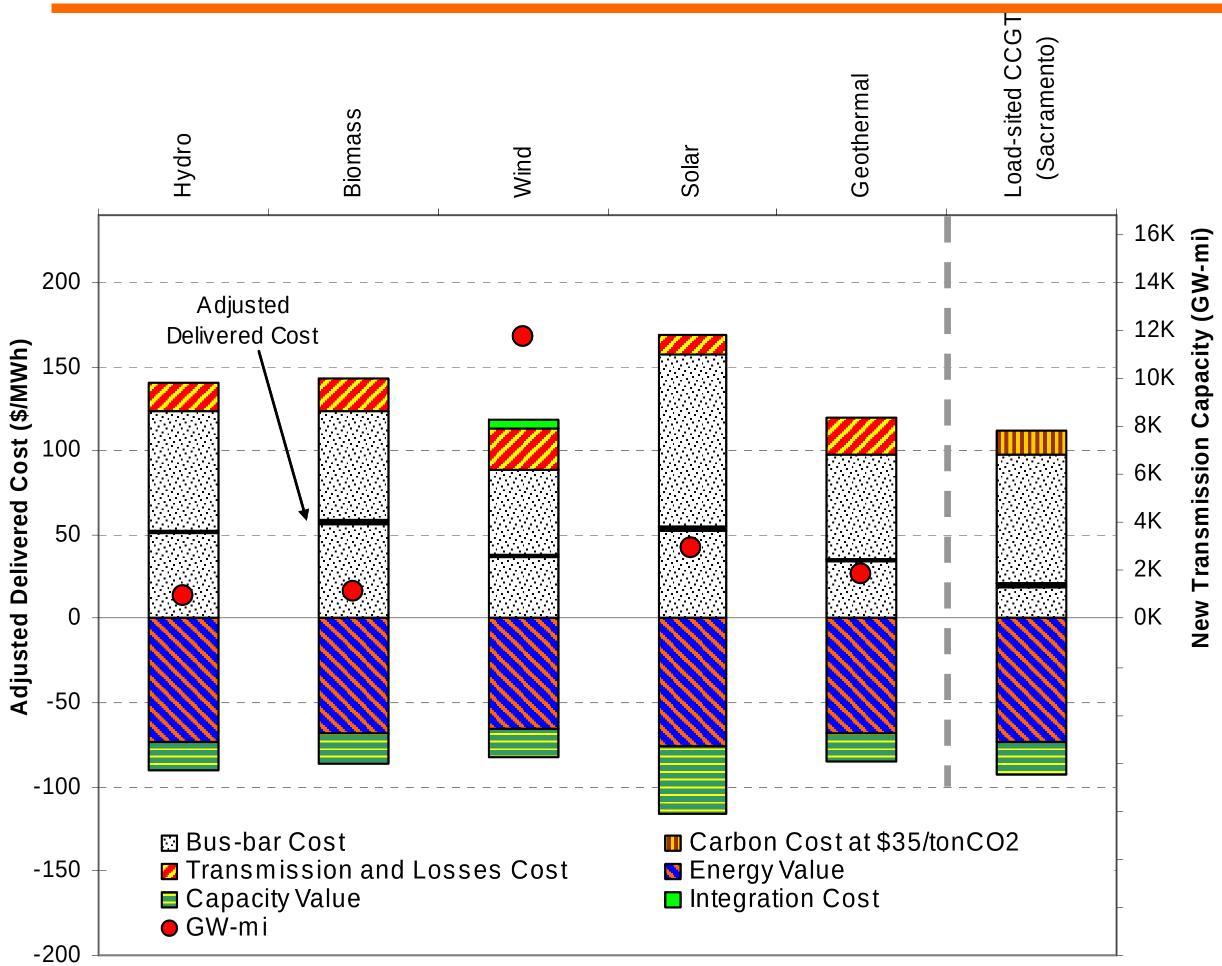


Wind Is the Largest Contributor to Meeting the 33% RE Target with WREZ Resources



- Nine load zones procure only wind in the Base case
- Solar thermal is second largest resource and is particularly important in the Southwest
- Transmission expansion driven by Seattle, San Francisco, Calgary, Los Angeles, and Vancouver

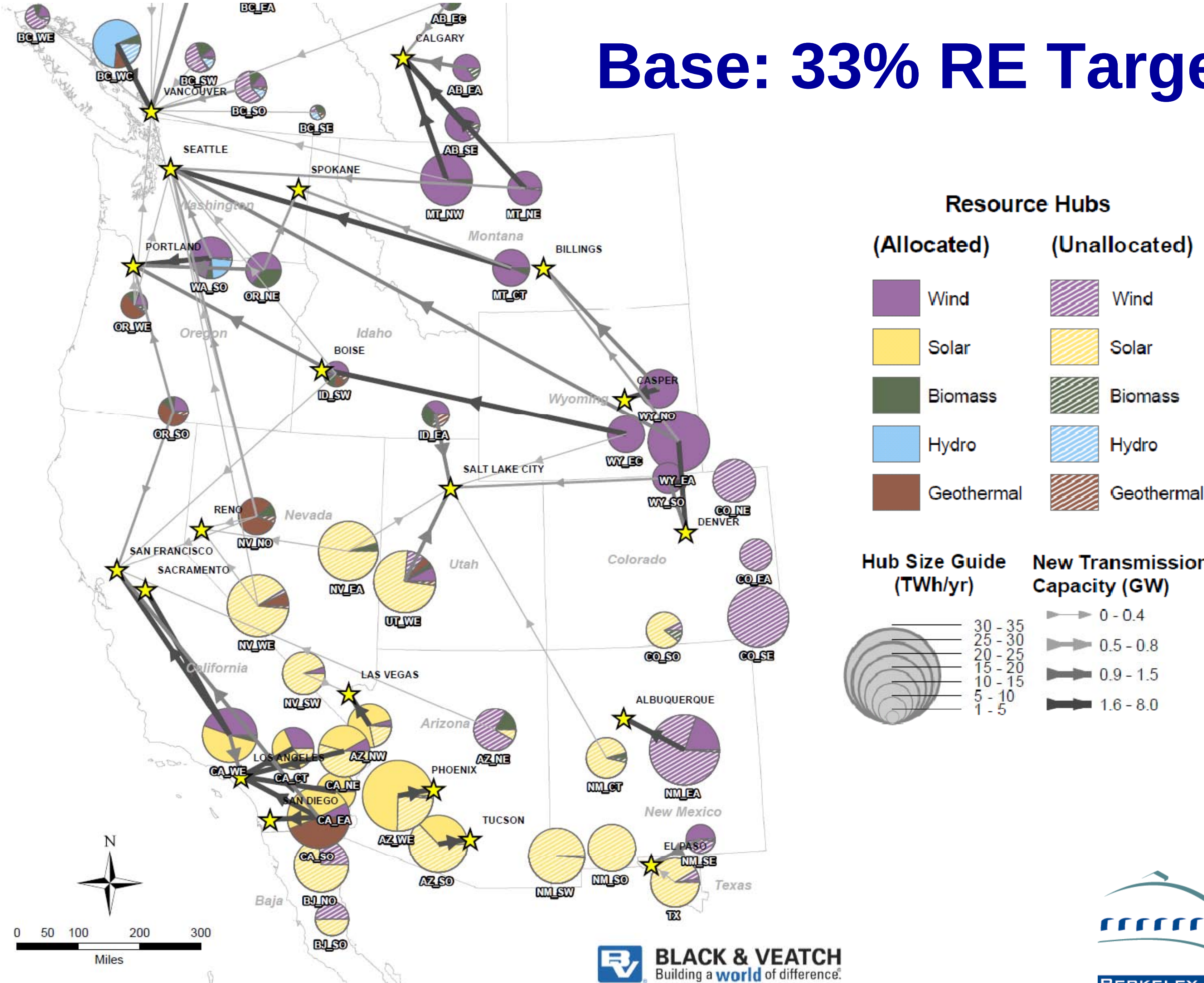
High Bus-bar Costs of Solar Are Offset by High TOD Energy and Capacity Value



Note: Load-sited CCGT cost assumes $8/MMBTU gas cost

- Average TOD energy and capacity value of solar thermal with storage procured in Base case is $34/MWh greater than TOD energy and capacity value of procured wind
- Adjusted delivered cost of solar is more sensitive to correlation with loads and avoided resource adequacy costs than other technologies
- Wind provides 49% of the renewable energy but drives 63% of transmission expansion

Base: 33% RE Target



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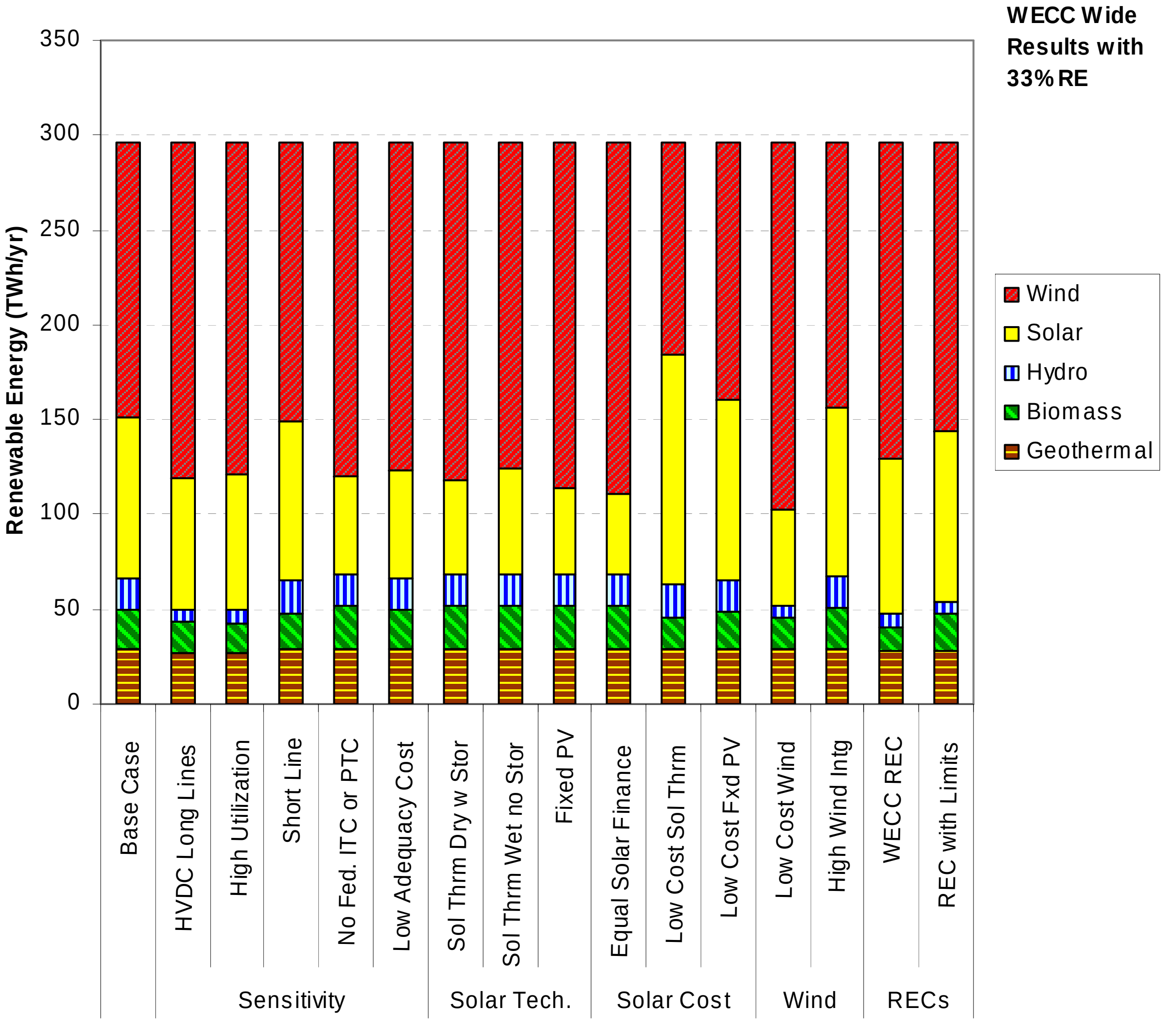
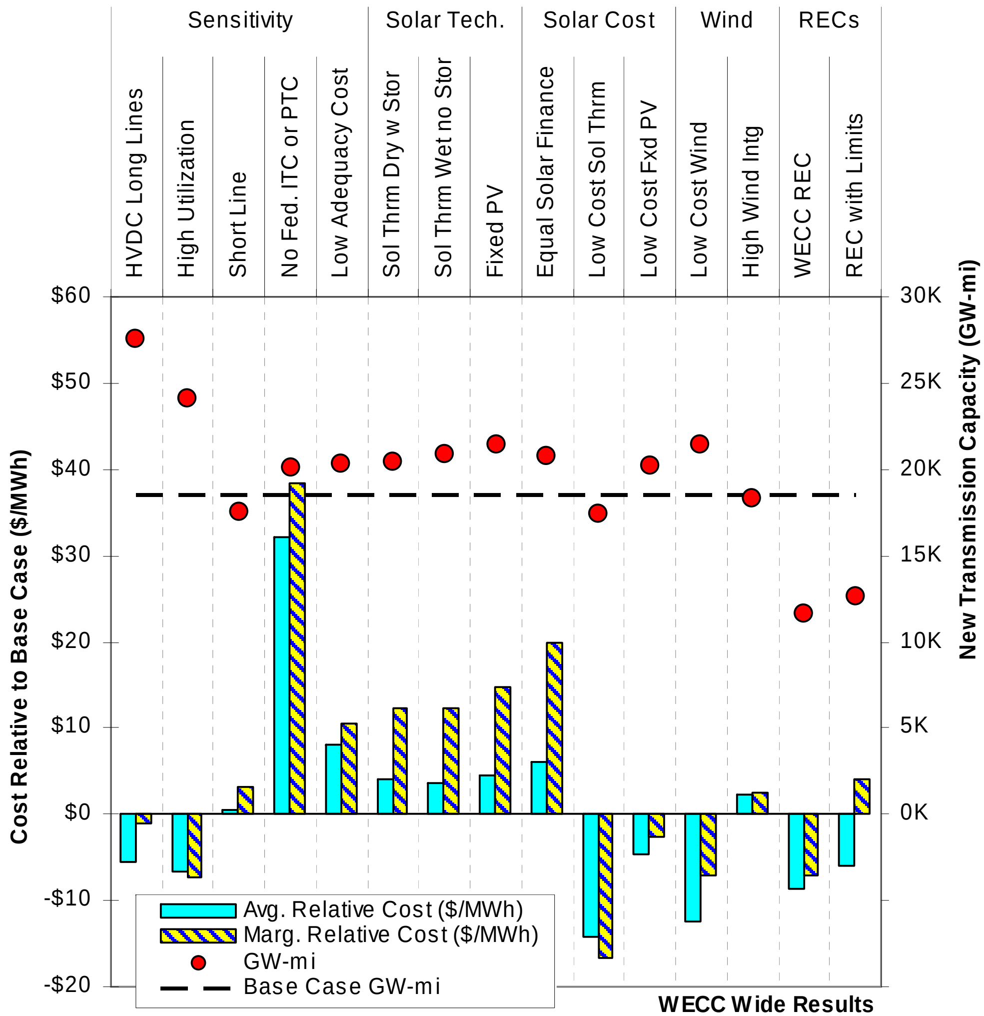
Key Uncertainties Can Shift Balance Between Wind and Solar Procurement



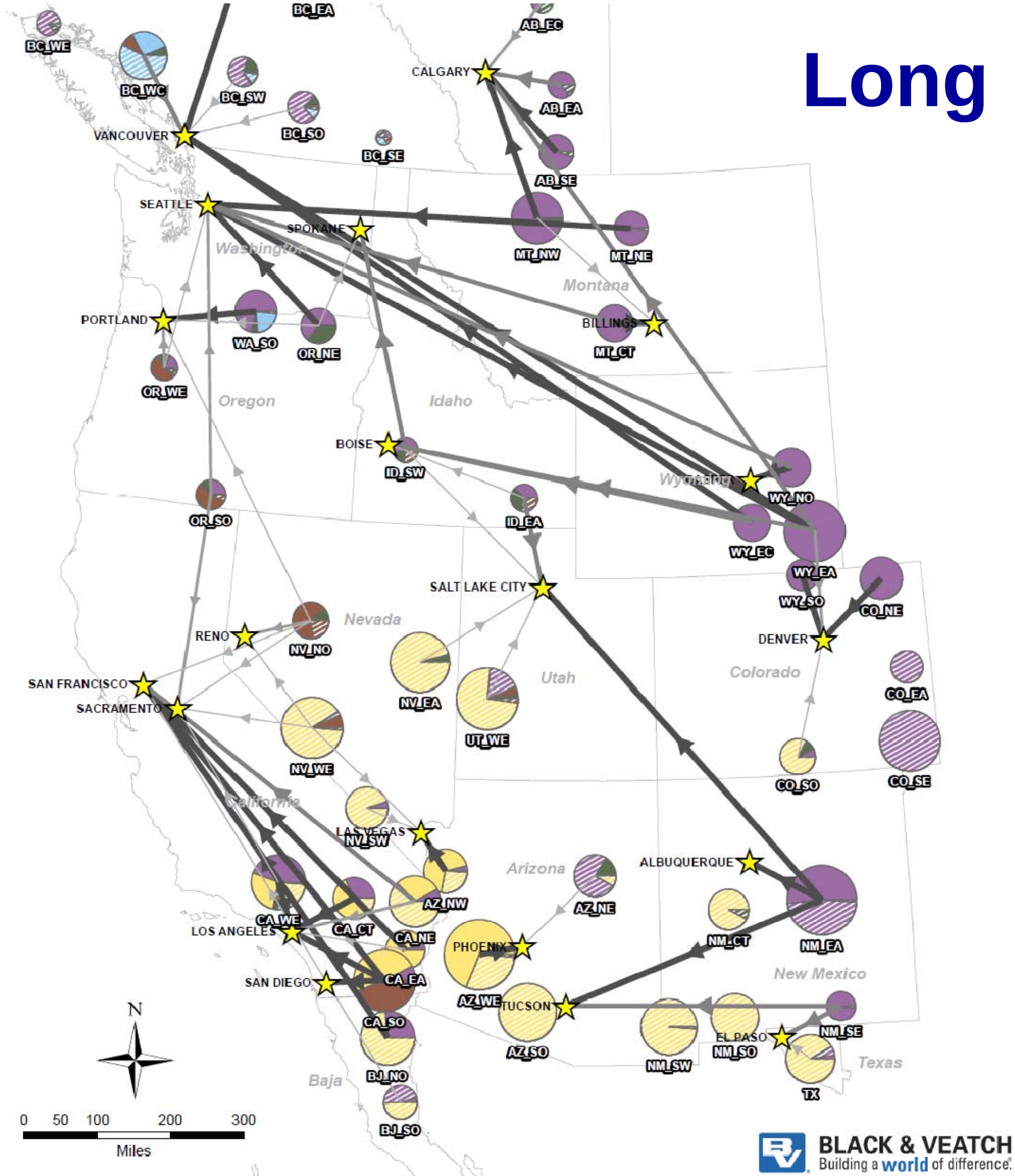
- Biomass, hydro, and geothermal contribute 16-23% of overall portfolio across all cases: supply constrained
- More wind energy is procured when wind costs are low, transmission costs are low, resource adequacy costs are low, or federal tax incentives for RE are allowed to expire
- More solar energy is procured when solar capital costs decline or wind integration costs are assumed to be higher
- Dry-cooled solar thermal, solar thermal without thermal storage, and fixed PV are all less attractive than wet-cooled solar thermal with thermal storage, under starting point assumptions

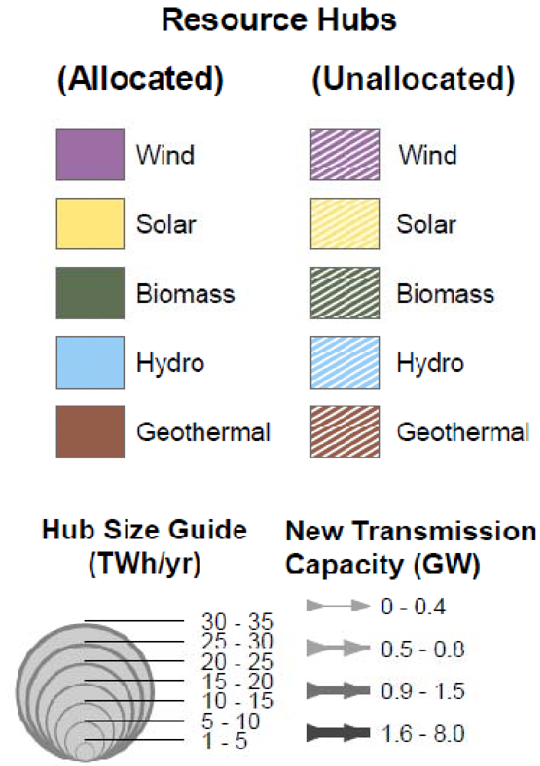
Transmission Costs with 33% RE Delivered to Each Load Zone Are $22-34 Billion



- Overall cost is most influenced by availability of Federal tax incentives and potential reductions in renewable capital costs
- Transmission expansion is greatest in scenarios with significantly more wind
- Cases with more transmission than Base case sometimes also have overall lower costs than Base case
- Transmission costs are only a fraction of delivered costs: 14-19% in cases that require 33% RE to be delivered to each load zone

Long HVDC Lines

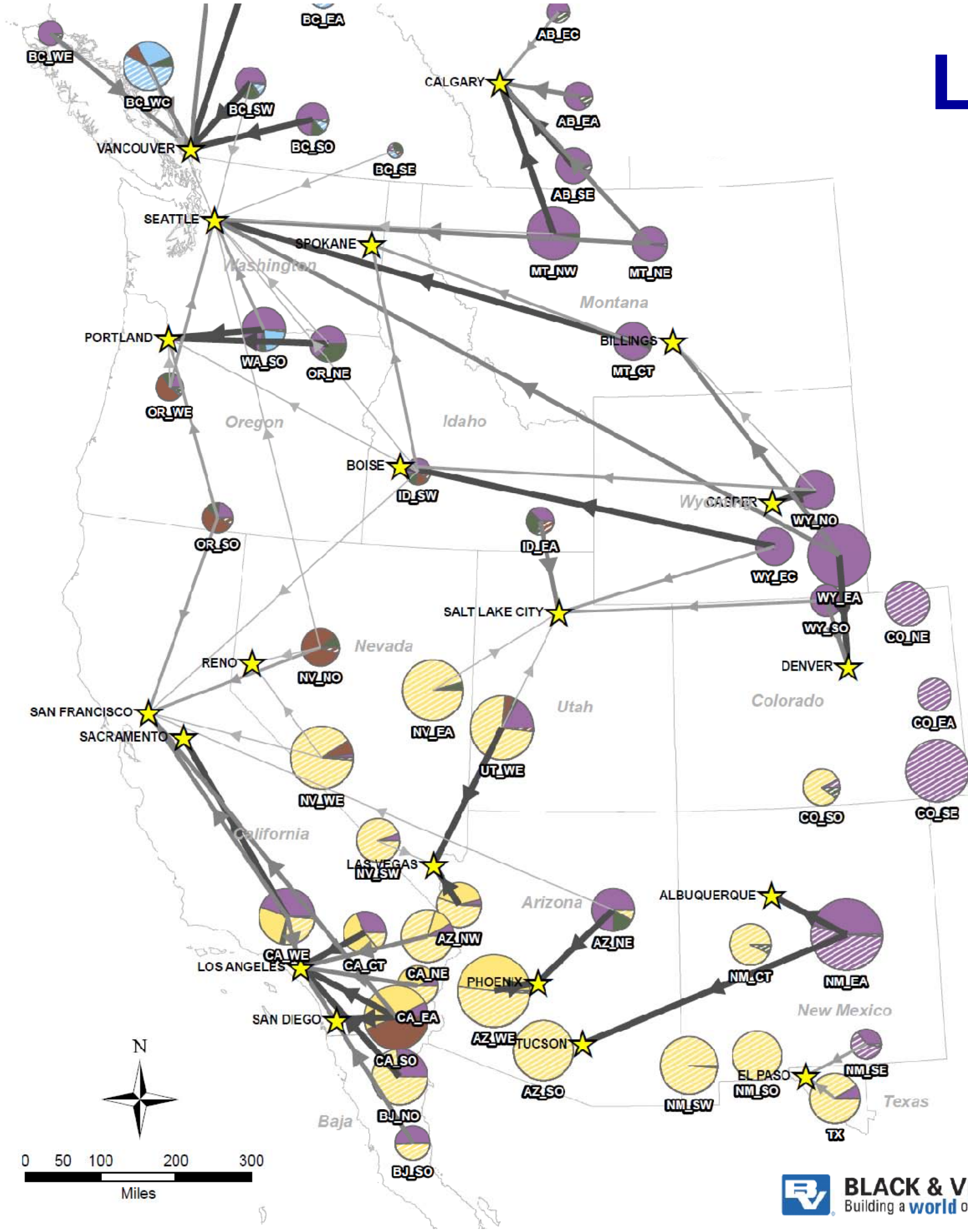




Relative to Base Case:

- 49% **more** transmission capacity
- 23% **more** wind energy
- \$5.5/MWh **lower** average cost

Low Cost Wind



Resource Hubs

(Allocated)	(Unallocated)
Wind	Wind
Solar	Solar
Biomass	Biomass
Hydro	Hydro
Geothermal	Geothermal

Hub Size Guide (TWh/yr)	New Transmission Capacity (GW)
30 - 35	0 - 0.4
25 - 30	0.5 - 0.8
20 - 25	0.9 - 1.5
15 - 20	1.6 - 8.0
10 - 15	
5 - 10	
1 - 5	

Relative to Base Case:

- 16% **more** transmission capacity
- 34% **more** wind energy
- $12.3/MWh **lower** average cost

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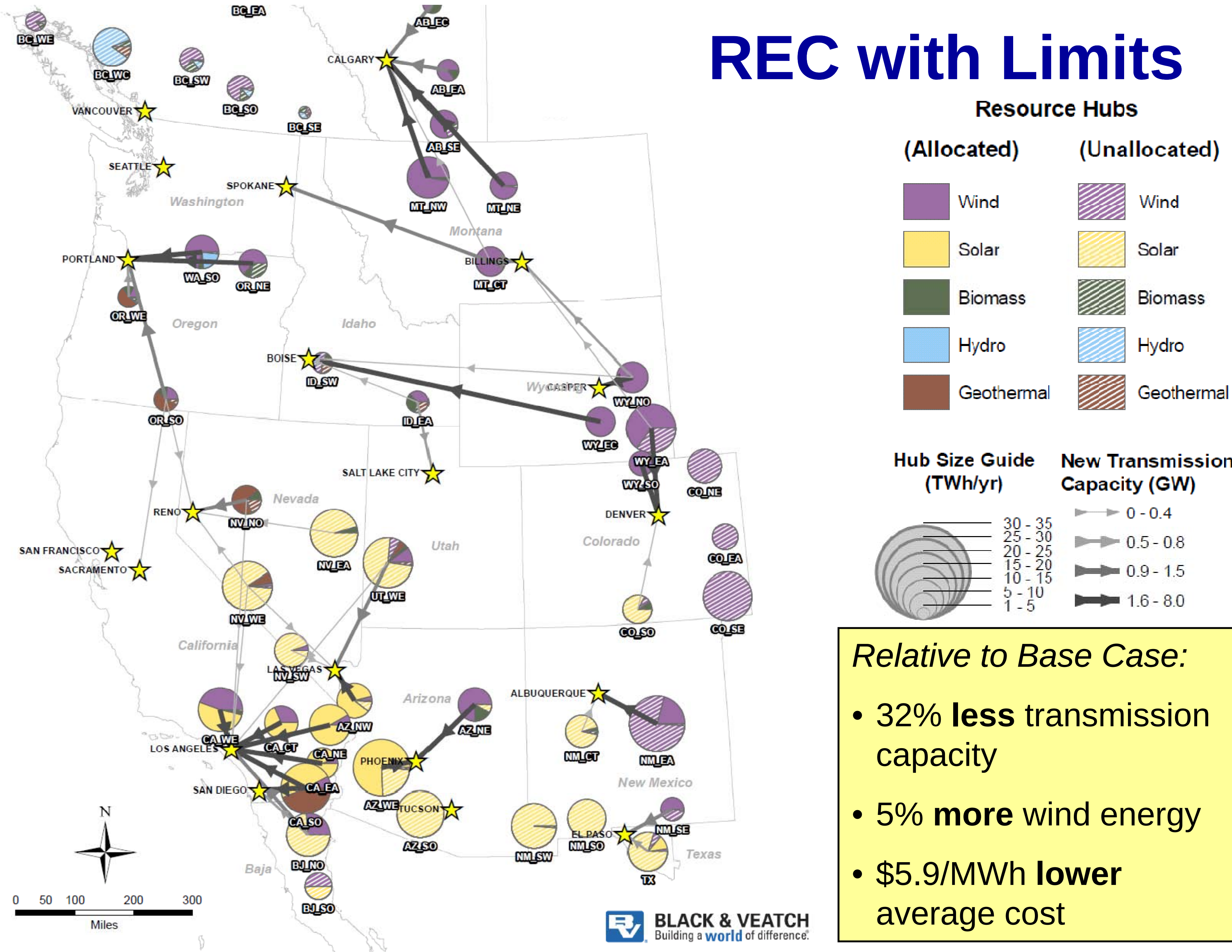
REC with Limits



Relative to Base Case:

- 32% **less** transmission capacity
- 5% **more** wind energy
- $5.9/MWh **lower** average cost

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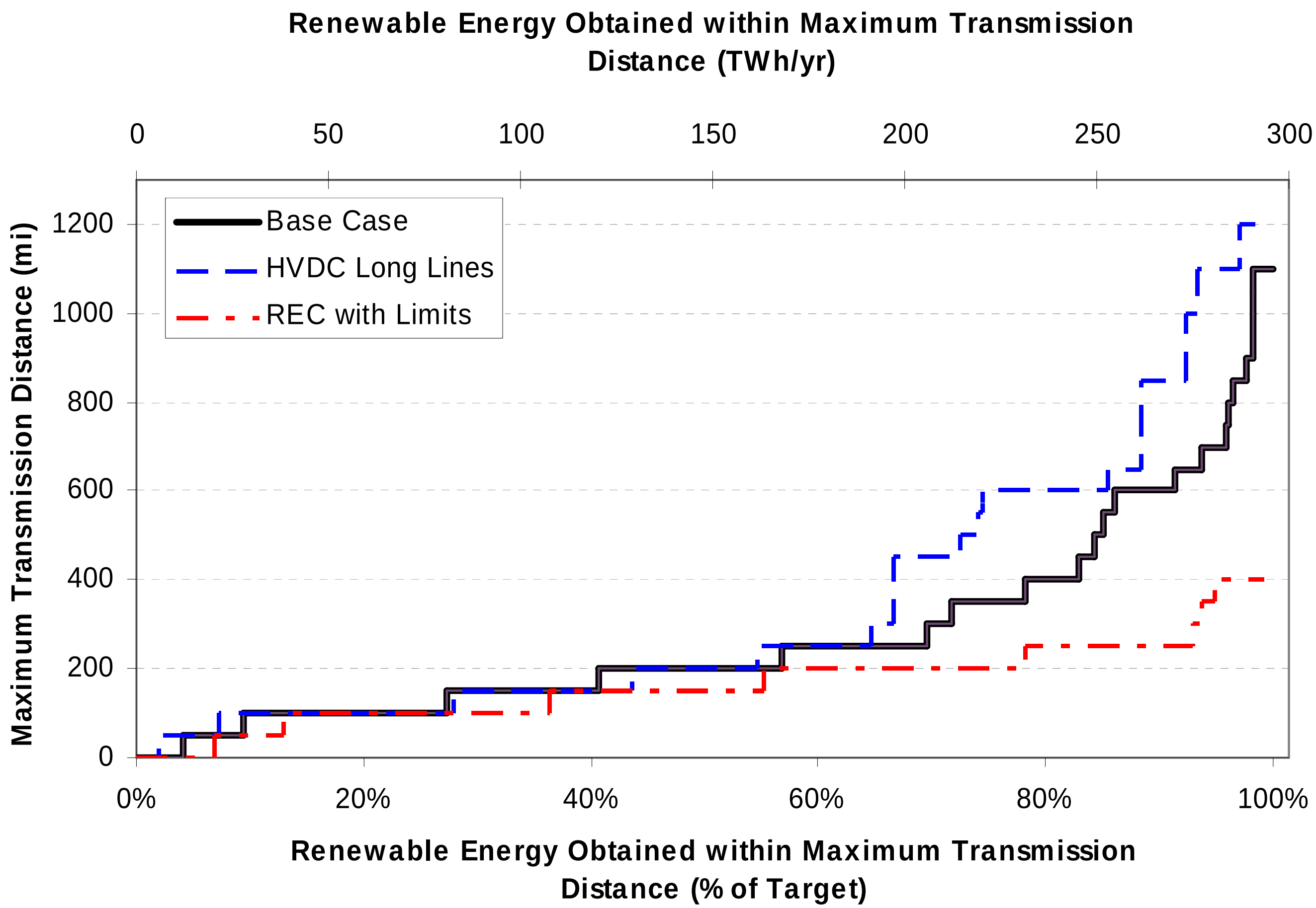
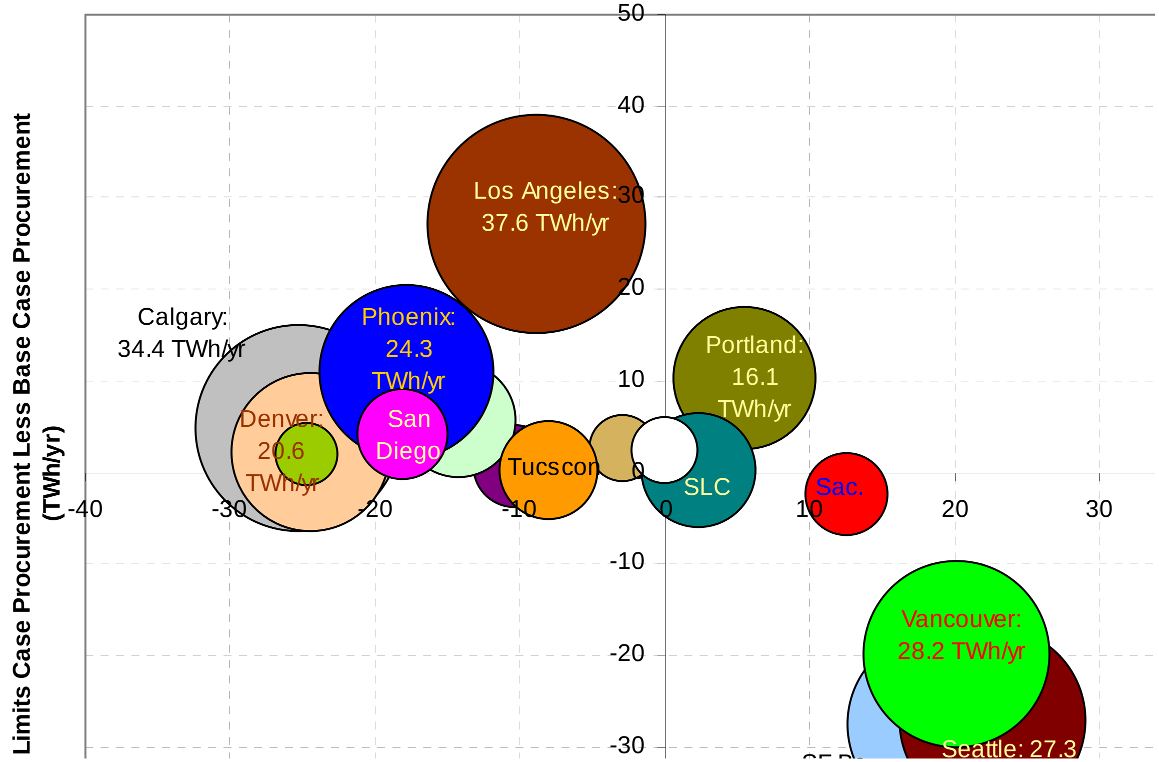
Long Trans. Lines Can Be Economically Justified But Most Are Relatively Short



- Lines over 800 miles long can be economically justified in some cases
- Long lines are more prevalent when HVDC is assumed for lines longer than 400 miles
- Average transmission distances are 230-315 miles when 33% RE is delivered to each zone
- Any long distance lines built to access renewable energy in the west would ideally be coupled with an even-greater emphasis on short-distance lines

Renewable Energy Credits Can Reduce Transmission Expansion and Overall Costs

- Costs of meeting RE targets are heterogeneous across load zones
- RECs allow loads near high-quality resources to increase procurement and loads distant from resources to decrease procurement
- RECs can reduce transmission costs by $8 billion in 33% RE target scenario
- RECs may potentially reduce average costs of meeting 33% RE target by $6/MWh



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Conclusions

- Assumptions and policies that affect bus-bar costs of renewables have the largest impact on resource selection and transmission expansion
  - Renewable resource capital cost, financing parameters, availability of incentives, and resource quality need careful consideration
- Bus-bar costs are only one piece of the puzzle: transmission and market value assumptions can also be important
- Wind energy is the largest contributor toward a 33% RE target under starting point assumptions, but key uncertainties can shift the balance between wind and solar in the Southwest
- Transmission investment to meet 33% RE with new WREZ resources estimated at $17-34 billion
- Transmission costs are 10-19% of delivered cost of WREZ resources
- Availability of tradable RECs should be explicitly considered in more detailed transmission planning

Future Research

- **Considerable non-WREZ renewable resource potential** exists in the West; the adjusted delivered cost of non-WREZ resources should be compared to the adjusted delivered costs of WREZ resources
- **Market value adjustment factors** will change with penetration levels; more detailed tools should evaluate changes in market value at higher penetration, particularly in identifying the potential role of tradable RECs
- **Higher transmission utilization** increases wind procurement; detailed analysis should evaluate the costs and benefits of approaches to increasing transmission utilization for wind energy

For more information...

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Download the full report:

http://eetd.lbl.gov/ea/EMS/re-pubs.html

Download the WREZ model:

www.westgov.org

San Diego Gas & Electric

Planning for a Safe, Reliable, Affordable and Sustainable Energy Future

June 2010

SDG&E Business Overview

- Provider of electric and natural gas services
  - 3.5 million consumers
  - 4,100 square miles of service territory
  - 2.3 million electric & gas meters
  - 11,000 new meters in 2009

- Affilated with Southern California Gas company
  - Both owned by Sempra Corporation

Note: Data as of December 31, 2009.

State's Energy Action Plan – Electric Action Areas

Resource Plans reflect state's policies prioritizing:

1. **Energy Efficiency** to reduce overall energy consumption
2. **Demand Response** to reduce energy use during periods of high demand
3. **Renewable (Green) Power** to satisfy up to 33% of energy needs by 2020
4. **Electricity Adequacy, Reliability and Infrastructure** mainly focuses on new conventional plants, combined heat and power applications, transmission and distribution facilities

Overall driving policy is climate change

Energy Efficiency

- Energy efficiency (EE) means installing things that help reduce energy use in homes and businesses
- Over the last 20 years, SDG&E has achieved savings of 4.2 million MWh ~ enough to supply energy to about 655,000 homes for one year and reduced peak load by 952 MW ~ the equivalent of 1.5 giant power plants
- Current Plan: Achieve all “cost-effective” energy efficiency

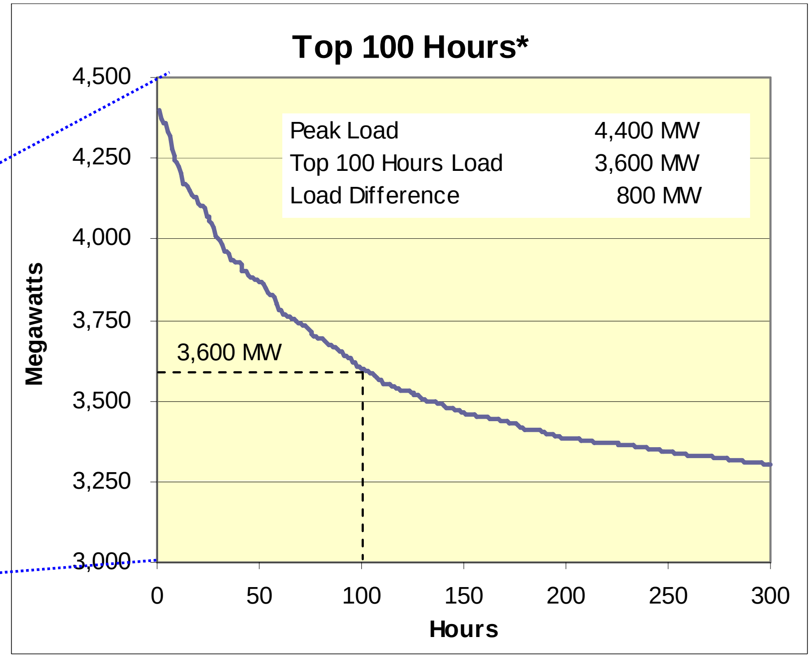
SDGE Southern California Gas Company Sempra Energy utilities

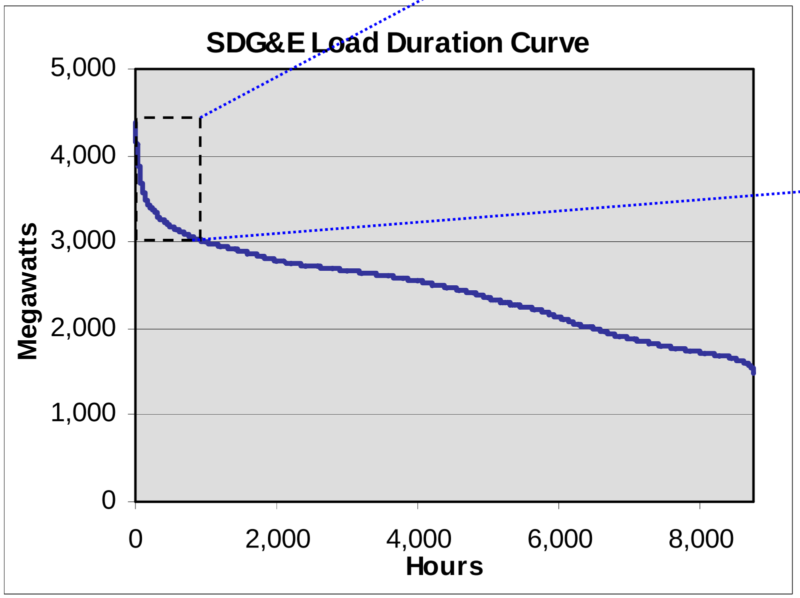
Demand Response

- Temporarily reducing electricity use, or shifting the time you use electricity when demand for energy is at its highest
- Current plan: Develop cost-effective programs, send price signals so customers can make informed decisions
  - installing Smart Meters to all customer

Why Demand Response ?

Close to 20% of the resources are needed for 1% or less of the year





*Values shown are approximate and are based on a load shape for a typical weather year.

San Diego Gas & Electric® (SDG&E®) and Southern California Gas Company are separate companies.
Each utility has a distinctive service area within the Southern California region.

EE/DR Portfolio Overview

- **Key Programs :**
  - **Residential Segment:**
    - Whole House Retrofit (EE)
    - New Construction (EE)
    - Advanced Lighting (EE)
    - Plug Load (EE)
    - Air Conditioner cycling (DR)
  - **Commercial/Industrial Segment**
    - Retrofit incentives/rebates (EE)
    - New Construction (EE)
    - Small Business direct install (EE)
    - AC cycling for small customers (DR)
    - Critical Peak Pricing for >200 kW (DR)

Policies that Impact Energy Efficiency

- Rate Unbundling
  - Utility profits are not impacted by customer consumption levels
  - Commodity costs are passed through to customers without mark-up and are trued-up annually
- Incentives
  - Utility shareholders should be able to earn a return on EE activities equivalent to investments in power plants to serve the load
  - Challenge: evaluation, measurement and verification to determine incentive awards
- Current Challenges
  - Need for large up-front capital investments
  - Party that pays the energy bill is different than the party that needs to make the investment

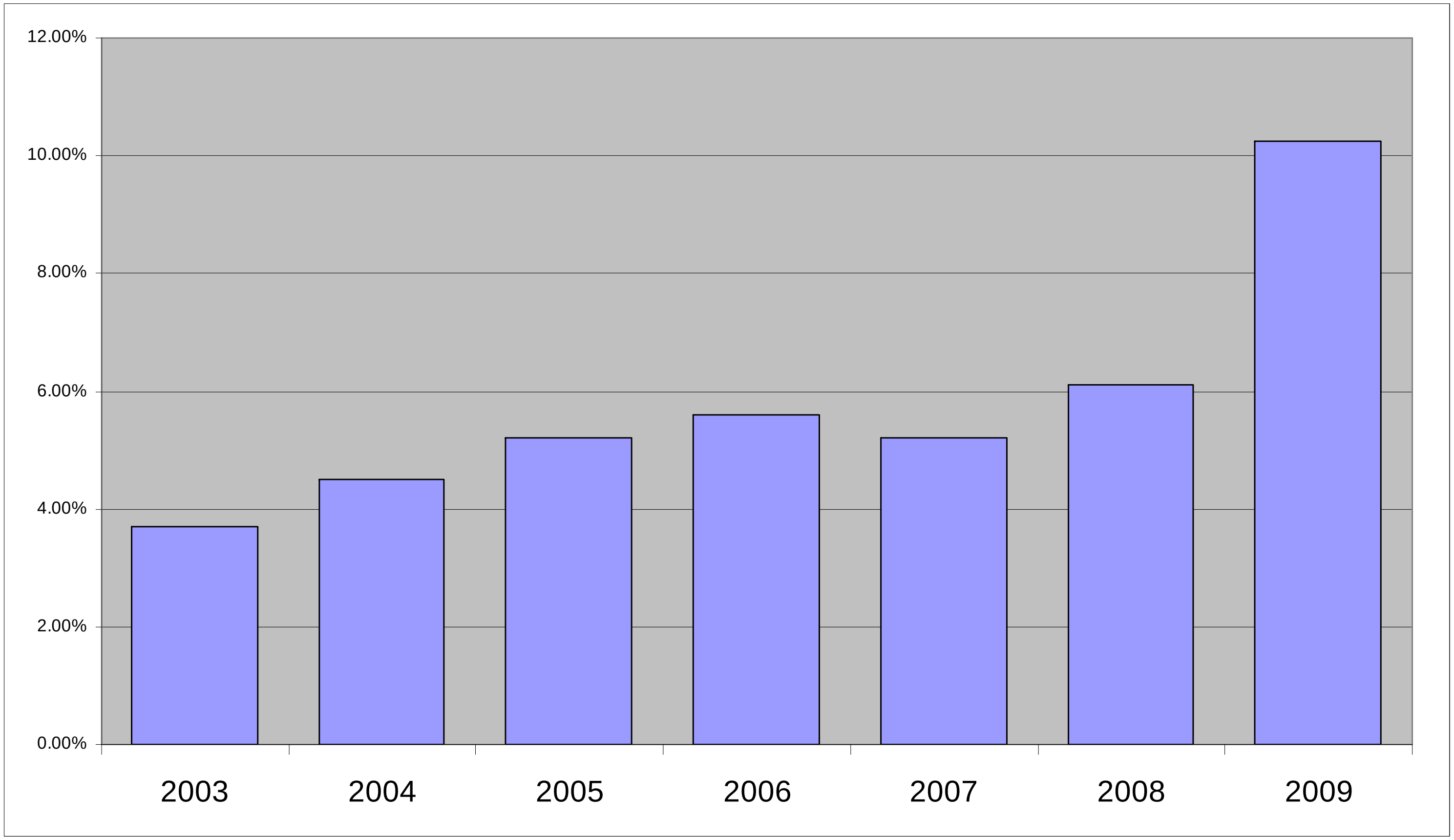
SDGE Southern California Gas Company Sempra Energy utilities

Renewable Energy

- Estimating renewable energy will be about 14% of SDG&E's energy needs in 2010.
- State law requires 20% renewables in 2010;
  - Law has "banking and borrowing" provisions
- Legislature is looking to revise the law and set the target at 33% in 2020.
- SDG&E has made a pledge to reaching 33% in 2020

Main objective is to reduce greenhouse gases

Renewable Energy - % of Sales



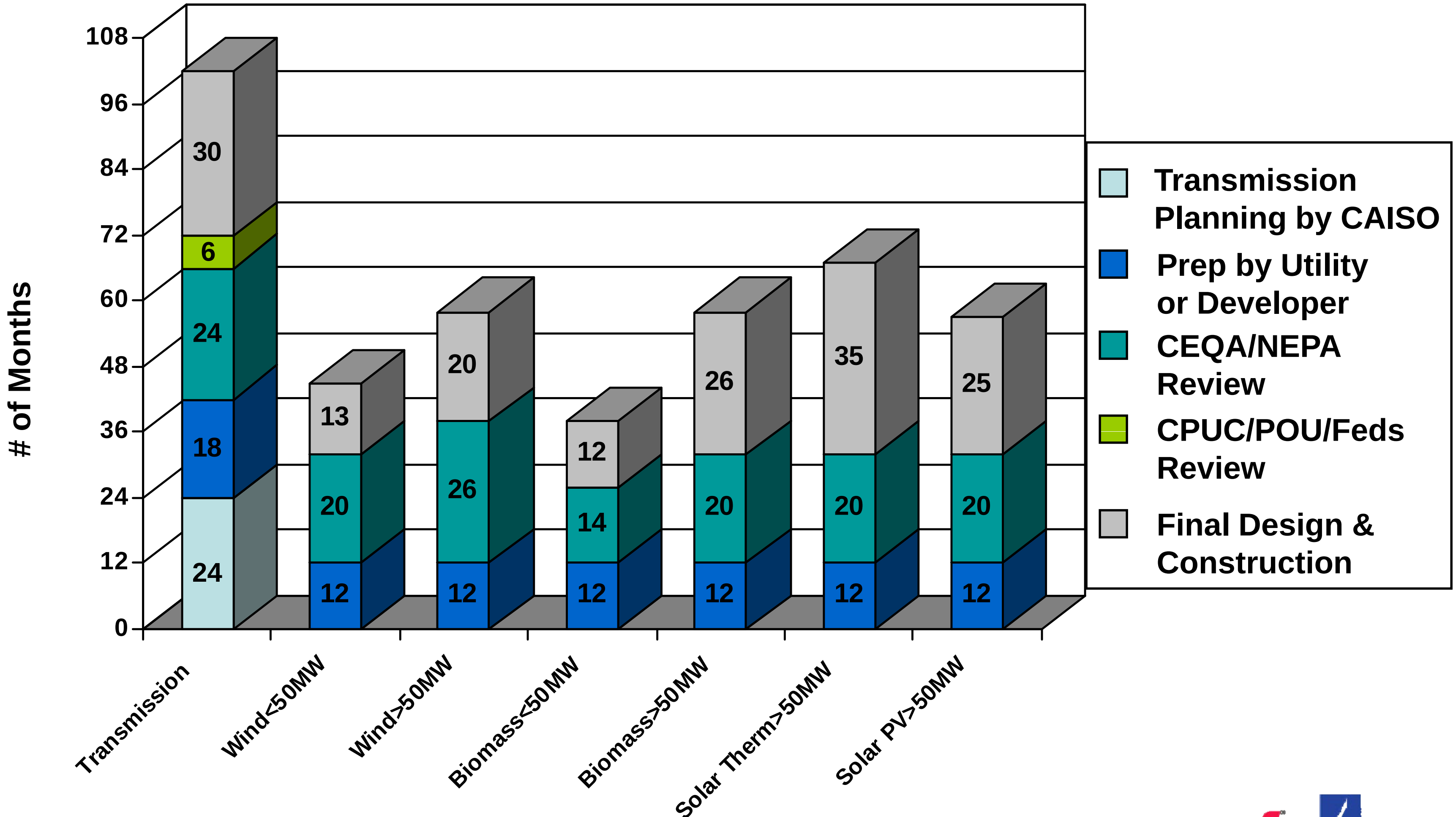
Source: IOU's August, 2009 RPS Compliance filings

Policy Implications

- Competing State Goals
  - Costs, in-state jobs, other environmental constraints
  - Timelines
  - Rooftop photovoltaic programs do not count
  - Licensing agencies are overwhelmed by number of projects
- Supporting Infrastructure
  - Renewable need to built where the “fuel” is, driving need for new transmission
  - New non-renewable generation needed to integrate intermittent renewables
  - Photovoltaic causing power quality problems on distribution system
  - Creating a need for storage, but what kind and how much not clear

SDGE Southern California Gas Company Sempra Energy utilities

Generation & Transmission Timelines



Source: CPUC 33% Renewable Portfolio Standard Implementation Analysis, June 2009

San Diego Gas & Electric® (SDG&E®) and Southern California Gas Company are separate companies.
Each utility has a distinctive service area within the Southern California region.

Sunrise Powerlink

- 120-mile electric transmission line, capable of delivering 1,000 megawatts of clean, reliable energy
- $1.883 billion project, net savings to customers
- 2010 – Construction start
- 2012 – In-service date
- Vocal opposition: NIMBYs, environmental groups, consumers

Rolling Out Plug-In Electric Vehicles

Scope

- 1,000 240V home chargers
- 1,500 commercial and public chargers (60 DC fast-chargers)
- 1,000 Nissan LEAF cars
- Three experimental rates (pending CPUC approval)

Status

- Nissan reservations opened April 2010
- Regional stakeholder team formed to select charging sites
- Initial sites installed Q4 2010
- Vehicles arriving Dec. 2010

PG&E's Demand-Side Management Portfolio

Jan Berman
Sr. Director, Integrated Demand-Side Management

Pacific Gas and Electric Company

Energy services to 15 MM people:

- 5.1 MM Electric customer accounts
- 4.3 MM Natural Gas accounts

70,000 square miles with diverse topography

20,000 employees

A regulated investor-owned utility

Newsweek GREEN RANKINGS 2009

Ranked the greenest utility in the United States

Why Do Utilities Support Demand Management?

- **Our customers want it**
- **Helps utilities mitigate the impact of demand growth on infrastructure**
- **Reduces our long term bill impacts**
  - Energy efficiency is less expensive than new generation
- **Allows us to allocate capital to other needed infrastructure projects**

- **Positive impact on earnings**

California's Legislative Landscape

Energy Action Plans (2003 and 2005)

- Established a "loading order" of energy resources to guide procurement decisions made by utilities
- Places energy efficiency and demand response ahead of generation

California's Legislative Landscape

AB 32: Global Warming Solutions Act (Sept. 2006)

- Establishes comprehensive program of regulatory and market mechanisms to achieve real, quantifiable, cost-effective reductions of greenhouse gases

- Reduce carbon emissions to 1990 levels by the year 2020 (25 percent reduction)

- First statewide program in the U.S. to mandate an economy-wide emissions cap that includes enforceable penalties

California's Legislative Landscape

Governor's Executive Order S-3-05, California's Emission Reduction Goals (June 2005)

- By 2010, reduce greenhouse gas (GHG) emissions below year 2000 levels
- By 2020, reduce GHG emissions below year 1990 levels
- By 2050, reduce GHG emissions 80% below year 1990 levels

Demand-Side Management As Procurement Resource

Consider DSM resources just as you would a power plant

California Energy Action Plan establishes a loading order which requires utilities to prioritize resource procurement

- Energy efficiency and demand response
- Renewable energy
- Clean fossil-fuel generation

PG&E is a leader in customer demand management programs

Energy Efficiency

- Develop and implement programs that help our customers save energy without losing productivity

Low Income Energy Efficiency

- Develop programs and install measures that help our customers save energy and lower their energy bills

Demand Response

- Develop and implement programs that pay customers to reduce their energy use on short notice during spikes in load or for short-term deficiencies in supply

Solar

- Provide incentives for our customers who install solar generation on their side of the meter

ClimateSmart

- Allows customers to combat climate change by offsetting the greenhouse gas emissions associated with their energy use

Energy Efficiency

Keys to Energy Efficiency Success in California

Revenue/sales decoupling mechanisms are paired with annual rate adjustment mechanism

Sustained, deep commitment by regulators, state lawmakers, utilities and other stakeholders

Growing interest and commitment by the public to improve the environment and mitigate climate change

General agreement that utilities have been and continue to be a key player in delivering energy efficiency programs and savings to customers

Aggressive efficiency improvements in building codes and appliance standards

Manufacturers and distributors are included in efficiency efforts

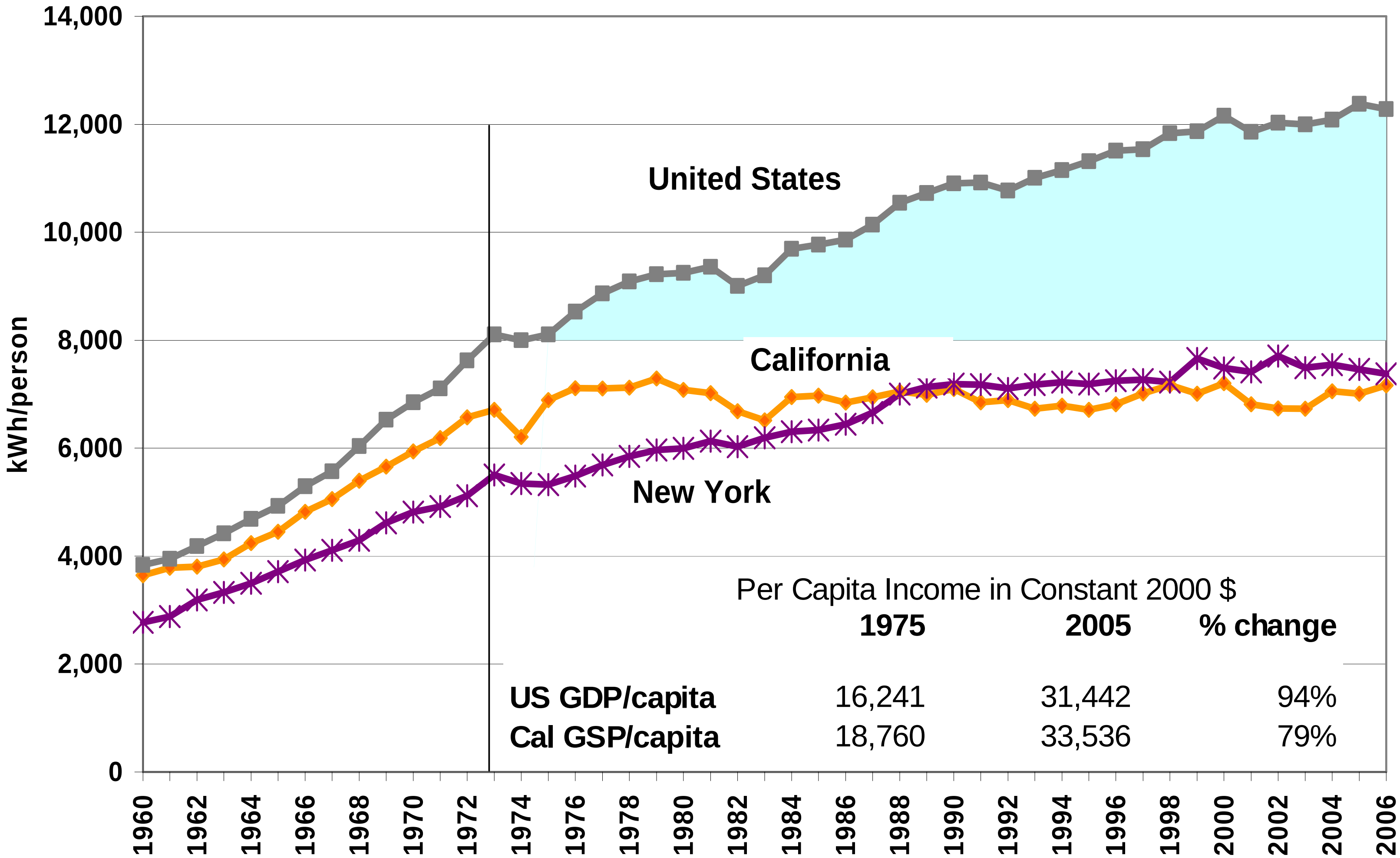
California utilities are recognized by the customer as energy efficiency and demand response experts

The Numbers Talk

Since 1976, PG&E's energy efficiency programs have:

- Saved 155 million MWH and 12.5 billion therms
- Helped California avoid building 24 large power plants
- Saved customers over $24 billion
- Avoided 155 million tons of $C0_2$ emissions

Per Capita Consumption of Electricity
(not including on-site generation)



Per Capita Income in Constant 2000 $

	1975	2005	% change
US GDP/capita	16,241	31,442	94%
Cal GSP/capita	18,760	33,536	79%

PG&E Annual Goals and Budgets

	MW*	GWh	Million Therms
2009	**230**	**1,014**	**15.1**
2010	**218**	**964**	**15.6**
2011	**234**	**1,032**	**16.2**
2012	**251**	**1,114**	**17.1**

- **Total budget for 2010-2010: $1.3 B**
- **Total 2009 spend: $450 M**

2010-2012 Energy Efficiency Programs

Core Programs

- Programs implemented by PG&E to deliver energy savings
- Designed around market segments
- 10 programs
  - Residential
  - Commercial
  - Industrial
  - Agriculture
  - New Construction
  - Workforce Education and Training
  - Emerging Technologies
  - Codes and Standards
  - Heating, Ventilation and Air Conditioning (HVAC)
  - Zero Net Energy Pilots

Government Partnerships

- Partnerships with local governments and statewide departments provide community-specific EE services and support for municipal retrofits

Third Party (3P) Programs

- CPUC requires that 20 percent of EE funding is allocated to third party implementers
- Typically 3P programs focus on niche markets or technology expertise

EE Core Programs

"Core" PG&E programs delivering savings to portfolio

Residential

- Target single family and multifamily residential customers
- Work with market actors throughout the delivery stream (upstream, midstream and downstream)
- Offerings include
  - Home Energy Efficiency Survey/On-site Audit
  - Lighting Incentive
  - Energy Efficiency Rebates
  - Appliance Recycling
  - Business and Consumer Electronics (BCE)
  - Multifamily Energy Efficiency Rebates

Agriculture Commercial Industrial

- Target specific customer segments and industries
- Provide customized energy efficiency services that address the specific needs of that customer segment
- Program segments also broken down into sub-segments, i.e. retail, dairies, high tech, etc.
- Focus on larger customers and/or large-scale operations that can deliver significant energy savings

New Construction

- Transform California's residential and nonresidential new construction markets
  - Savings by Design: works with architects, engineers, designers and building owners to foster buildings designs with superior energy efficiency
  - Residential New Construction (RNC): encourages single- and multifamily residence builders to construct homes that exceed California's T-24 energy efficiency standards by at least 15 percent

Agriculture Program

Providing customized support

- Partnership with industry, trade allies and others
- Emphasize integrated solutions
- Targeted to end-use agriculture and food processing customers
- Asti Winery Case Study:
  - $165,325 PG&E incentives
  - 1,224,191 annual kWh savings

Heavy Industry Energy Efficiency Program

Implemented by Lockheed Martin

Identifies and facilitates installations of major process oriented and other energy efficiency upgrades (i.e., process, lighting, HVAC)

Offerings include:

- Design assistance
- Engineering support
- Financing guidance

Lockheed Martin builds and maintains successful relationships with customers

Business & Consumer Electronics Program

A first-of-its-kind program

Contracting directly with major manufacturers and retailers to deliver upstream/midstream incentives for energy-efficient consumer electronics

Provides education to end-use customers through in-store signage and other marketing vehicles

Participating retailers include: Dell, Best Buy, Target, Wal-Mart, Sam's Club, Sears, Kmart, Costco and the Nationwide Buying Group

Supporting Programs

Additional programs that support energy efficiency efforts

Workforce Education & Training

- Energy efficiency trainings and classes
- All services offered free to contractors, architects, installers, designers and other building professionals who serve PG&E customers
- Curriculum development to promote green careers to K-12, Community College and University students

Emerging Technologies

- Accelerate commercialization of new energy-efficient technologies
- Screen and assess emerging and underutilized energy efficiency technologies
- Inform DSM portfolio about development of new energy efficiency solutions for customers
- Identify channels for accelerating market adoption of emerging technologies

Codes and Standards

- Develop Codes and Standards Enhancement (CASE) studies to assess the potential and market readiness for code changes
- Selected standards originally proposed by PG&E for California have since been adopted by 10 other states and the federal government

Supporting California's EE Strategic Plan

Programs in Support of "Big Bold Initiatives" of California Energy Efficiency Strategic Plan

- The HVAC industry will be transformed to ensure that its energy performance is optimal for California's climate
- By 2020, all residential new construction in California will be zero net energy
- By 2030, all nonresidential new construction in California will be zero net energy

Heating, Ventilation and Air Conditioning (HVAC)

- Comprehensive set of downstream, midstream and upstream strategies that builds on existing program, education and marketing efforts

Zero Net Energy Pilots

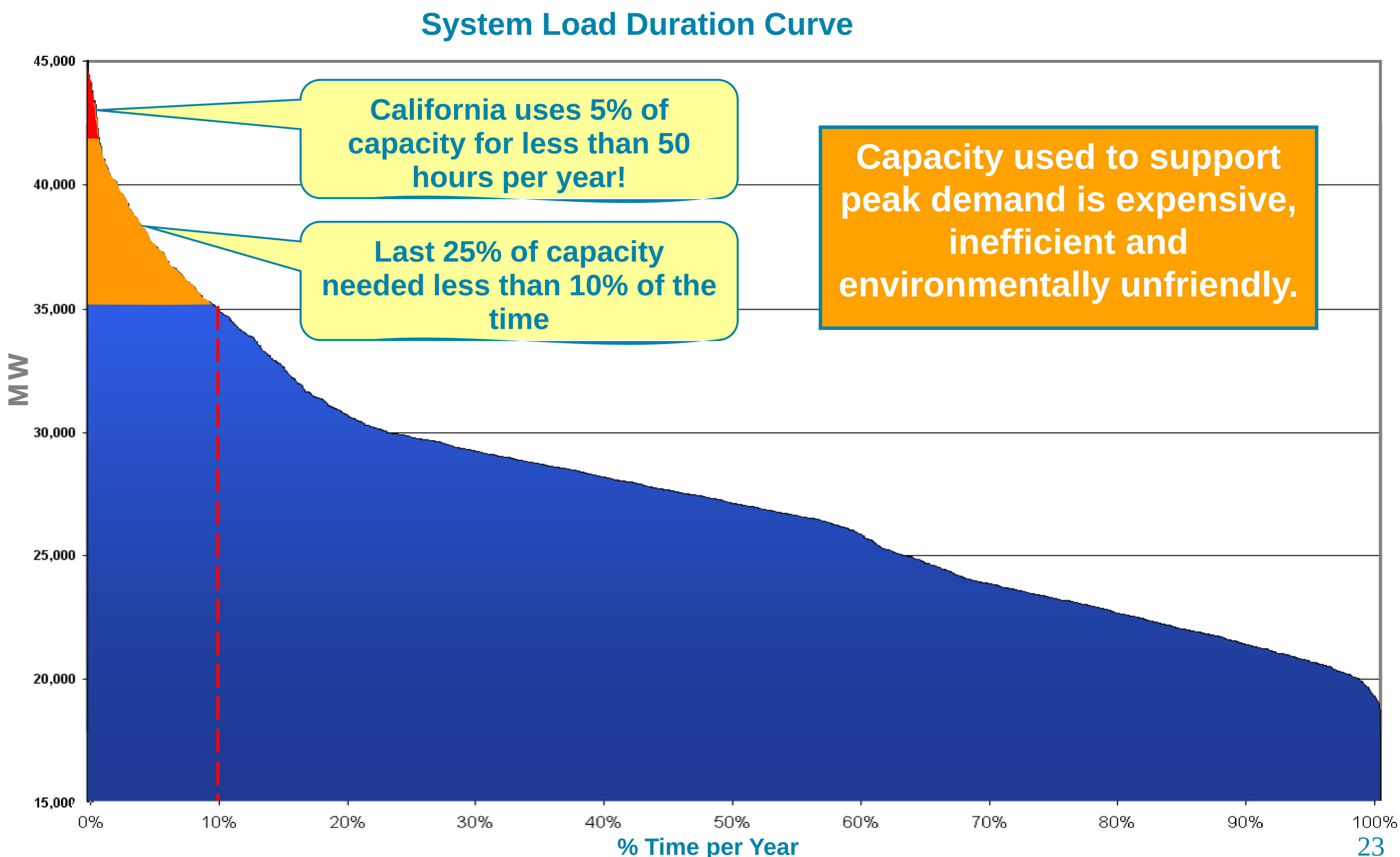
- Engage "whole building" research, development and demonstration projects support the path to "zero net energy" and that plan to include on-site clean distributed generation

Demand Response

Why Demand Response?

- DR programs help manage demand on electric grid during peak times
- Offer financial incentives to customers who reduce electric demand during peak times and/or permanently shift electric load

California's Electricity Need



Source: California Independent System Operator Corporation

Demand Response Benefits

- Reduces electrical demand during "critical peak" periods
- Rewards customers contributing to demand reduction
- Enables:
  - Reduced need for excess generation capacity to serve peak loads: DR is a "virtual peaking plant"
  - Enhanced electric grid reliability
  - Lower average electric procurement costs
  - Lower environmental impact

PG&E's Demand Response Programs

- **Occasional, temporary reduction - when notified or when prices are high**
- **Pays incentives**
  - Enablement - hardware, software, equipment, controls, programming
  - Participation - reduce demand temporarily when called
    - More commitment to flexibility = higher incentives

Enablement Programs

Technical Incentives (TI)

- Up to $125/kW of demonstrated load drop
  - Up to 50% of project cost for retrofit
  - Up to 100% of project cost for new construction
- Must participate in DR program for 3 years
- DBP & PeakChoice Best Effort = $50/kW

Auto-DR

- Up to $300/kW (goes to $250/kW in Jan 2010)
- Up to 100% of project cost, you must be in DR for 3 years
- Facility control system communicates directly with PG&E
- You have full control and can opt out

Participation Programs: Key Features

- **Notification: Day-ahead vs. Day-of**
- **Commitment: Voluntary vs. Committed**
- **Event Trigger: Emergency vs. Price Sensitive**
- **Operating Months: Summer vs. Year-around**
- **Curtailment Window: Afternoon hours vs. 24 hours**

Distributed Generation

Distributed vs. Utility Scale Renewables

Utility Scale Renewables

- Economies of scale
- Modular
- High MW penetration possible

Distributed Renewables

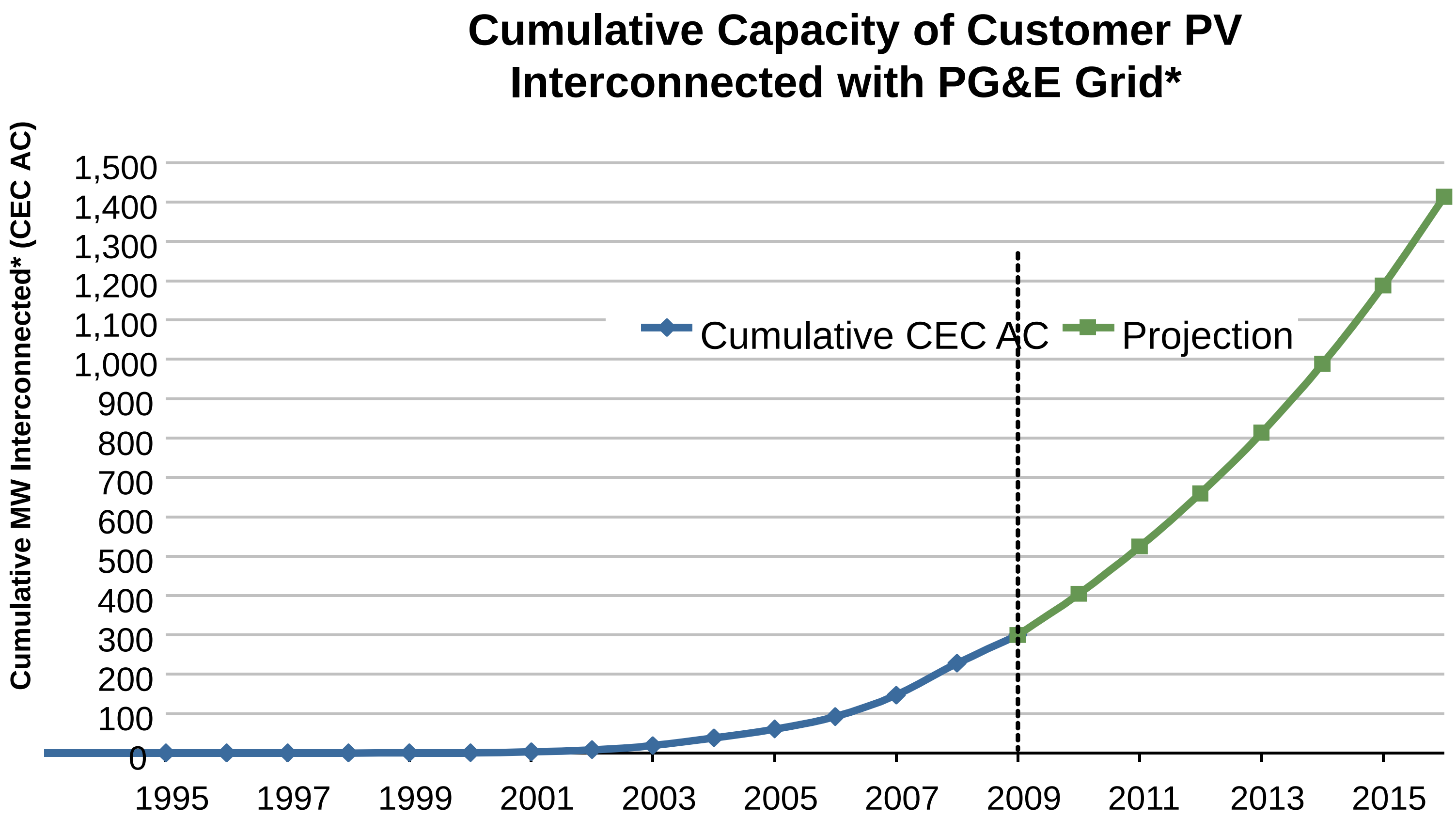
- Speed to market
- Not transmission dependent
- Allows Customer Choice

A diverse portfolio of resources provides the best combination of benefits.

The California Solar Initiative

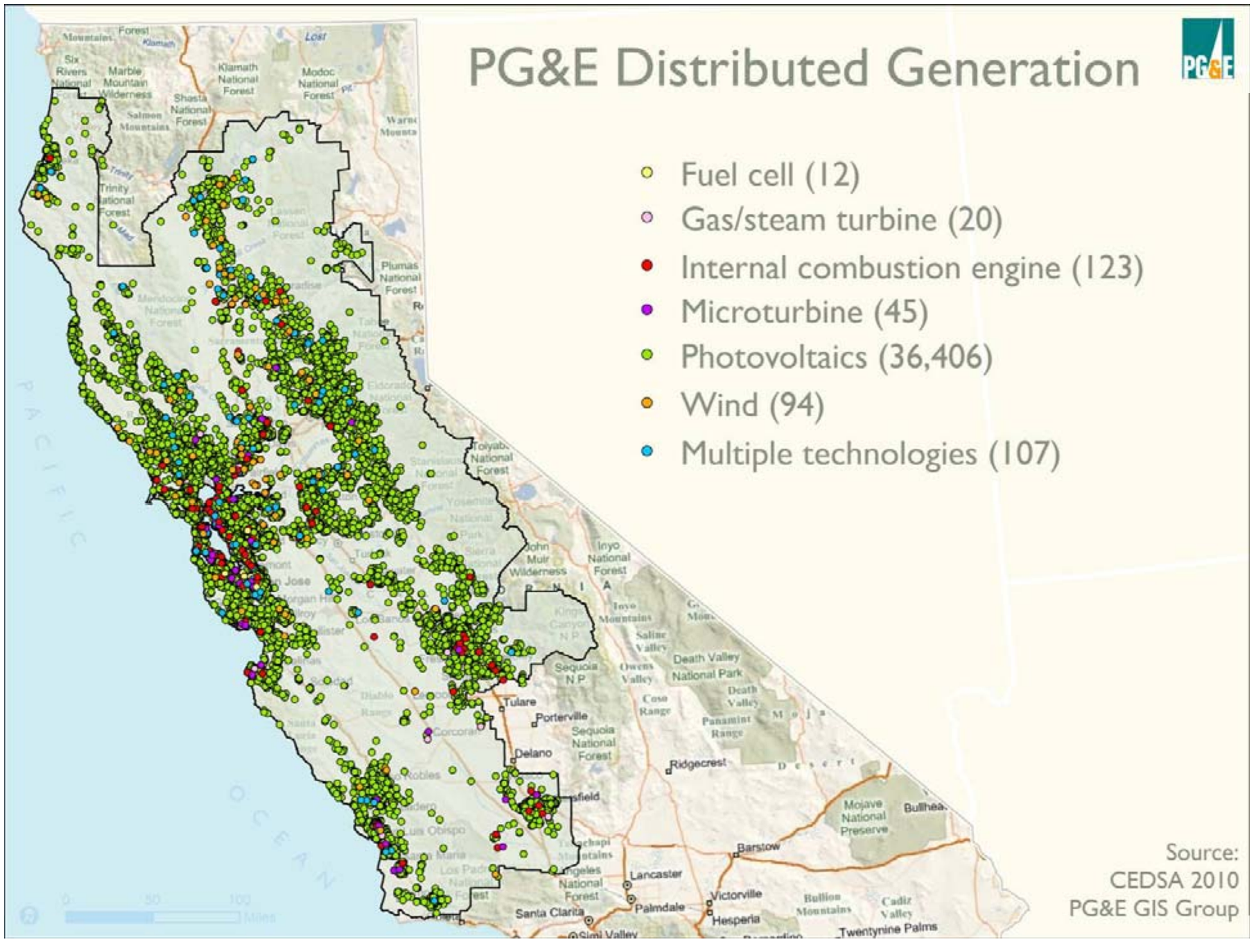
- PG&E began administering in 2007
- $950 million in PG&E solar incentives over the next decade
- Statewide goal is to install 3,000 MW by 2016
- Customers must perform energy efficiency audit to be eligible for incentives
- Over 39,000 PG&E customers have installed almost 340 MW of PV – 40% of the US total
- In 2008 and 2009 PG&E interconnected more PV than any other utility in the US

Distributed Generation Today and the Future



* Includes all NEM projects (PV, W, MT, VNEM); excludes Non-Export projects

Distributed Generation Today



Thank You

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Electricity Markets: Theory and Practice

Ajay Pandey
IIM Ahmedabad

Why Electricity Markets?

- Competition
  - Obviously, the main reason
  - Generation (and Supply) is potentially competitive unlike “wires” part of the sector
  - Welfare maximizing in case markets are perfectly competitive
- Price Discovery
  - Prices important in consumption and production

Why Competition and Electricity Markets need to be designed?

- The electricity sector consists of natural monopoly (“wires”) business and potentially competitive (generation and supply) businesses.
- Therefore, competition and markets have to be by design so that “Natural Monopoly” part of the sector does not interfere with the competitive parts.
- Since electricity markets are designed, there can be alternative designs.

Necessary Conditions

- “Wires” business should not have commercial/any interest upstream and downstream
  - Unbundling
- “Wires” should be controlled by the technical considerations alone
  - Security-constrained dispatch
  - ISO
- Centralized Coordination and control is required so that competing players do not violate security.

Competition in the Sector

- Other Important conditions
  - Competition can take place only if the entities are commercial
  - If the subsidies have to be given to a set of consumers, then they have to be entity-neutral
  - Regulated prices and competition cannot co-exist

Competition in the Sector

- Issues
  - Competition at what level?
    - Wholesale and/or retail
  - Model of whole sale competition
    - Electricity market and procurement
  - Model for retail competition
    - Open access with default supplier
    - Separation of DNO from supplier

Market Design Principles/ Objectives behind Competition

<u>General-</u>

- Social welfare maximization overrides contractual arrangements
    - Contracts are financial and not physical
- Competition should not be curbed by any vested interest.

<u>In the short-run-</u>

- Prices should reflect marginal cost and value of electricity.
- Prices should also reflect marginal losses and congestion induced by the drawing entities at a location.

Costs to be Recovered

At Wholesale level-

- Generation Capacity related costs
- Energy or use of generation capacity costs
- Ancillary service such spinning reserves etc.
- Transmission capacity related costs
- Transmission losses & congestion costs, if any

At Retail level-

- Distribution capacity related costs
- Distribution losses
- Consumer-specific investment related costs
- Consumer servicing costs

Objectives of the Market Design

In the long-run-

- All “economic costs” should be recovered.
- Prices should be cost and value reflective.
- Prices should be reflective of forward looking costs, i.e., of supplying electricity competitively in the future.
- Prices should signal where network should expand and generation capacity should add.
- Hedging or risk allocation should be facilitated.
- Prices should result in adequate capacity being available.

Additional Considerations

- Volatility of prices
- Competition at the wholesale level only or up to retail level.
- Regulatory stance on "Stranded Assets"
- Legal framework/ Case laws on handling "Stranded Assets"
- Political economy considerations

Why Spot Market?

- Financial contracts (not physical contracts) require basis of settlement.
- Physical contracts weaken the control and degrees of freedom for the ISO.
- Common market advantage
  - No distortion in consumption decision/ value of trade

Choices and Concerns in Market Design

- Demand side bidding
- Bilateral contract driven market with imbalance market / Net pool
- Gross pool with hedging
- Energy-only market or separate capacity payments
- Price cap specifications
- Mechanism for ensuring capacity adequacy
- Wholesale-retail price linkage
- Competition at retail level and hedging level
- Basis of pooling and recovering joint costs
- Transmission pricing
- Market power/ level of competition

Markets in Practice

Gross Pool with Capacity charge separation-

- PJM and New England, USA
- Philippines
- Chile
- England and Wales Pool till NETA

Gross Pool, Energy only-

- NEM Australia
- Old California Market

Net Pool, Energy only-

- NETA UK
- Nordic pool

Ensuring Capacity Adequacy

- Engineering and Centrally estimated capacity payments
  - LOLP x VOLL (Old E&W Pool)
- Planning Reserve obligation and capacity market
  - PJM and New England, USA
- Scarcity rent reflected in market prices
  - Volatile and high prices

Thanks!

Electricity Markets: International Experience & Issues in India

Ajay Pandey

Objectives of Market-based reforms in Electricity Sector

- Efficiency through Competition
  - Pricing Efficiency (marginal cost)
  - Productive Efficiency (merit order in dispatch)
  - Investment Efficiency
- ….and often, Location specific Price Signals
  - For consumption (losses and congestion)
  - For siting of generation
- ….and hope of price reduction

Elements of Electricity Markets

- Long-term competitive procurement market
- Bilateral/ Financial (cash settled futures/options) Medium term market
- Spot (day ahead physical) Market
- Intraday (physical) market
- Balancing (physical) Market

Integration of Various Elements

- Spot market prices are/ can be used for settling medium term or long term derivatives or even bilaterals
- Any of these markets can be used to hedge and procure by buyers and for supply by suppliers
- And hence unless any element is badly designed, the prices should be consistent
- Spot prices, if from competitive market having depth, provide reference prices for other markets

Spot Market Designs

- Exchange Model
  - Decentralized, voluntary and required coordination with System Operator
  - Price discovery usually independent of transmission and no attempt at optimization across generation and transmission

  (NETA, UK, Most EU markets, India)
- Pool Model
  - Centralized, compulsory (sometimes voluntary, Net Pool) and integrated with the System Operator for market clearing and dispatch
  - Standard Market Design of FERC (as in PJM) discovers prices at different nodes using algorithms to optimize across generation, transmission and factoring in losses and congestion, if any
  - Intraday, balance and ancillary services markets are integrated with the spot market

  (PJM, US, Canada, Philippines, Australia, Iberia, Russia etc.)

Some Major Issues in Market Design

- Price Discovery and Productive Efficiency
  - Energy only bids or separation of capacity bids (charges) from energy bids
  - Implication for merit order and price volatility

    (Most Exchanges and Some pools operate with energy only while Iberian market, PJM (US) have separation)
- Market Power and Auction Design
  - Uniform Price Auction, Pay-as-bid Auction
  - Inconsistency between pricing efficiency and productive efficiency
  - Use of price caps

  (Most markets have Uniform Price Auction with price caps)

Some Major Issues in Market Design

- Handling Losses and Congestion
  - Socialize losses and cost of re-dispatch in the event of congestion (Most markets)
  - Market splitting (Nord Pool)
  - Nodal Pricing indicating marginal losses and costs imposed by congestion causing nodes (PJM, Iberian market)
- Handling Complementarities in Generation costs
  - Block Bids
- Consistency between long-run Investment efficiency and short-run productive efficiency
  - Failure of spot markets on energy-only basis to provide incentive for capacity addition
  - Separate capacity markets
  - Interdependence between generation capacity addition and transmission capacity/ network expansion

Learnings from International Experience

- Spot markets are critical for proving reference prices for consumption, medium and long-term bilateral contracting and hedging and price discovery in the spot market should be robust.
- In the electricity markets, market power can be easily exercised by economic or physical withholding even by relatively smaller players when the capacity is tight.
- Hedging and market depth reduces incentive for exercise of market power in the spot market.

Learnings from International Experience

- Lack of demand side participation in the wholesale markets makes demand inelastic enhancing the effect of market power.
- Energy-only spot prices are expected to be volatile and provide inadequate incentive or price signal for capacity addition.
- In case of transmission bottlenecks, exchange model without market splitting or nodal prices may be not very effective.
- Both decentralized and centralized models are currently being used internationally.

Indian Electricity Markets

- Elements in Place
  - Long-term competitive procurement mandatory
  - Exchange model (voluntary/decentralized spot market)
- Missing Elements
  - Medium term financial market for hedging
  - Effective centralized system operation control and therefore, Balance Market

Issues in Indian Markets

- Use of UI for balancing
- Lack of depth in Spot markets
- Open Access for generators
- Load shedding and other forms of non-commercial behavior of distribution utilities
- Transmission capacity and congestion management
- Lack of contracts for hedging

UI and Balance Market

- Unlike other markets, UI based transactions do the balancing in real time in India.
- UI is unscheduled interchange whereby the supply and demand is met through frequency adjustments and the price for UI is based on frequency.
- The relative share of transactions through bilateral, UI and spot is approx. 5:3:1
- This is despite CERC’s position that UI and ABT should not be used as market.

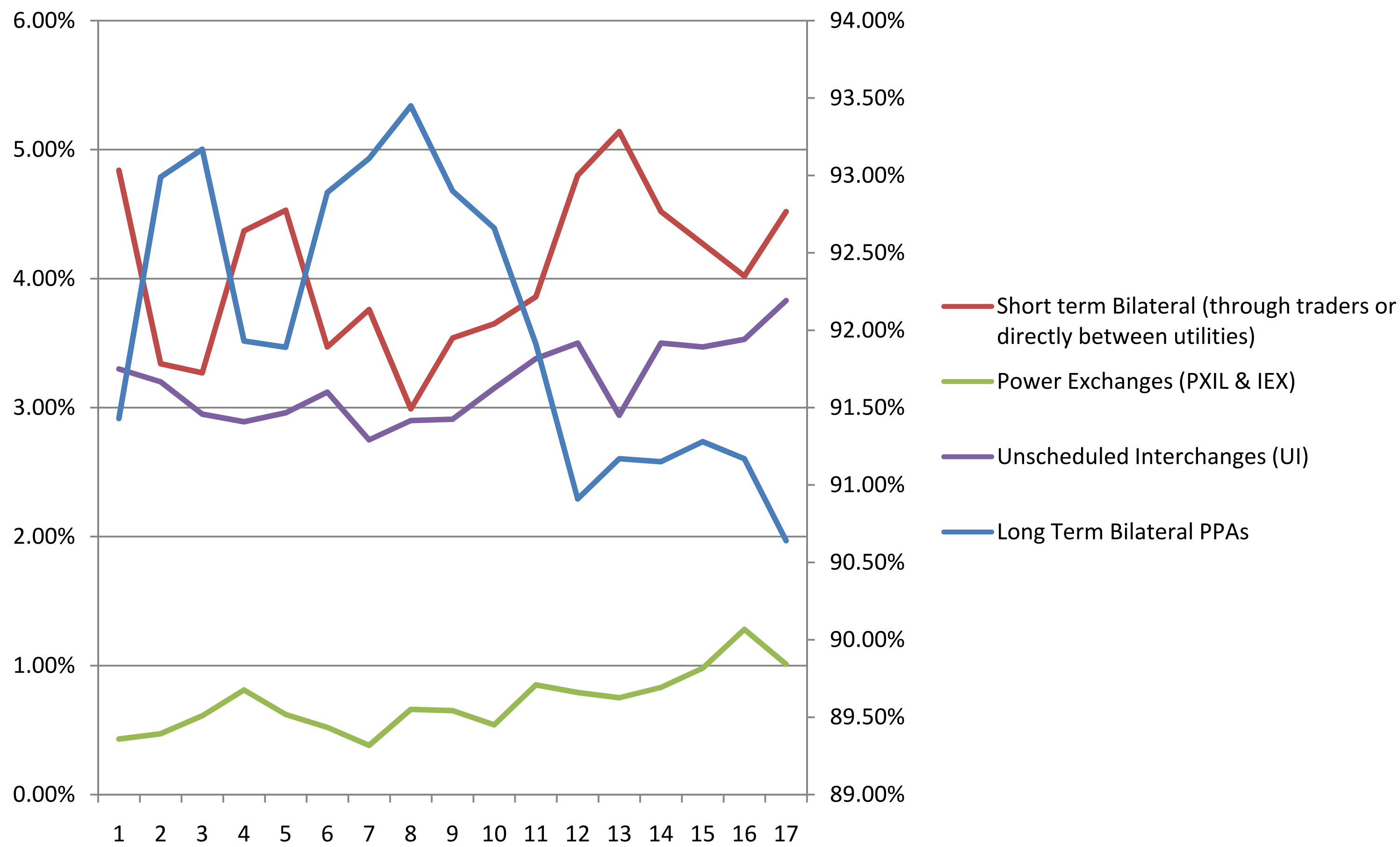
UI and Balance Market

- UI being frequency linked asymmetric price does not discover any price.
- Price cap on generators being lower than buyers reduces incentive for the generators to respond
- Frequency-linked fixed price reduces incentive for buyers to formally contract particularly for peak or contingent power.
- UI can be used against consumer interest by shedding load to earn UI even if power was procured.

Shallow Spot Markets

- The volume transacted through market is low (1%) with preference for bilaterals and and uncontrolled UI
- Consequence as well the cause of lack of integration of different elements (bilaterals, spot and balance) of the market

Trend of Share of Long Term, Short Term (Bilateral, PX, UI) over last year and a half



Open Access for Generators

- Section 11 of the Electricity Act used unfairly by the states to prevent flow of power outside the state by IPPs.
- Open access resisted by the states for IPPs/CPPs informally or formally (charges/ transmission capacity).
- State-owned generators act on instructions from the state rather than acting commercially.

Non-commercial Orientation of Utilities

- Load shedding and buying at any price (before elections) marks the behavior of utilities
- Both these and other non-economic behavior coupled with use of UI impedes in price discovery

Transmission Capacity & Congestion Management

- Currently, the exchanges get the last priority in case of congestion in inter-state and inter-regional corridors after long-term and short-term bilaterals
- Exchange traded power, however, has to pay a uniform transmission charge unlike bilaterals

Pure Financial/Hedging Contracts

- Such contracts are not available
- Unless spot market price discovery is robust, such contracts can not be launched
- Regulatory jurisdiction need to be clarified and in case of multiple regulators, co-ordination is required for market rules and surveillance

Thanks!

Lessons of Telecom Sector Reforms for Other Infrastructure Sectors

Rekha Jain
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Indian Institute of Management, Ahmedabad

Where We Are – Telecom Parameters

- **Penetration:** Teledensity
  - Dec 31, 09
    - Rural – 21.16%, Urban – 110.96%, Total – 47.88%
  - March 31, 09
    - Rural – 14.93%, Urban – 89.44%, Total – 36.98%
- **Tariffs –** One of the lowest in the world
  - Current: Re.1 per minute or less
  - In mid 90s: Rs 16.40 per minute
- **Waiting List**
  - March 31, 1990: 1.7 million
  - March 31, 2002: 1.0 million
  - No waiting list since cellular inception

- Source - IRIS (01 April 2009)
- *Rural and Urban Teledensity as on Dec – 08, http://www.dnaindia.com/report.asp?newsid=1236321, http://www.ibef.org/artdisplay.aspx?cat_id=194&art_id=22069, - http://www.mkhoj.com/home/news/?tag=mvas

We are the Largest Music Company in India (Bharti)

Background

- Some Technical Terms
  - Spectrum, Bandwidth, Local Loop, Switching (Circuit Switched, Packet Switched)
  - GSM, CDMA
- Increasing Focus on Wireless (costs, revenues).

Where We Are – Telecom Parameters

- **Value Added Services**

  - Oct 2008 - Rs 5,000 crores

  - June 2009 – Rs 10,000 crores and increasing

- **QOS (coverage, mobility, reliability)**

- **Creation of several large companies (last 15 years): tax revenues for the government, wealth for shareholders, employment**

Where We Were

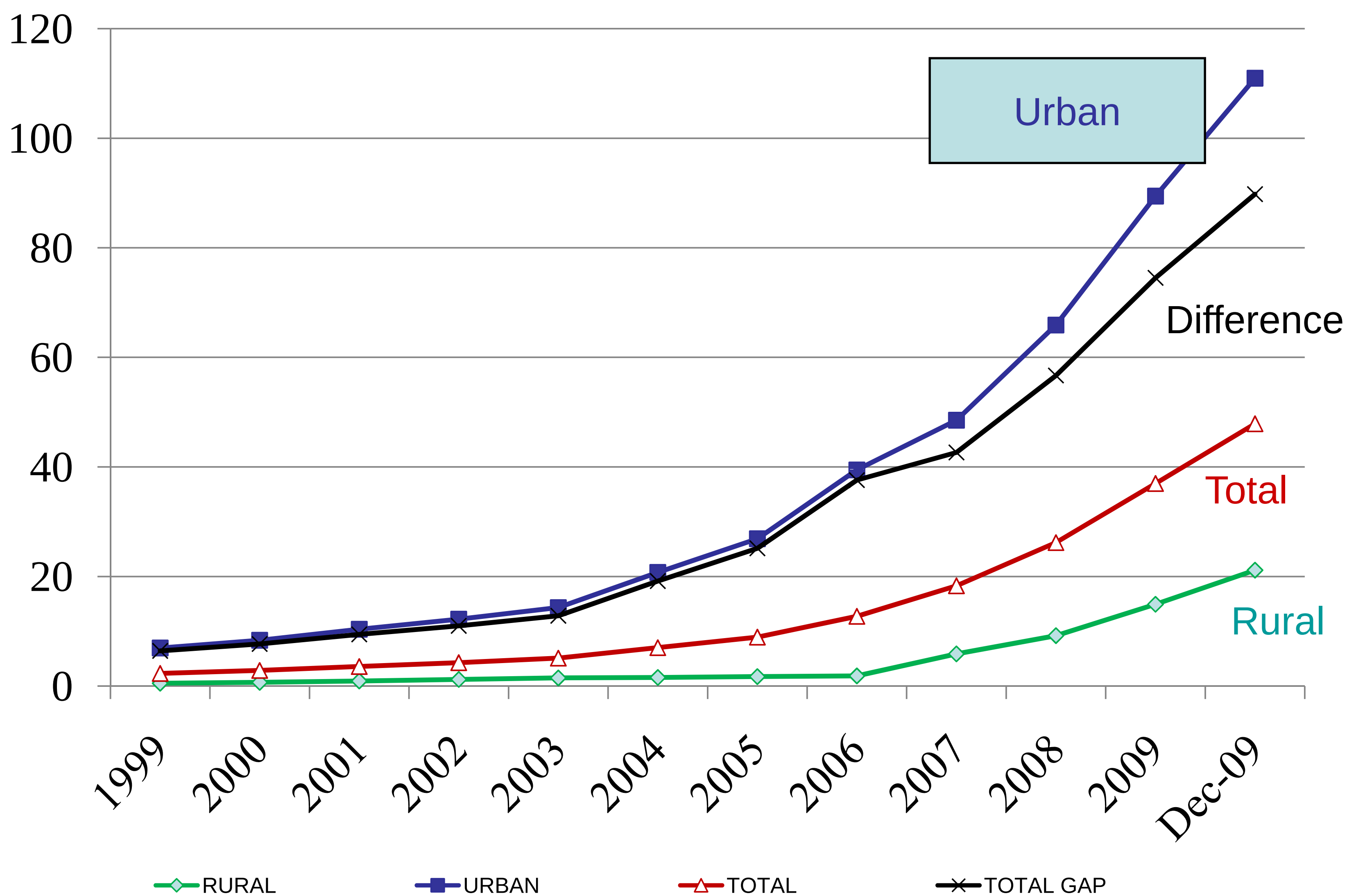
The primary need of the people is food, water and shelter.

Telephone development can wait.

In place of doing any good, development of the telecommunication infrastructure has tended to intensify the migration of population from rural to urban areas. There is a need to curb growth of telecom infrastructure particularly in the urban areas. (Approach Paper to the Sixth Plan (1980-85), quoted in Balashankar, 1998, p. 30)

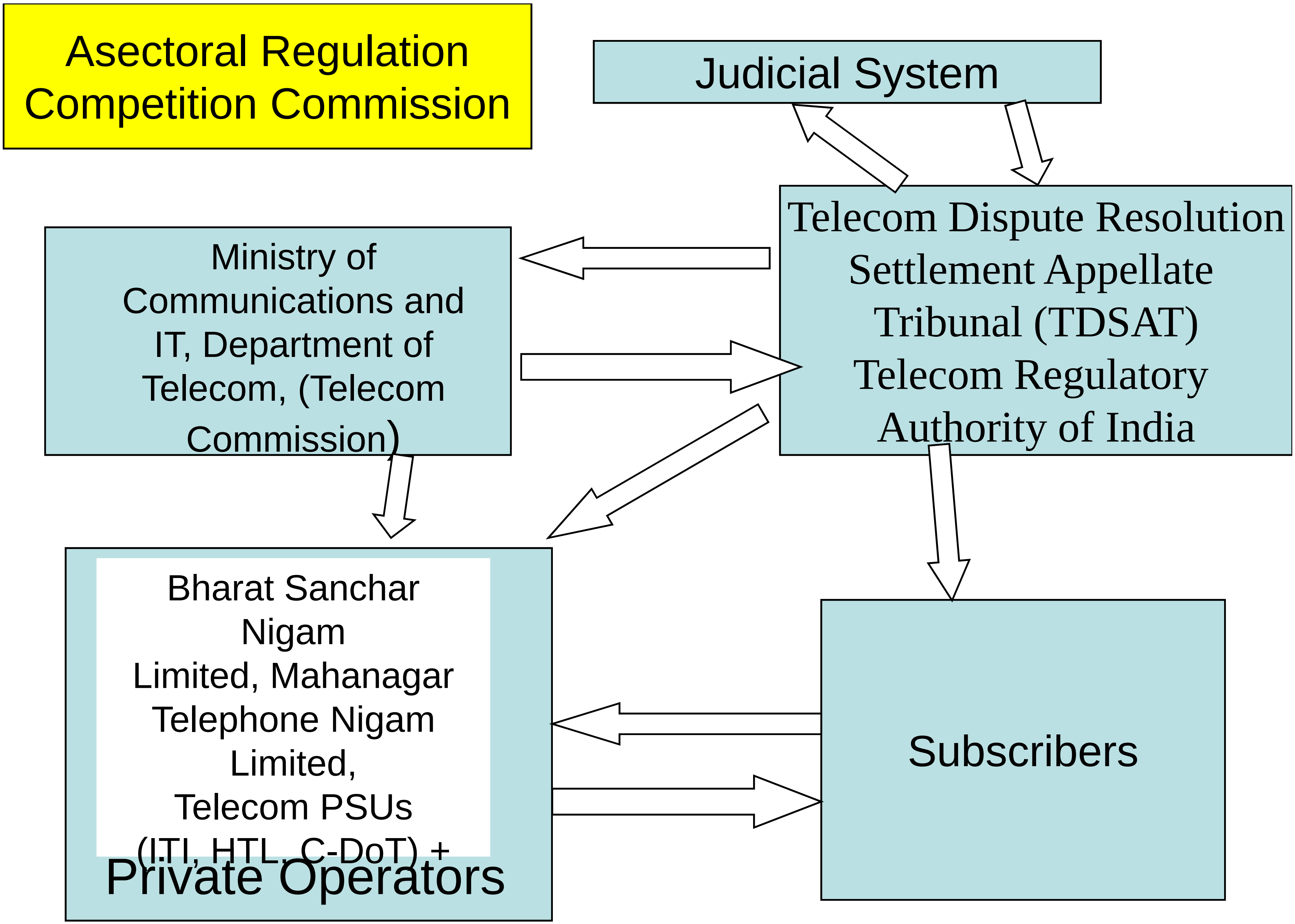
Source: Telecommunications Reform in India, Edited by Rafiq Dossani, Paragraph 3, p. 3.

Teledensity



Where We Are

- Multiple Players (Presence of Foreign Players)
- Regulator (Review and Restructuring)
- Appellate Tribunal
- Corporatized Government Incumbent
- Privatized Government Incumbent
- Indian Players Going Abroad (Bharti/Reliance/Tata)
- USOF Administrator


Asectoral Regulation
Competition Commission
Judicial System
Telecom Dispute Resolution Settlement Appellate Tribunal (TDSAT)
Telecom Regulatory Authority of India
Ministry of Communications and IT, Department of Telecom, (Telecom Commission)
Bharat Sanchar Nigam Limited, Mahanagar Telephone Nigam Limited,
Telecom PSUs (ITI, HTL, C-DoT) +
Private Operators
Subscribers

How Did We Reach Here

- Private Participation/Cellular Metros (1992) (‘supplementary services’), Duopoly
- NTP 94 (Private Participation/Cellular All States + Fixed) (Local Competition)
- Setting up TRAI (1997)
- NTP 99 (Revenue Sharing, USOF, Convergence), Opening Up of National Long Distance
- Corporatization of BSNL (2000)
- Restructuring of TRAI (2000)

- Unbundling basic and Value Added services, local and long distance, regulatory oversight, USOF

How Did We Reach Here

- Fourth Cellular Operator/WLL Controversy (2001)
- Unified Access Service License (2003)
- USOF (2002/04)
- Additional 2G Licenses (2007-08)
- 3G (awarded)

What Helped Us Reach Here and Implications for Other Sectors

- Competitive Bidding (Almost!)
  - All Sectors
- Leveraging a Wider Base of Expertise (Foreign Players)
  - Road, Air, Ports
- Willingness to Restructure Contracts
  - Airports, Ports
- ITS -> IAS : Technical -> Generalist -> Open Professionals
  - *Railways*

What Helped Us Reach Here and Implications for Other Sectors

- Unbundling (Policy, Regulation, Operations)
  - Power, *Railways*, *Road*
  - True unbundling? Linkages of regulators with operators (Power, Telecom)
- Social Responsibility; Sourcing Funds from the Sector
  - Road, *Air*, *Rail*
- Separation of Infrastructure and Services
  - Power, Road, Air, *Rail*
- Technology Neutral (?)
  - *Power*

What Helped Us Reach Here

- Political Will
- Missionary Approach (C-DOT, PCO)
- New Technology Introduction (fresh start)
- Rise Above Scams

Where Have We Got Stuck?

- BSNL, MTNL disinvestment/privatization: Constant erosion of value
  - Functional separation
  - Geographical separation
- Independence of regulators
- Spectrum Availability: Strategic Review of Spectrum
- Rural Roll Outs
- Manufacturing: R&D, Developing Telecom entrepreneurs

A Framework for Regulation

- Market failures especially due to cost and pricing structures.
- Access to key/limited national resources
- Inability to appropriately internalise external costs
- Inherent information asymmetry

TRAI

- Scope (1997 Act)
  - Regulate only telecom services (specifically left out broadcast services)
  - Left out of regulating a key resource: Spectrum management
  - Recommendatory role (licensing)
- Scope (Amendment (2000))
  - Separation of a Telecom Dispute Settlement Appellate Tribunal
  - Regulate telecom services including broadcast services that are termed as telecom services.
  - Recommendatory role: Spectrum, standards
  - Function: Fix interconnect terms
  - Issues in the Power Sector

TRAI

- Review of Functioning
  - Had focused on tariff rather than on lowering entry barriers.
  - Could competitive bidding focused on tariffs be better?
  - Internal structure is technology oriented (basic (fixed), cellular, WLL (LM), convergent networks. Needs to move to functional (licensing, universal service obligations etc.) and possibly market (corporates, rural, urban or by service) oriented structures.
  - Autonomy

TRAI

- Review of Functioning
  - Consultation process has been established, however its quality can be improved (refer to TDSAT's pronouncement)
  - Should use its position to get data from the service providers
  - Decision making processes (Role of members?, FCC)
  - Extent of internal sharing of info with members?
  - Training programs for internal skill development

Review of Appellate Bodies

- Technical expertise
- Incumbent operator’s involvement
- Scope of Jurisdiction (wide vs narrow)
- Manning of chair and members
- Movement of people across agencies

TRAI (Scope)

- Broader Questions
  - Interface to Competition Act
    - Includes disputes between licensor and licensee. Role of Tribunal in competition issues precluded
    - But what is not a ***competition issue?***
    - Option: Concurrent Regulator (Oftel and competition commission)
    - Linkages with competition commission?

Framework for Assessing Regulatory Institutions and Instruments

- Autonomy
- Accountability
- Powers

Framework for Assessing Regulatory Institutions and Instruments

- Autonomy
  - Finances
  - Selection of chair and members
  - Internal staffing
  - Salary
  - Relationship with the government

Framework for Assessing Regulatory Institutions and Instruments

- Accountability
  - Transparency
  - External scrutiny
  - Audit
  - Appellate bodies
  - Removal process

Framework for Assessing Regulatory Institutions and Instruments

- Powers
  - Penal provisions for contravention of order
  - Penal provisions for contravention of directions
  - Offences by government departments
  - Power to make regulations

Thank You

Implications for Other Infrastructure Sectors

- Competitive Bidding
  – All Sectors
- Leveraging a Wider Base of Expertise (Foreign Players)
  – Road, Air, Ports
- Willingness to Restructure Contracts
  – Airports, Ports
- ITS -> IAS : Technical -> Generalist -> Open Professionals
  – *Railways*

Implications for Other Infrastructure Sectors

- Unbundling (Policy, Regulation, Operations)
  - Power, *Railways*, *Road*
  - True unbundling? Linkages of regulators with operators (Power, Telecom)
- Social Responsibility; Sourcing Funds from the Sector;
  - Road, *Air*, *Rail*
- Separation of Infrastructure and Services
  - Power, Road, Air, *Rail*
- Technology Neutral (?)
  - *Power*

TRAI (Scope)

- Standard Setting
  - From the DoT perspective specifying technology/ standards
  - Regulatory experience in standards
    - Failure of markets, role to grow the network
    - (FCC, ETSI, GSM, 3G).

TRAI

- Standard Setting
  - Specifying technology/ standards
  - Regulatory experience in standards
    - Failure of markets, role to grow the network
    - (FCC, ETSI, GSM, 3G).

TDSAT Scope

Adjudicate disputes between Licensor and Licensee, 2 or more service providers, Groups of consumers and Service Providers, directions/decision/order of TRAI

Recent Regulatory Outcomes

- Most TDSAT cases of cable/DTH
- Within telecom, BSNL vs TRAI
  - Issue of appointment of functionaries across BSNL, TRAI, TDASAT

Scope

- Licensing
- Pricing
- Service levels
- QOS
- Dispute resolution?

Going Forward

- Variety of licenses: Administrative (circles) vs business (nationwide, smaller areas)
- Assignability of licenses
- Lock in period (Swan-Etisalat)
- Introducing market competition is slow, messy, difficult to manage, but where present, better than privatization alone
- Network expansion and efficiency greater where adequate definition of property rights
- Regulatory Capture by state (3G)/private entities

Summary Points

- Jurisdiction
  - Sectoral vs Multi sectoral vs Asectoral
  - Centre vs State
  - Judicial vs Non Judicial
- New Act vs Amendment
- Creation of a New Institution vs Enhancing Powers of an Existing Institution
- Scope
  - Identification of areas to be regulated (TAMP, AERA (traffic throughput of 1.5 mn))

Prime Ministers

No	Name	Entered Office	Left Office	Political Party
1	Chandra Shekhar	10-Nov-90	21-Jun-91	Samajwadi Janata Party
2	P. V. Narasimha Rao	21-Jun-91	16-May-96	Indian National Congress
3	Atal Bihari Vajpayee	16-May-96	1-Jun-96	Bharatiya Janata Party
4	H. D. Deve Gowda	1-Jun-96	21-Apr-97	Janata Dal
5	Inder Kumar Gujral	21-Apr-97	19-Mar-98	Janata Dal
6	Atal Bihari Vajpayee	19-Mar-98	22-May-04	Bharatiya Janata Party
7	Dr. Manmohan Singh	22-May-04	Incumbent	Indian National Congress

Current Regulatory and Policy Issues

- Issue of number of players (license conditions, amount of spectrum, whether wireless or wire line)
- Spectrum allocation: Bundled with service license, minimum initial quantum allocated, conditional additional spectrum available, subscriber linked criterion
- Substantial equity of an entity in more than one license in a service area
- “Dual technology” under one license, one service area

Current Regulatory and Policy Issues

- Pressure on Spectrum
  - Spectrum pricing, allocation, refarming
  - Broadcast spectrum, Digital Dividend
- USO: Contributions, Disbursals
  - Separation of network and services
  - Contractual Obligations

Current Regulatory and Policy Issues

- M&A
  - Prior approval of DoT
    - Principles or guidelines over which DoT should exercise its discretion (uncertainty)
    - Issue of notification of public listed companies: disclosure guidelines through stock exchange
  - Level of Dominance
    - Relevant market share of merged entity will not be more than 40% (either subscribers or revenues (separately for wireline and wireless)
    - Power of approval to DoT vis-à-vis Competition commission (dual anti competition guidelines?)
    - Lock-in period: involved companies should have been in operation for 3 years
    - Merger of license limited to the same service area
    - Quantum of spectrum, remaining duration of license

Current Regulatory and Policy Issues

- Cable/DTH (Information infrastructure)
  - State of infrastructure
  - Possibilities of different services (Convergence of Services)
- Local Loop (Pressure from ISP to unbundle the local loop (DSL))

Market Structure *('000 crores)*

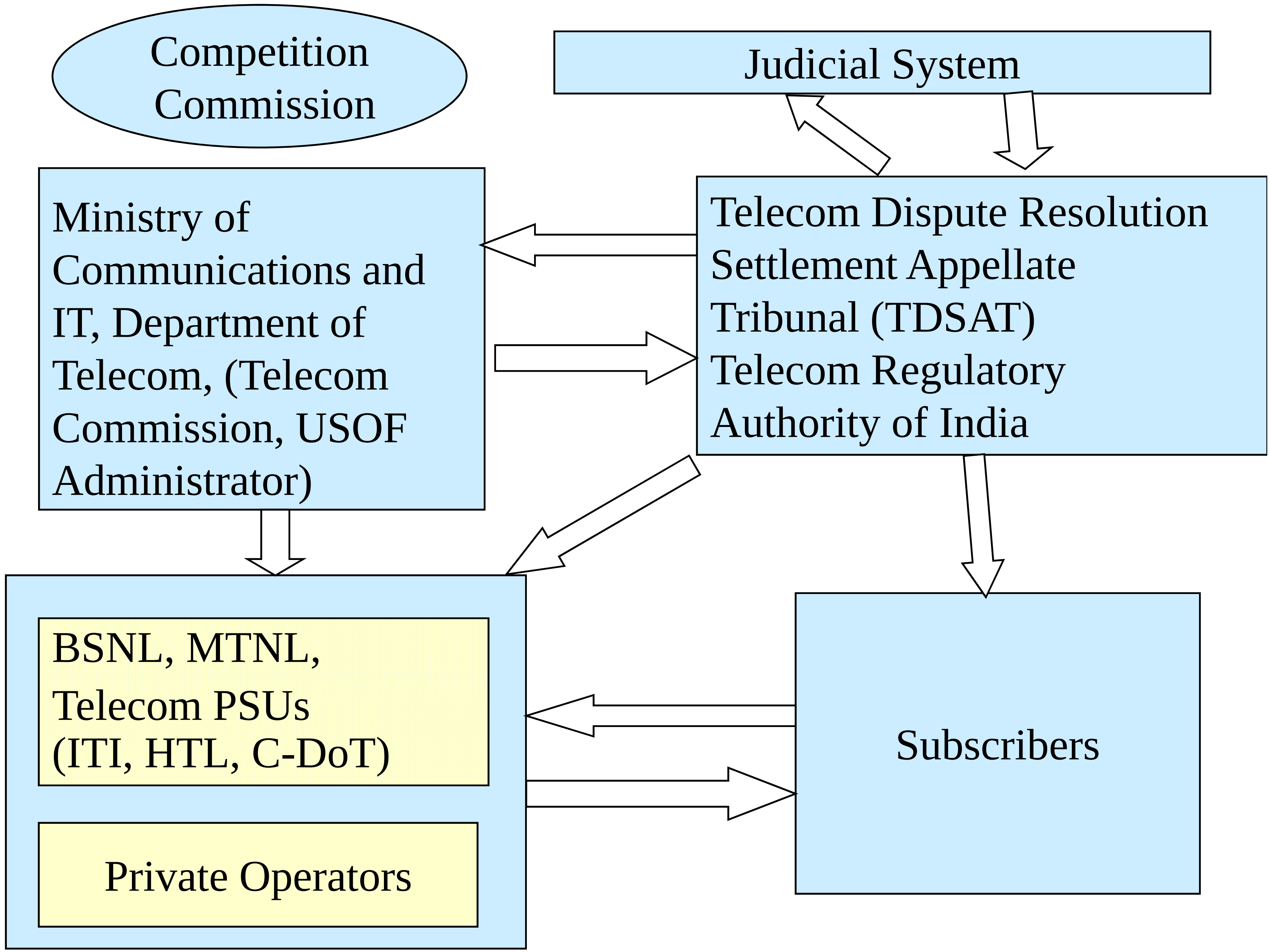
	02-03	03-04	04-05	05-06	06-07	07-08	%
Basic Services	25.9	33.0	32.6	34.2	30.2	26.7	20.4
Cellular Services	8.6	14.3	23.3	36.0	56.2	76.6	58.7
NLD	6.0	5.1	6.3	9.0	7.2	9.7	7.4
ILD	5.0	4.4	3.8	7.3	11.5	11.5	8.8
ISP	1.3	1.6	1.6	1.6	2.0	5.4	4.1
Others	0.3	0.4	0.5	0.5	0.6	0.6	0.5
Total	47.1	58.7	68.1	88.5	107.7	130.6	100.0

Top Telecom Service Providers

	Service Providers	Revenue ('000 crores)				Category
		04-05	05-06	06-07	07-08	
1	BSNL	33.5	39.0	41.2	35.3	Fixed , Cellular, ISP, NLD,ILD
2	Bharti Tele-Ventures	7.8	11.0	17.9	26.4	Fixed, Cellular, NLD,ILD,VSAT, ISP
3	Reliance Infocomm	5.4		14.5	18.6	Fixed, ILD, NLD
4	Vodafone Essar	4.4		10.6	15.5	Cellular
5	Tata Communications	3.4			8.4	Integrated
6	Idea Cellular	2.4		4.4	6.7	Cellular
7	MTNL	6.1		4.9	4.7	Fixed, Cellular

Types of Regulation

- Competition Regulation
  - Necessary to protect competitive environment, assessing anti competitive behavior, mergers
- Economic Regulation
  - Tariff regulation (monopoly prices?)
- Access Regulation
  - Bottleneck facilities
- Technical Regulation
  - Compliance with quality, safety, privacy, environmental standards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Ministry of Communications and IT, Department of Telecom, (Telecom Commission, USOF Administrator)
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BSNL, MTNL, Telecom PSUs (ITI, HTL, C-DoT)
Private Operators
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Industry Structure: Institutions Influencing Domestic Telecom Regulation

- International Telecommunication Union (ITU)
- Spectrum Harmonization
  - 2G-3G harmonization—Brazil
  - WiFi -- Unlicensed band

    -- Licensed bands

WTO : --Interconnection

--Significant market power

-- RIO –unbundling

- Federal Communications Commission: Accounting Rate
- European Union Directives

Why Regulate Telecom?

- Existence of multiple networks, which need to be connected, large incumbent networks
  - Growing base of mobile (emergence of new incumbents?)
- Some segments have large fixed costs and so should be considered natural monopolies
  - Technology innovations change the location of bottlenecks (Access networks, spectrum)
- Rural Areas, Designated entities
- Coordination for Spectrum
- Standards (GSM, CDMA)

Why Regulate Telecom

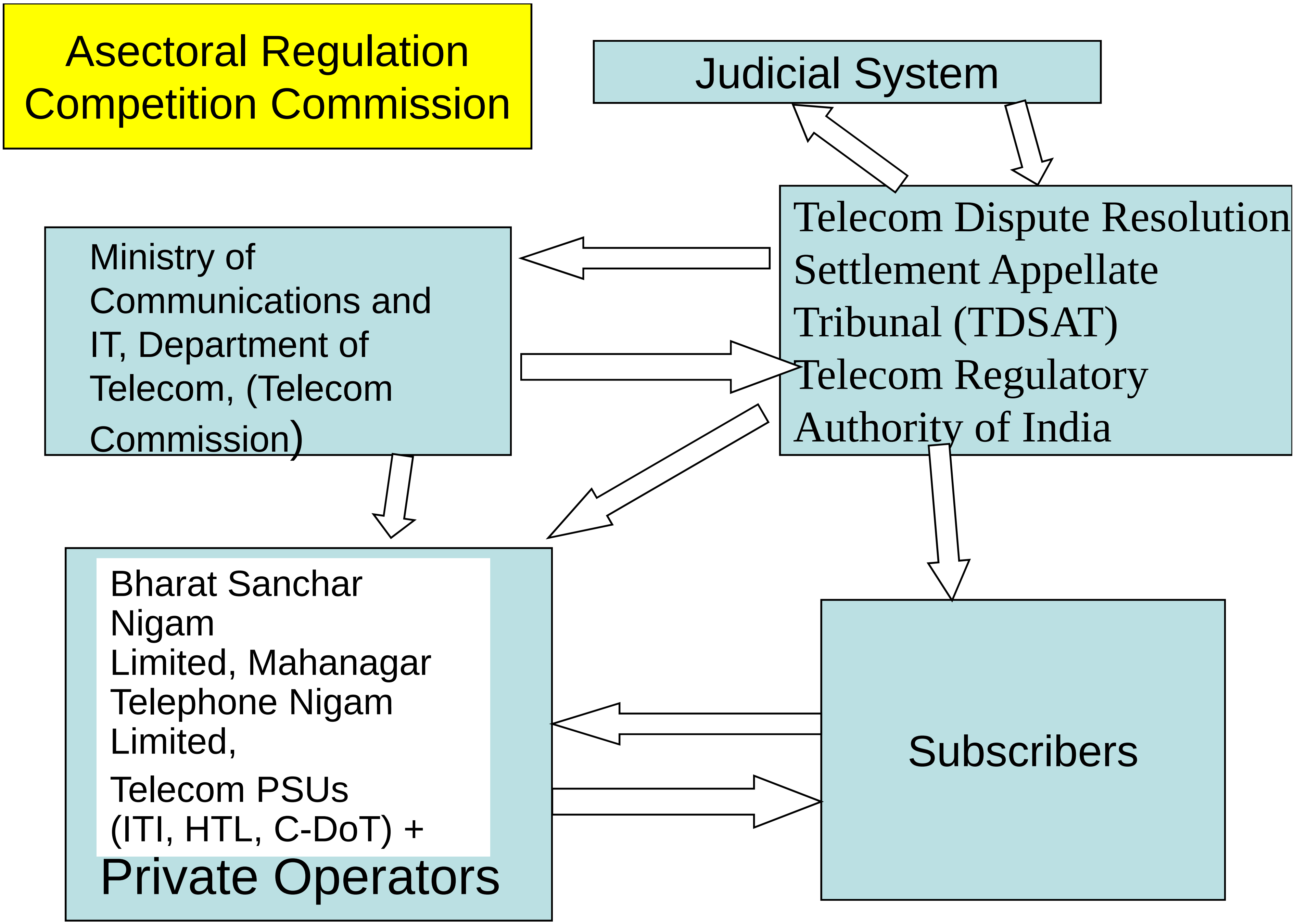
- Interface to Competition authority: Regulation seeks to create an environment in which market forces can control market power.
  Competition law—remedy for abuse of power
- Tariff (Rebalancing): Impact on incumbents, market opportunities for new entrants
- Quality of Service
- Licensing
- Bottleneck facilities
  - Interconnection
  - Access Network (unbundling local loop)

- De-licensing of Generation except Hydropower
- No license for Dedicated lines & Distribution in Rural Areas
- Transmission Open Access
- Distribution Open Access in Phased Manner
- Transparency & Competition in procurement of services
- Encouragement to Captive Power Plant including Group Captives
- Trading of Power –a distinct activity
- Focus on Renewable Sector –Minimum Purchase Obligation
- Institutional Framework –Independent Regulators
- Appellate Tribunal Operational since July 2005Enabling Framework for Investors –Electricity Act 2003

- Competitive Bidding in Generation 19thJan05
- National Electricity Policy 12thFeb05
- Tariff Policy for Power Procurement 6thJan 06
- Guidelines for Competition in Transmission 17thApr 06
- National Environment Policy18thMay 06
- Rural Electrification Policy23rdAug 06
- New EIA Notification14thSep 06
- Guidelines for Coal Allocation3rdNov 06Key Milestones

Going Forward

- Issue of ‘Regulatory Discipline’/Turf wars
- Multinationals and new economy firms (asking for better service)
- State owned entities (unions and politicians, who may be supported by domestic businesses)
- Role of Institutions (agencies that participate) in management of Change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Bharat Sanchar Nigam Limited, Mahanagar Telephone Nigam Limited,
Telecom PSUs (ITI, HTL, C-DoT) +
Private Operators
Subscribers

Approach to Regulation

- Only competition authority
- Separate competition issues from sector specific issues
- Concurrent jurisdiction
- Only sector regulator

Enabling Framework for Investors –Electricity Act 2003

- De-licensing of Generation except Hydropower
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System Operation Issues in Competitive Electricity Sector and International Experience

S.K. Soonee
Chief Executive Officer
Power System Operation Corporation (POSOCO)
(Wholly owned by Power Grid Corporation of India Ltd.)

Resources

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  - http://siteresources.worldbank.org/INTENERGY/Resources/transmissions.pdf
- Governance Structures for an Independent System Operator (ISO) by William W. Hogan, et.al., Background Paper, Harvard Electricity Policy Group, Harvard University, June 1996
  - http://www.hks.harvard.edu/fs/whogan/iso0696.pdf
- Governance and Regulation of Power Pools and System Operators An International Comparison by James Barker Jr., Bernard Tenenbaum and Fiona Woolf, September 1997
  - http://www.stoft.com/metaPage/lib/Barker-T-W-1997-ISO-Governance.pdf

Power Sector Reforms

- Reforms
  - Hard Side – Technical Issues, Economic Issues
  - Soft Side – Institutions
- Successful reforms need
  - Good Engineering
  - Good Economics
  - Good Institutions
- System Operation
  - Last true monopoly of the power sector
  - Critical to any power sector reform process
  - System Operators to act as “Impartial Policemen”

Institutionalizing Change

- Success of power sector reforms
  - Threat:
    - Getting stuck with a set of grid or market rules that are flawed or incomplete
  - Challenge:
    - Create a system that ensures efficient rule changes even though the system may suffer from “change fatigue” and one or more private participants are strongly opposed to such changes
- Feasible alternative
  - Establish a market surveillance group of independent outside experts to “institutionalize change”
    - Experts must be perceived as independent and objective
    - Must have a broad mandate
    - Make regularly scheduled visits
    - Present analysis and recommendations in a timely and public manner

Governance

- Governance refers to how decisions are made and implemented within an organization.
- Key Issues:
  - What decisions are made?
  - Who makes them?
  - How are decisions enforced?
  - How are disputes resolved?

"The challenge is to design a governance system that lubricates day to day operation, facilitates constructive capital investment and channels political energy in a constructive way."

Goals For Effective Governance System

- The pool and system operator is not controlled by any single market participant or class of market participants (independence).
- The market is fair (i.e., non-discriminatory access) and efficient.
- The grid achieves targeted reliability levels.
- The decision-making process is transparent.
- The pool and operating rules can be changed in a reasonable period of time.
- The cost of governance is minimized

"The truth is rarely simple and never pure."   Oscar Wilde

Why & How of Independence

- Actions independent of all market participants in *Word, Deed and Appearance*
- Non discriminatory nature
- Ownership restrictions – two way
  - SO cannot have financial interest in market participants
  - Market participants cannot have financial interest in SO
- Governing Board of System Operators
  - Stakeholder / Non-Stakeholder
- Key to good governance
  - Composition, Size, Voting Rules

Independence & Accountability

- Independence from market participants
- Definition of market participant
- Independence from political authorities
- Number of members on the Board
- Conflict of interest provisions for Board Members and employees
- To whom the Board is accountable (Regulator, Advisory Committees, Govt.)
- Market monitor
  - Does it report to the Board or the same Govt. body as the Regulator
  - Can it review decisions of the System Operator Board
- Code of conduct for the Board Members

Board Selection

- Who selects?
- Self renewing Board?
- Professional and/or educational requirements
- Do Board members serve staggered terms?
- Should there be one or two candidates for each Board position?

Fiduciary Responsibility

- Is the Board responsible to market participants, the government, the general "public interest" or the TSO itself as an organization?
- What interests should the Board be promoting and advancing—the general public interest (e.g., open access, competition and reliability), the interests of market participants or the interests of the TSO as an organization?
- What are the legal liabilities of individual Board members?
- What are the liabilities of the board as a whole?
- How much time are Board members required to devote to the Board?

Functions of the Board

- Is the Board responsible for:
  - Filing transmission tariffs and market design rules before the regulatory commission?
  - Operating a market and meeting established reliability standards
  - Oversight and hiring of the TSO senior staff?
  - Review and approval of the budget?
  - Market monitoring?
- What matters go to the Board?
- What is the Board's relationship with management?

Relationship with Stakeholders

- Are there one or more committees of market participants?
- Are the committees advisory in nature or do they share some decision making authority with the Board?
- Who is eligible to participant on these committees? How are committee members selected?
- Do Board members serve on one or more of the advisory committees?
- Are there both formal and informal channels of communication between the Board, the advisory committees and individual stakeholders?
- Are representatives from regulatory commissions or government ministries allowed to participate on these committees?

Experience in Other Industries (1)

- Cooperative Self Governance
  - Relatively common interests among the members
  - Problems in case of divergent interests
  - Costs of collective decision making
    - Inefficient decisions
    - Cost of decision making process itself
- Electricity Markets
  - Heterogeneous interests
  - Large number of players
  - Natural caution
    - Ability of voluntary negotiation to resolve complex issues
    - Success of cooperative management without some public oversight

Experience in Other Industries (2)

- Interstate Compacts
  - Used to coordinate cross-state management
    - Bridges, water rights, criminal corrections, etc.
  - Requires high level of agreement between affected states, difficult to negotiate
  - Mandate
    - Precise – for limited responsibility
    - General – Commit states to very little
- Energy sector
  - Generally defined responsibility
  - Commit states to discuss regional cooperation

Experience in Other Industries (3)

- Automated Teller Machine (ATM) Networks
  - Shared of networks
    - Proprietary
    - Non-proprietary
  - Agreement between members
  - Set of operating rules
  - Accept each other member's cards for a network set fee
  - Network operator does not issue cards, own or operate ATMs
  - Members are not prohibited from entering into Bilateral arrangements

ISO Governance - Issues

- *Should the ISO be governed by a public or private entity?*
- *If governed by a private entity, should it be administered as a for profit or not for profit?*
- *If governed by a board or committee, who should be on that board? Who should have voting rights? What should be the voting structure?*
- *How can the need for expertise in ISO governance be balanced against the need to ensure that the ISO does not discriminate in its operations?*
- *Will those entities with special responsibilities for reliability or an obligation to serve enjoy any preferred standing in decision making?*

Who decides? When? How?

Legal Structures for ISOs – Options (1)

- Not for profit
  - Insulation from competitive pressures
  - May not protect electricity markets from unfair competition
  - Large no. of representatives with diverse interests could cripple decision making process

Legal Structures for ISOs – Options (2)

- For profit
  - Possibilities
    - Run by a single transmission owner
    - Run by a consortium of transmission owners
  - May be subject to intermittent competition
  - Market position contestable
  - Unlikely to be able to extract monopoly rents

Legal Structures for ISOs – Options (3)

- Regional Public Governance
  - Appropriate where jurisdiction extends across several states
  - State Govts role in oversight of functions which affect their well being (electricity delivery)
  - Allow federal oversight of transmission system

Basic Governance Models

Four basic decision-making models of power pool governance.

Model 1. A Multi-Class Stakeholder Board

Model 2. A Non-Stakeholder Board

Model 3. A Single Class Board

Model 4. A Single For-Profit Corporation
Not Affiliated With Market Participants

Model 1. A Multi-Class Stakeholder Board

- Club or legislative approach to governance
- most or all classes of users and owners are represented on the governing board.
- designed for collective, self-governance by all
- Collective governance
  - through voting allocations and rules
- "independence by diffusion,"
- fail to achieve independence if one company or one class has the voting power to block actions that everyone else supports

Model 2. A Non-Stakeholder Board

- Board members are explicitly prohibited from having current or future financial interests in any market participants.
- Goal to create a board that will represent the broader “public interest,” not the commercial interests of any particular market participant.
- Experienced and Qualified Board Members
- Principal danger
  - become isolated and politicized

Model 3. A Single Class Board

- **one class controls decision making**
- **Historic -old style tight power pools model**
- **Achieved through**
  - **limiting voting membership to a one class**
  - **committees dominated by one class**
  - **favored class to select “independent” board members who are not really independent**

Model 4. A Single For-Profit Corporation Not Affiliated With Market Participants

- Most power pools around the world are organized as non-profit associations or corporations owned or controlled by some or all market participants.
- Alternative
  - A single for-profit corporation not affiliated with any market participants
- Governance becomes an internal corporate matter
- Nord Pool comes closest to this approach.
- Nord Pool indirectly owned by the governments of Norway and Sweden
- Not a good example of the for-profit governance model because government policies are likely to affect corporate decisions directly

Operationalizing Independence

Box 2. Operationalizing Independence

1. The pool/system operator and its key employees should not have any financial interests in any of the market participants (generators, distributors, marketers, brokers and suppliers).

2. The pool/system operator should not have any financial interest in the market.

   - Should be indifferent as to whether pool prices are high or low. But it should have an incentive to keep the prices of ancillary services as low as possible. (The pool or system operator may not be totally indifferent to pool prices if they affect the cost of acquiring certain ancillary services, such as spinning reserves.)
   - Should have an incentive to minimize the spread between buy and sell offers.

3. The pool/system operator should not have any financial interests in the equipment used to provide its own services.

4. The voting of the pool/system operator's decision-making body should not be controlled by any single participant or class of participants. (Stakeholder boards)

5. The pool/system operator should have the power to enforce any rules that it establishes.

6 Decision making should be transparent.

Possible Signs of Market Power

- Significant and sustained departures of market clearing prices from estimates of long run and short run marginal costs
- Capacity withholding
- Unexpected low plant availability
- Sufficiently different bids by generators of similar technology
- Scheduling of transmission line maintenance during times of high pool prices
- High bid prices by generators that must run for reliability reasons
- New and unexpected congestion on transmission
- Opposition by one or more generator to transmission that would relieve congestion

Functional Unbundling

- Rules require
  - Separate accounts for grid operations
  - Separate management of grid operations
  - Restrictions on information flows between the grid operator and other divisions/affiliates of the parent organization
  - Provision of non-discriminatory transmission service to affiliated and non-affiliated grid users under a published transmission tariff
- Impediments
  - Conflict of interest with the normal incentives of any commercial enterprise
  - Estimation of available transmission capacity
  - Curtailments
- Enforcement of rules by the Regulator is difficult

Effective Market Surveillance (1)

- Market Surveillance by outside individuals or organizations with no financial ties to market participants
  - Individuals and organizations performing market surveillance activities should be protected from liabilities associated with the performance of these activities.
- The surveillance program should have two components:
  - an ongoing monitoring program and
  - investigation of specific complaints.
- The market monitor should have access to commercially sensitive information on the condition that confidentiality is maintained.
- The market monitor should have the authority to assess both market behavior and market structure.
- If there are independent board members, the market monitor should report to them and not to stakeholder members.

Effective Market Surveillance (2)

- If the market monitor finds a violation of pool rules or abuse of market power,
  - To recommend remedies to the governing board (e.g., fines, loss of trading privileges, referral to the regulator or referral to antitrust authorities).
- The regulator should automatically receive reports and recommendations of the market monitor.
- The regulator should have the authority to order the market monitor to perform specific studies.
- The regulator must approve the design and operation of the program.
- The pool should finance market monitoring but the regulator must approve the budget.

An Effective Regulatory Backstop (1)

- The regulator must have access to good information about the pool.
  - He should be aware of disagreements before they become formal disputes.
  - His knowledge of pool operations and disputes should not be limited to what is written in formal legal documents.
  - The regulator or his representatives should be able to attend all pool meetings as a non-voting observer.
- The regulator must have the authority to make changes in pool rules on his own initiative.
  - Need not wait for an appeal

An Effective Regulatory Backstop (2)

- When the regulator receives an appeal of a pool rule change,
  - Should not be limited to accepting or rejecting the proposed rule change.
  - Authority to modify the proposed rule if he thinks that it will improve the operation of the pool.
- The regulator should have the authority to raise an issue and propose a possible solution without being “conflicted out” (i.e., prohibited from making a final decision)
  - State government directives
- The decisions of the regulator should be appealable to a court of law.

Changing Meaning of Power Pools (1)

Old Style Pools	New Style Pools
Dispatch is typically based on audited or unaudited estimates of variable operating costs (i.e., cost based dispatch)	Dispatch is typically based on bid prices (i.e., bid price dispatch)
Often a closed club among vertically integrated power enterprises	Usually an open club among integrated and non-integrated power enterprises (generators, transmitters, marketers, suppliers and distributors)
Pool members are required to be self-sufficient suppliers through either ownership of generating units or long term power purchase agreements	Pool members with retail or franchise load responsibilities may or may not be required to be sulf-sufficient suppliers through ownership of generating units or long-term power purchase agreements

Changing Meaning of Power Pools (2)

Old Style Pools	New Style Pools
Initially, trading was a secondary concern. In most cases, the principal motivation was to provide emergency support and to share operating and installed reserves to achieve targeted reliability levels at lower cost	Trading is the primary concern. Initial motivation is to create a competitive generation market
Minimal incentives to trade because of assured recovery of fixed and variable costs from captive retail customers	Strong incentives to trade because generators are not guaranteed cost recovery and all enterprises are (often) required to buy and sell from the pool
Trading is for different products with different durations and degrees of firmness. Tradaing in capacity rights among pool members may take place outside of the pool agreement	Trading in the pool is usually for 1-4 products with a high degree of firmness. Non-pool trading is usually in financial hedging instruments that allow buyers and sellers to insure against price fluctuations
Transmission service is contractually available usually only for specified power sales. No generalized "Open Access"	Pool operation is accompanied by generalized “Open Access"

FERC’s Proposed Principles for ISOs (1)

- The ISO’s governance should be structured in a fair and non-discriminatory manner
- An ISO and its employees should have no financial interest in the economic performance of any power market participant. ISO should adopt and enforce strict conflict of interest standards
- An ISO should provide open access to the transmission system and all services under its control at non-pancaked rates pursuant to a single, unbundled, grid-wide tariff that applies to all eligible users in a non-discriminatory manner

FERC’s Proposed Principles for ISOs (2)

- An ISO should have the primary responsibility in ensuring short-term reliability of grid operations. Its role in this responsibility should be well-defined and comply with applicable standards set by NERC and the regional reliability council
- An ISO should have control over the operation of interconnected transmission facilities within its region
- An ISO should identify constraints on the system and be able to take operational actions to relieve those constraints within the trading rules established by the governing body. These rules should promote efficient trading

FERC's Proposed Principles for ISOs (3)

- The ISO should have appropriate incentives for efficient management and administration and should procure the services needed for such management and administration in an open competitive market
- An ISO's transmission and ancillary services pricing policies should promote the efficient use of and investment in generation, transmission, and consumption. An ISO or an RTG of which the ISO is a member should conduct such studies as may be necessary to identify operational problems or appropriate expansions
- An ISO should make transmission system information publicly available on a timely basis via an electronic information network consistent with the Commission's requirements.

FERC's Proposed Principles for ISOs (4)

- An ISO should develop mechanisms to coordinate with neighbouring control areas

- An ISO should establish an ADR process to resolve disputes in the first instance.

INTERNATIONAL PRACTICES

Models for Transmission & System Operation

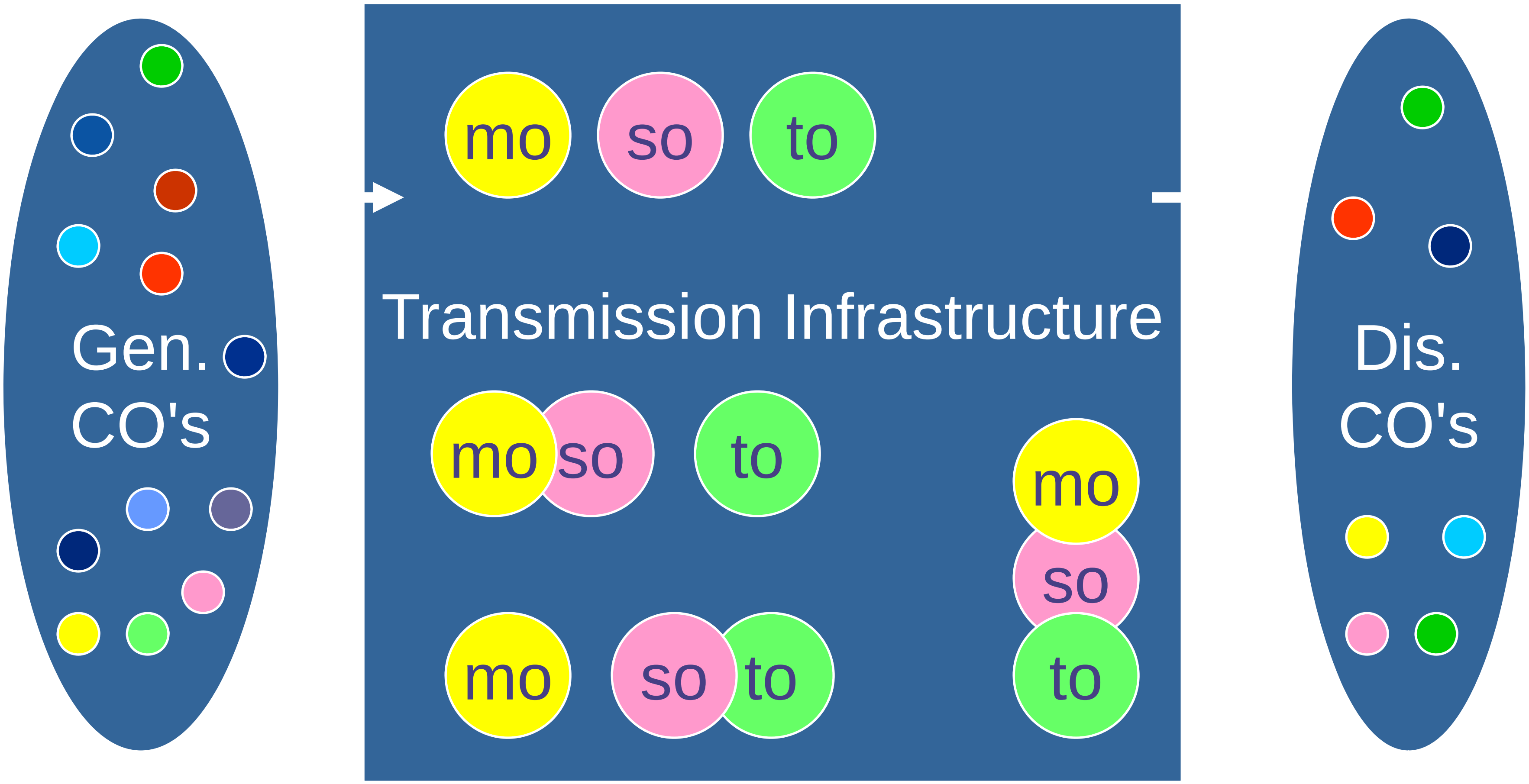
- TSO MODEL (Transmission System Operator)
  - The responsibility for development of transmission systems and operation of transmission systems remains with single entity.

- ISO MODEL (Independent System Operator)
  - System Operation function is independent of the function of transmission assets management

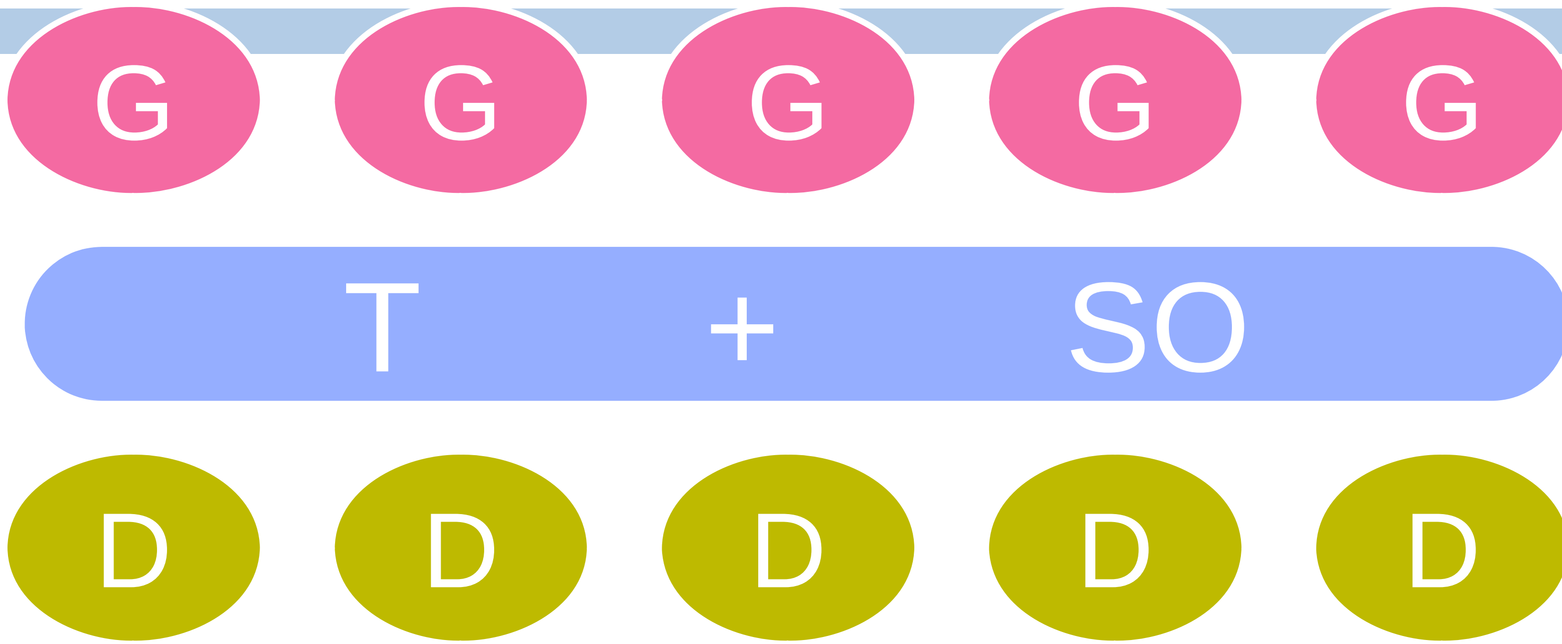
- Mix of TSO & ISO

- Transmission, Distribution & System Operation

Possible Models …

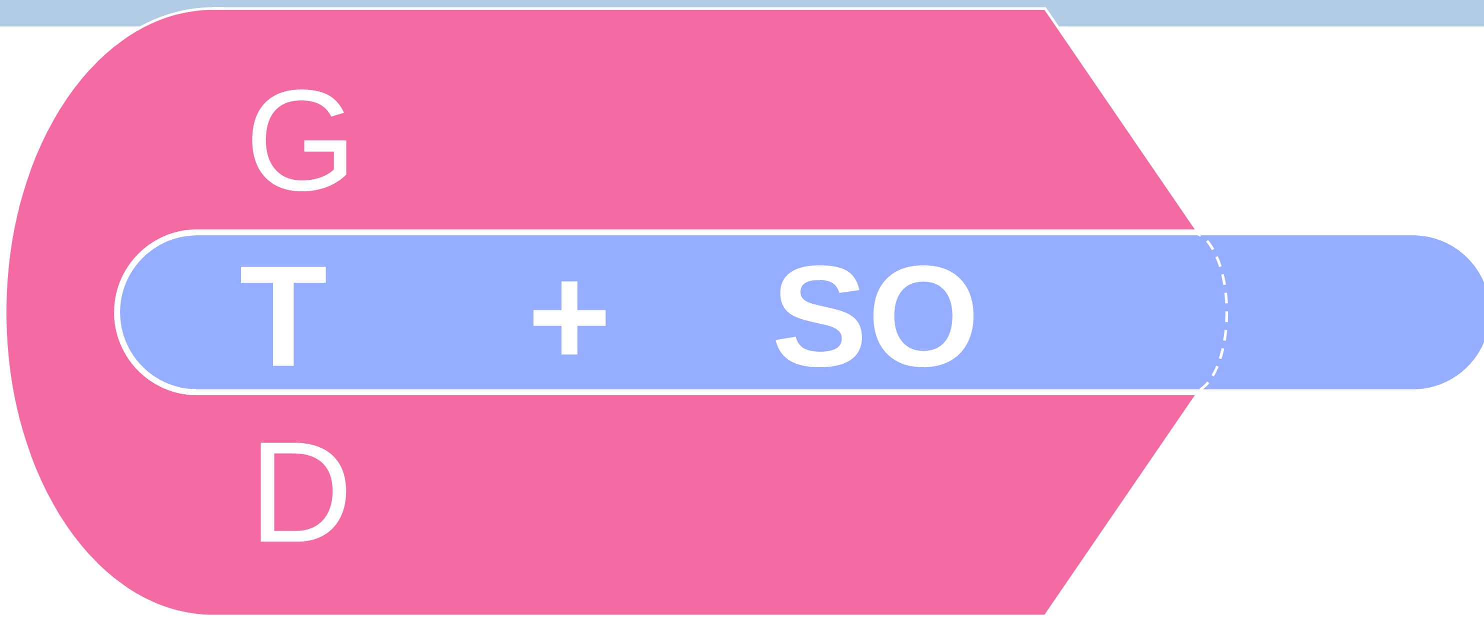


EUROPEAN & SOUTH AFRICAN MODEL



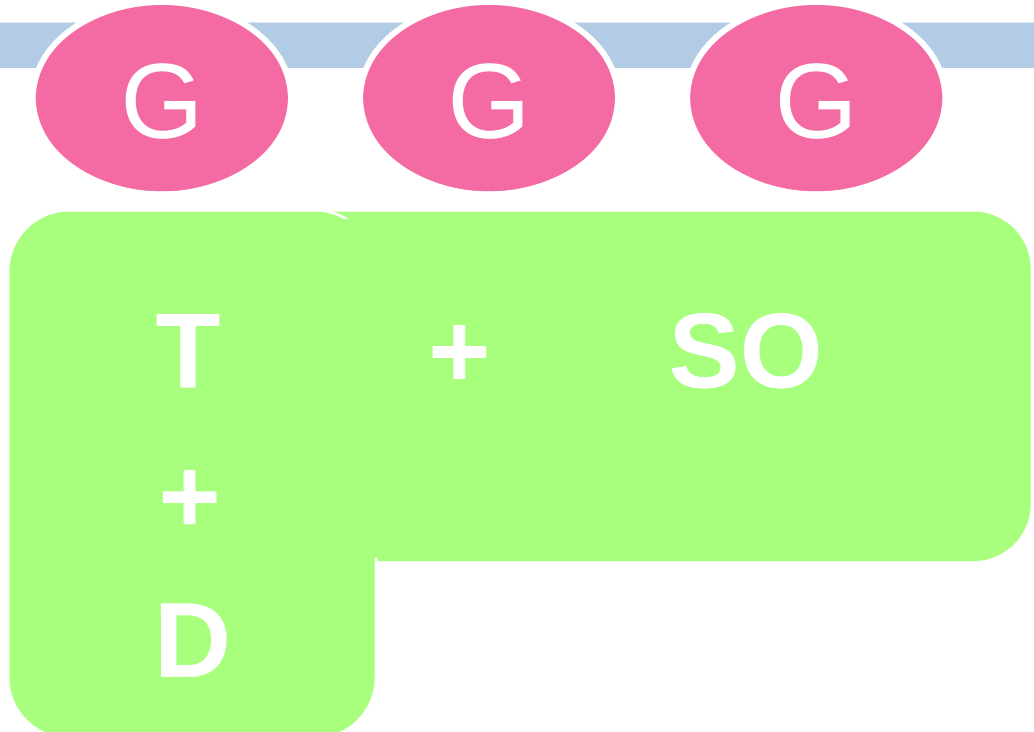
- This model is followed in UK by NGC, in Norway by Statenett, in Sweden by Svenska Kraftnet, in Finland by Fingrid, in Netherland by Tennet, in Denmark by Eltral/Elkrafts and in South Africa by Eskom.

FRENCH MODEL



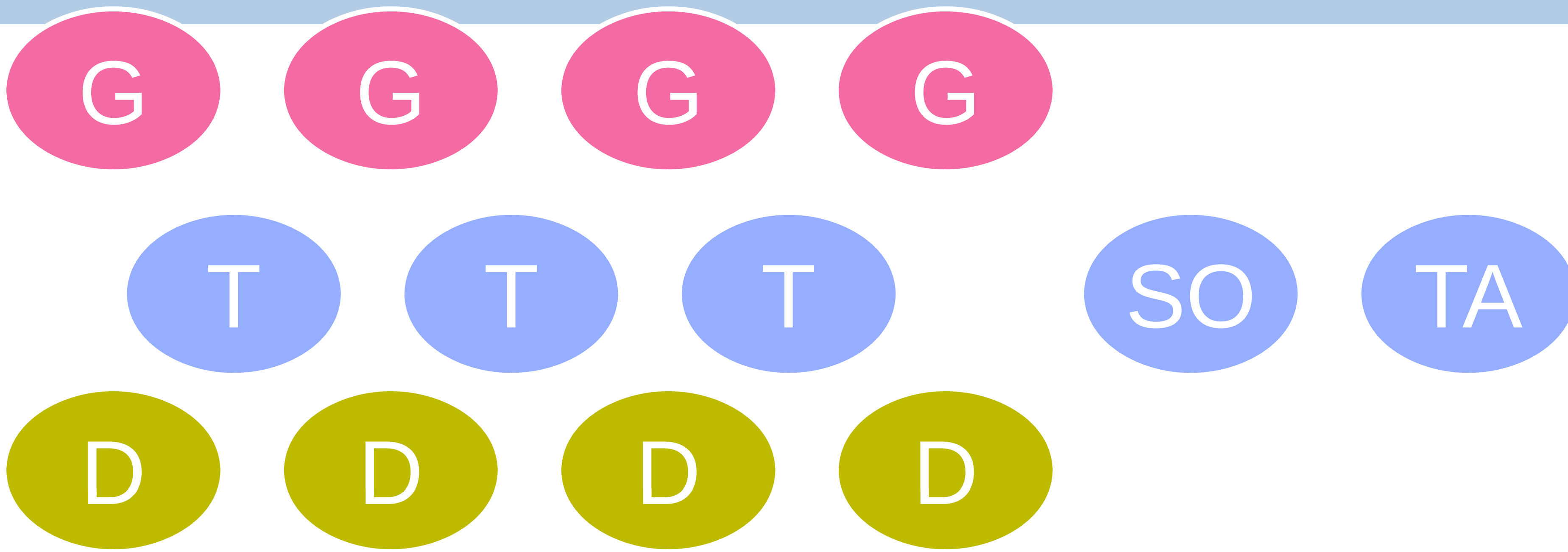
- This model is followed in France, wherein Transmission and System Operation functions have been delegated to RTE. EdF is responsible for the Generation and the Distribution.

MALAYSIAN AND KOREAN MODELS



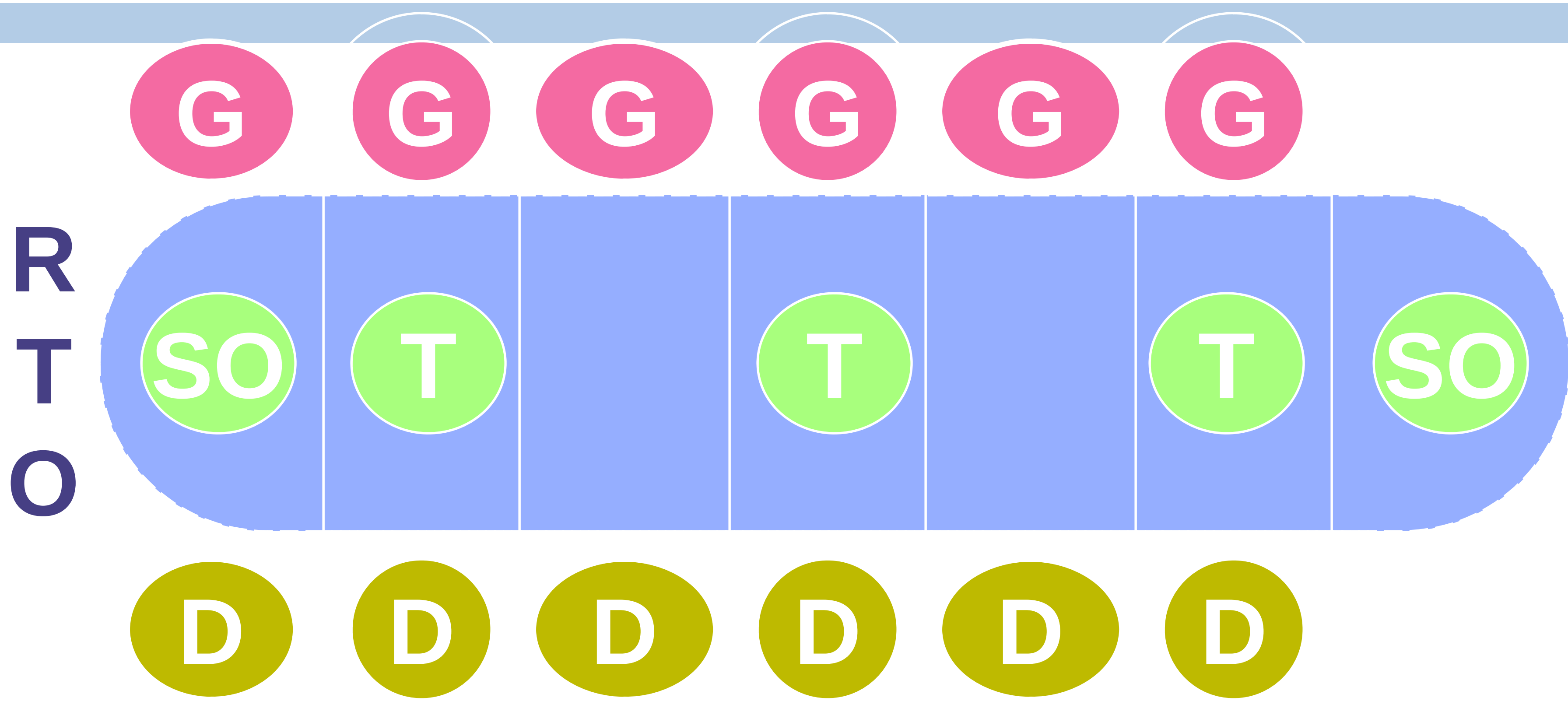
- This model is followed in Korea by KEPCO and in Malaysia by TNB. These entities are now in the process of separating the distribution function from Transmission & SO functions.

CANADIAN MODEL



- This model is followed in Alberta of Canada. In this model, since, there are more than one main transmission companies, an independent System Operator and Transmission Administrator exist.

AMERICAN MODEL: RTO / ISOs



- This model is followed in USA. Based on their California experience, USA is now moving towards TSO model through RTO.

RTO in the American Context

- Independent entity that controls and operates regional electric transmission grids free of any discriminatory practices
- Does not own transmission, generation or distribution assets
- FERC approval needed for initial organization / subsequent changes
- State Regulatory guidelines must be adhered to
- ISOs established by FERC Orders 888 & 889 in 1996
- RTOs established by FERC Order 2000 in 1999

RTO Structure

- RTO Members
  - Transmission Owners
  - Generation Owners
  - Load Serving Entities
  - Industrial & Commercial Consumers
  - Other Market traders / participants
- RTO Stakeholders
  - RTO Members
  - State Regulators / State Utility Commissions
  - Consumer Representatives
  - Media Representatives
  - Other Interested Parties

RTO Governance

- Board of Directors
  - Independent or member segments representatives
- Advisory Committee
- RTO principles, rules and regulations described by
  - FERC approved tariff
  - Transmission Owners agreeement
  - State Regulatory Authority rules
  - Other agreements
- NERC Guidelines

Electric Reliability Organization (ERO)

- Mandated by USA Electric Power Act of 2005
- Mandatory Reliability rules
- Performance criteria
- Audits
- NERC

RTO Roles and Responsibilities

- Ensure open access of transmission system
- Ensure reliability of the electric system
- Operation of competitive wholesale electric market
- Accounting and billing
- Ensure that no member has undue influence
- Supervise or perform transmission planning
- Coordinate transmission expansion
- Provide inclusive and transparent governance

RTO Functions

- Reliability Services
- Energy Market & Congestion Management
- Ancillary Services
- Transmission Rights Market
- Capacity Market (Resource Adequacy)
- Settlements and Billing
- Market Monitoring
- Regional Planning

Some examples ...

	England and Wales	Victoria (Australia)	Alberta (Canada)	Norway
Do generators own transmission facilities?	No	No	Yes	Minimal
Is the pool operator also the system operator?[1]	Yes	Yes	Yes	Yes through affiliate connections
Is the system operator also the grid owner?	Yes	No	No[2]	Yes
Does the system operator make and implement grid expansion decisions?	Yes	Yes	No	Yes
Does the pool operator have a monopoly on physical transactions?[3]	Yes	Yes	Yes	No

Table 3. Decision-Making Structure: Key Elements

	England and Wales	Victoria (Australia)	Alberta (Canada)	Norway &Sweden
Pool Name	Electricity Pool of England and Wales[1]	Victorian Power Exchange[2] (VPX)	Power Pool of Alberta[3]	Nord Pool ASA
Type of Entity	Unincorporated, non-profit private association	Non-profit, gov't owned corp.	Non-profit corp.	A for-profit company owned by the Norw. and Swed. gov't- owned grid companies (50/50).
Established	April 1, 1990	October 1994	January 1996	January 1993-Norway January 1996-Norway & Sweden
Number of Participants	55	20	35	120
Governing Board	Pool Executive Committee(PEC)	Pool Consultative Committee (PCC)	Power Pool Council (PPC)	Company board
Chairman	2-year term. Salaried. No vote Selected by all members.	Selected by gov't appointed Board of Directors	Elected by PPC 2-year term	1-year term. Rotated between the Swed. and Norw. members
Composition of Governing Board	Generators = 5 Suppliers = 5 Total = 10	Chairman = 1 Generators = 3 Distributors = 1 Retailers/Cust = 3 Transmission Co = 1 Pool Mgr = 1 Sys Security Mgr = 1 Total = 11	Vert Integr Util =3 Distributors =4 Rural Elec Assoc =1 IPPs =1 Lrg Ind Customers =1 Minister's Appointments =0 Total =10	Norwegian owners =2 Swedish owners =2 Independents =4 Employees =1 Total =9
Role of Committees	Advises board. Some delegated authority, but PEC can review all actions.	Reports to PCC. PCC creates temporary committees to deal with specific issues.	6 standing committees that report to the PPC	8 member Mkt. Council Advises Board.

Table 3. Decision-Making Structure: Key Elements (Continued)

	England and Wales	Victoria (Australia)	Alberta (Canada)	Norway &Sweden
Board Voting Rules	Unweighted simple majority or 65% weighted votes.[4] Cap on weights to avoid dominance by large participants	Unweighted Voting (1 person, 1 vote) 9 of 11 votes	Unweighted voting (1 person, 1 vote) 75 % of the votes	Unweighted voting 5 out of 9
Voting Restrictions On Vert. Integrated Utilities	Yes	No vertically integrated enterprises	No	Not relevant
Single Class Veto	Yes	Yes	Yes unless govt expands membership	Not relevant
Differentiated Voting By Type of Issue	Yes—85% to change settlement adminis.	No	No	No
Mechanism for Changing Voting Alloc. & Voting Rules	Pre-established formula in the pooling and settlement agreement	Acceptance by regulator	Law, ministerial discretion or PPC decision	Internal board decision
Appeals	To members within 5 days To regulator within 10 days	Mandatory referral to regulator of resolutions that received 6, 7 or 8 votes if they have not been referred to VPX board	To the regulator after mandatory dispute resolution	Complaints can be taken to regulator.

Table 4. Powers of Regulator and Government

	England and Wales	Victoria (Australia)	Alberta (Canada)	Norway
Regulator	Director General of Electricity Supply	Office of the Regulator-General[1]	Alberta Energy and Utilities Board	Norwegian Water Resources and Energy Administration (NVE)[2]
Pool Rule Changes				
Must approve all proposed changes before they become effective even if no one appeals	Yes for most important rule changes	Yes if made as a "recommendation." No if made under "delegation."	No	Notified of proposed changes
Prerequisites for appeal/complaint to regulator	After a vote of all members	None	Must go through a mandatory dispute resolution process	None
Can unilaterally make changes	No. Can propose changes to Pool Executive Comm.	Yes	Yes	Yes
Regulators' decisions appealable	Yes to court[3]	Yes to court	Yes to court	Yes to Ministry of Industry & Energy
Board Composition				
Approves appointments	No, except for reserved seats for small generators & suppliers.	PCC (By Reg) No; Board. (By Gov't) Yes	No	Regulator--No Government--Yes
Makes appointments	Generally no	No; Yes	Gov't can make additional appts	Regulator--No Government--Yes
Can change voting rules & allocations	Voting rules—no Voting alloc.—yes	Yes; Yes	Voting rules—yes Voting alloc.—yes (through new appts.)	No

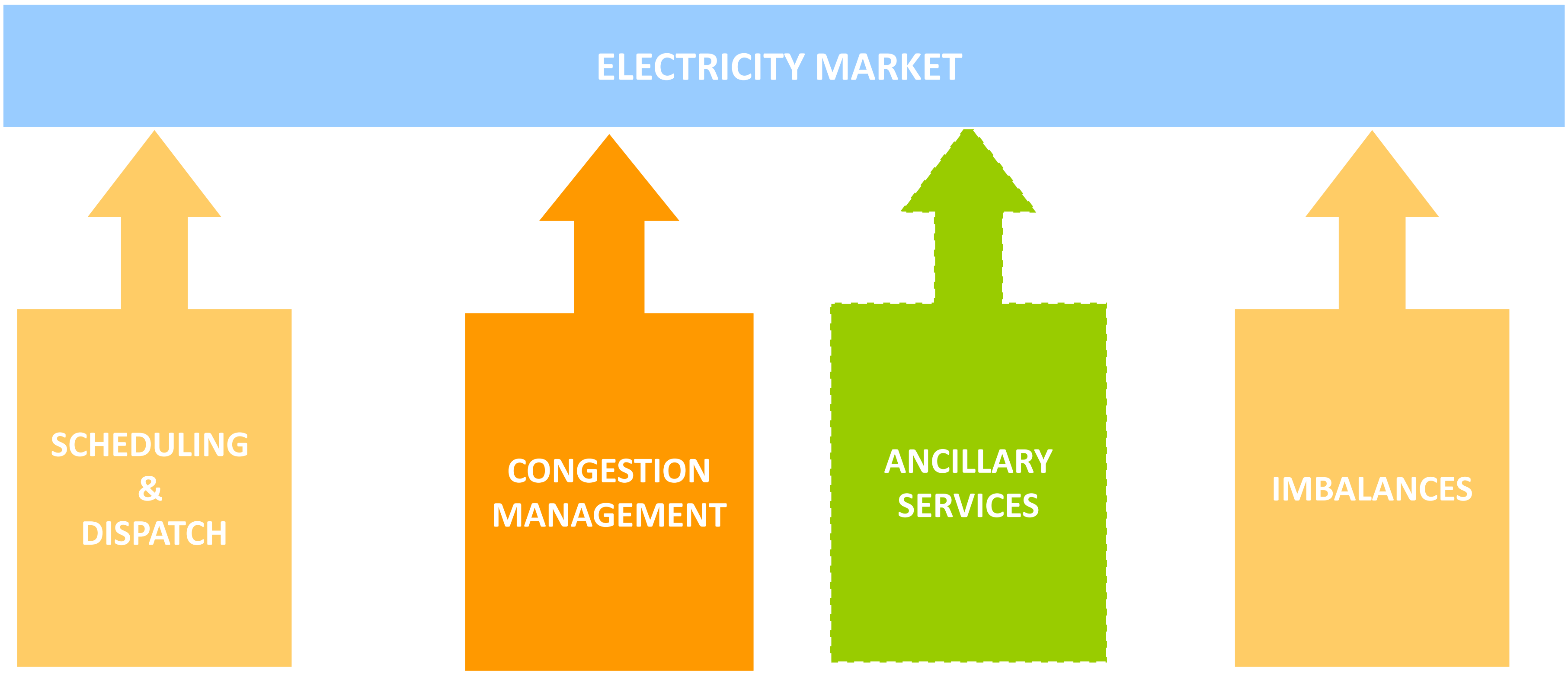
Table 4. Powers of Regulator and Government (Continued)

	England and Wales	Victoria (Australia)	Alberta (Canada)	Norway
Pool prices	Only indirectly under threat of referral to Monopolies & Mergers Commission	No	No but can be reviewed upon complaint	No but can refer to Competition Agency
		Market Surveillance		
Formal market surveillance group operated by regulator or pool	No	No but pool informally monitors market under delegated authority from regulator.	Yes, independent outside experts hired by pool. Reports to the PPC but analyses and recomm. will also go to regulator.	No
Regulator's access to information	Indirectly through grid operator's license & RECs economical purchasing obligation	Substantial	Considerable authority	Very substantial

Basic Market Design Issues for New Style Pools

Market Design

Four Pillars of Market Design



Market Design Issues for New Style Pools (1)

- What commodities (e.g., day ahead energy, regulating energy, futures contracts and ancillary services) are traded in the pool? Who is allowed to trade?
- Does the pool allow bidders to make their own unit commitment decisions (self-commit) or are the commitment decisions made by the pool (centralized commitments)?
- Does the pool have a monopoly on arranging and scheduling all transactions that produce physical flows within the region?
- Does the pool have a monopoly on imports and exports of power?
- Who guarantees physical delivery and financial settlement?
- Are pool members with customer load responsibility required to own or contract for a specified amount of generating capacity or operating reserves?

Market Design Issues for New Style Pools (2)

- **How is transmission service priced? Do transmission rates attempt to reflect congestion costs? Who pays for transmission costs?**

- **Who is responsible for scheduling maintenance of transmission lines? Are market participants informed of expected maintenance schedules?**

- **Who makes the decision on transmission investments? Is the decision centrally determined (top down)by the pool or system operator or is it made by one or more market participants (bottom up)?**

- **Is there a separate payment for generation capacity made available to the pool? How is this capacity payment established?**

- **Do generators bid a multi-part bid [$/MWh and separate prices for no-load fuel ($/hour) and start-up costs ($)] or a one part bid [$/MWh but which can include the generator's estimate of no load fuel and start-up costs]?**

Market Design Issues for New Style Pools (3)

- **Do generators bid a single price or a schedule of prices and quantities? Is there a single or multiple rounds of bidding? How many bidding blocks are allowed?**
- **How often are bidders allowed to vary the sizes of the bidding blocks?**
- **After submitting their initial bid(s), are generators allowed to change the price(s) and/or quantity(ies) bid (i.e., rebidding)?**
- **Must bidders submit bids by specific times or can bids be submitted on rolling basis?**
- **Are generators allowed to withdraw previously submitted bids?**
- **What determines when the bidding is closed?**
- **Are pool prices based on actual operation (ex post price setting) or anticipated operation (ex ante price setting)? Is there a single market clearing price or do prices vary by zones or nodes ?**

Market Design Issues for New Style Pools (4)

- Are there price caps on market prices? What triggers the price caps?
- What is the method for calculating market clearing price for each settlement period (e.g.,weighting of prices by amount of energy supplied or by time duration)?
- How does the pool pay generators that are “constrained on” or “constrained off”?
- What actions are taken against generators if they fail to follow dispatch instructions?
- How are ancillary or grid support services acquired and paid for? Is there competition for the provision of some of these services?
- Does the pool allow for demand side bidding?

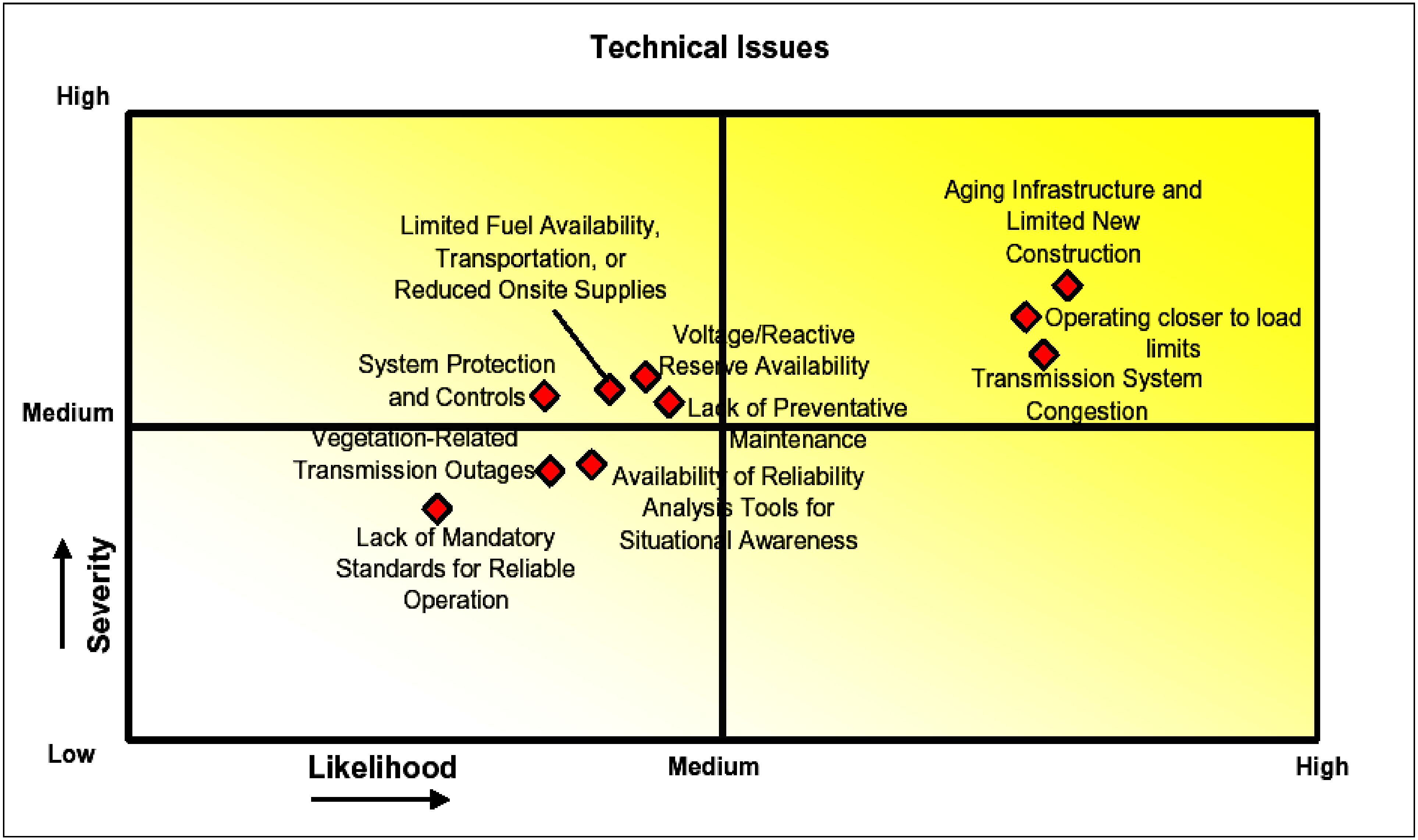
Market Design Issues for New Style Pools (5)

- **What fees are paid for pool and system operation? Who pays these fees?**
- **What actual or forecasted information is made available to pool participants?**
  - **For example, does the pool disseminate information on bid prices, market clearing prices, volume of trade, number of bidders and likely transmission constraints?**
- **Does the pool project peak demands,generation capacity availability, and expected load profiles?**
- **How often is this information disseminated?**
- **Is there market monitoring for inefficiencies and market power abuses? Who performs this function?**
- **What actions are taken to eliminate or control general or local market power?**

Market Design Issues for New Style Pools (6)

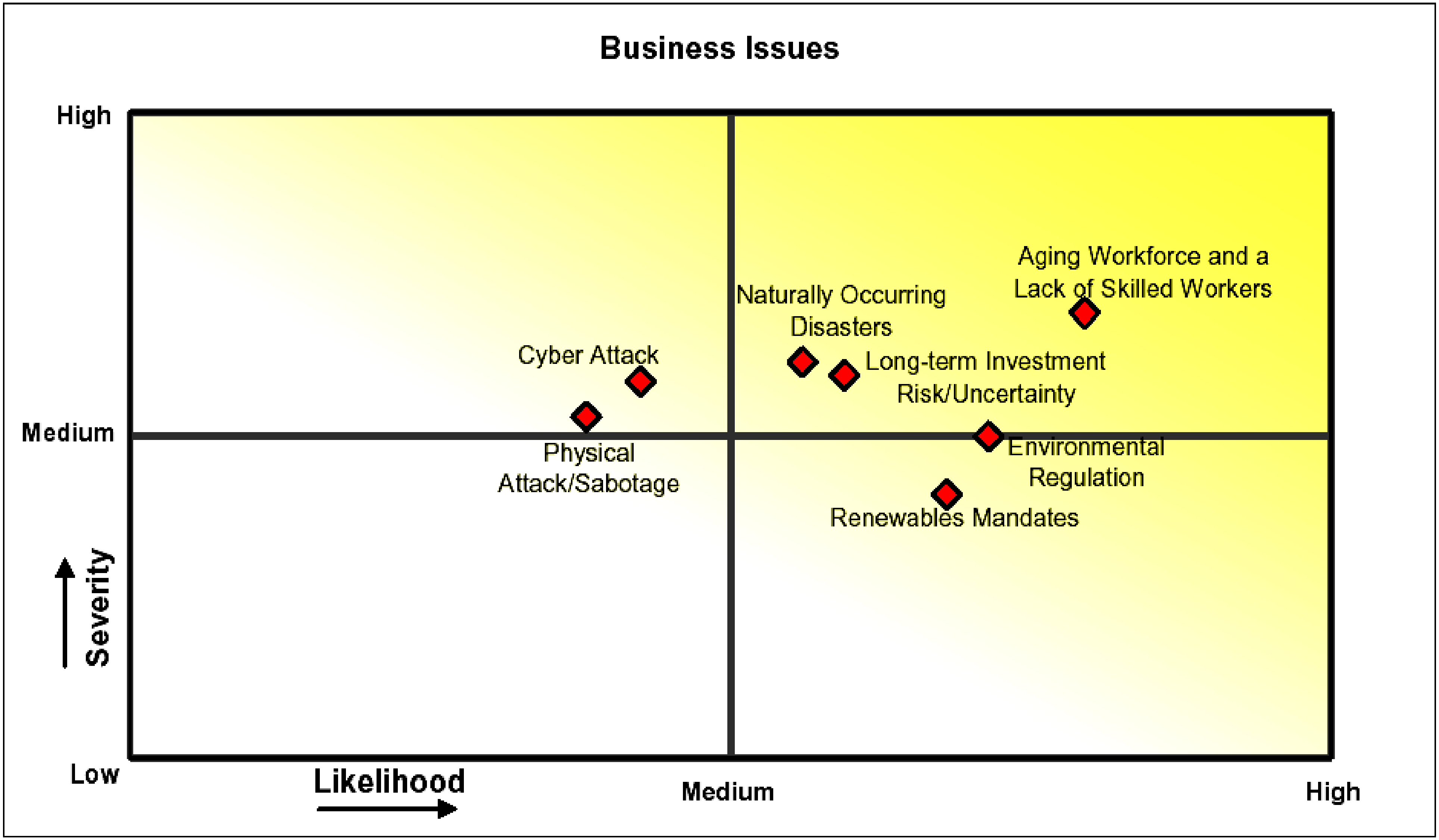
- **Is the pool operator subject to audits of its scheduling and dispatch decisions and its calculation of market prices?**
- **Who owns and maintains revenue meters and the associated data collection system?**
- **Does the pool have a legal obligation to ensure the availability of sufficient generating capacity?**
  - **If so, what actions can it take to fulfill this obligation? If the pool is not responsible for ensuring sufficient capacity, does any other entity have this obligation?**
- **Are there explicit penalties for failure to meet this responsibility?**

Power System Reliability: Technical Issues



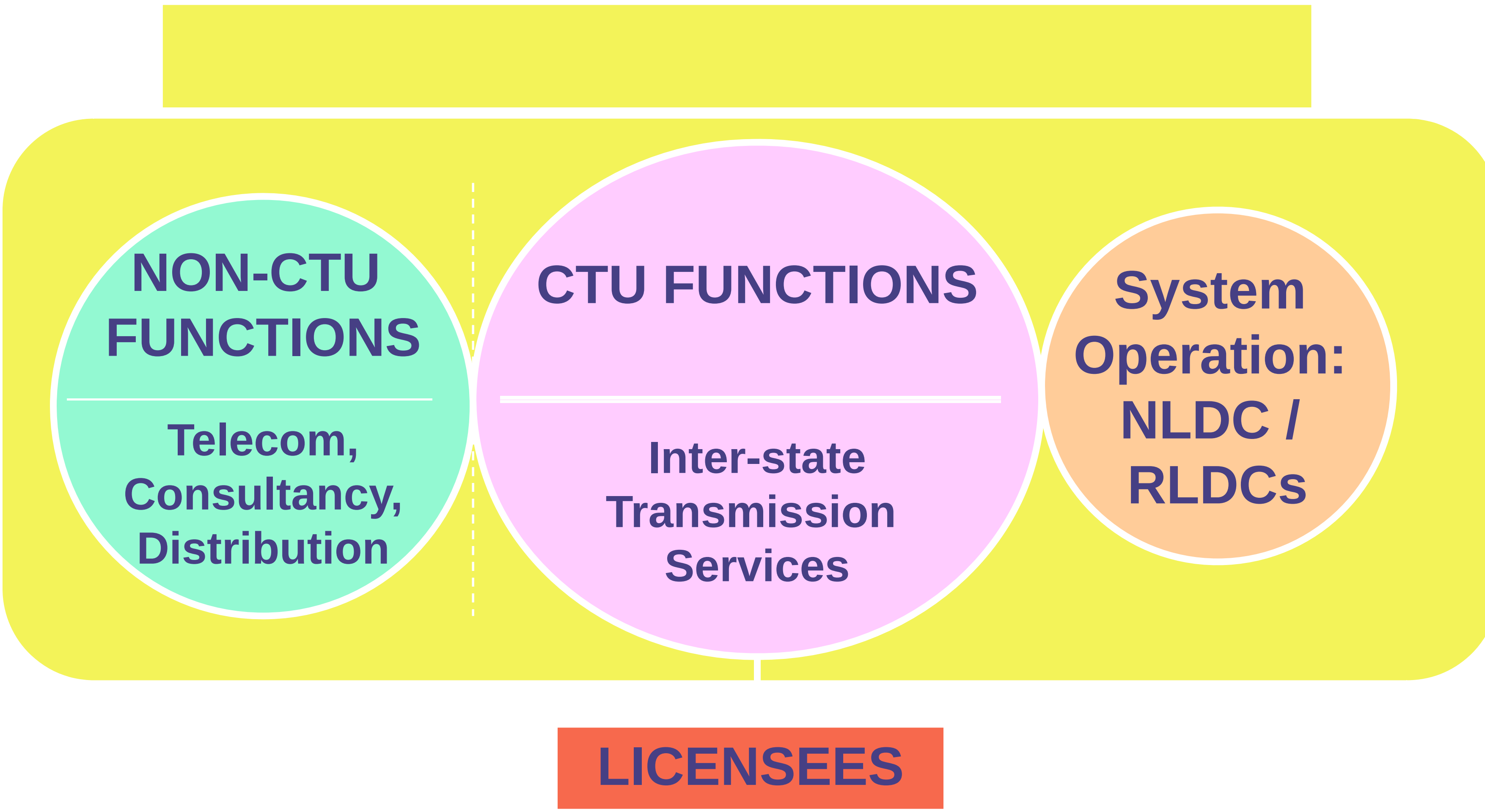
Source: 2007 Survey of Reliability Issues, NERC

Power System Reliability: Business Issues



Source: 2007 Survey of Reliability Issues, NERC

Indian Model



LEGAL FRAMEWORK

- Electricity Act 2003
- Subordinate Legislations
  - National Electricity Policy
  - National Tariff Policy
  - Standards (Metering, connectivity)
- Regulations By CERC/SERC
- Orders by ERCs
- Grid Code
- Procedures

EA 2003: Independence of LDCs by Design

- LDCs declared as apex organizations
- LDCs discharge statutory functions
- LDCs barred from trading
- RLDCs barred from generation
- CTU/STU barred from trading
- CTU barred from generation

Provisions for Grant Of Open Access

Electricity Act 2003:

- Section 38(2)(d): CTU
- Section 39(2)(d): STU
- Section 40(c): Transmission Licensees
- Section 42(2): Distribution Licensees

EA 2003: Roles of Agencies

Section	Deals With
38	Central Transmission Utility (CTU)
39	State Transmission Utility (STU)
40	Transmission Licensees
42	Distribution Licensees
52	Electricity Traders
61 – 64	Tariff Regulations
66	Development of Market
70	Central Electricity Authority
76	Central Electricity Regulatory Commission (CERC)
82	State Electricity Regulatory Commission (SERC)
83	Joint Commission
110	Appellate Tribunal for Electricity (ATE)

National Electricity Policy

- 5.3.7 The spirit of the provisions of the Act is to ensure independent system operation through NLDC, RLDCs and SLDCs. These dispatch centers, as per the provisions of the Act, are to be operated by a Government company or authority as notified by the appropriate Government. However, till such time these agencies/authorities are established the Act mandates that the CTU or STU, as the case may be, shall operate the RLDCs or SLDC. The arrangement of CTU operating the RLDCs would be reviewed by the Central Government based on experience of working with the existing arrangement …

- 5.3.9 … RLDCs and NLDC will have complete responsibility and commensurate authority for smooth operation of the grid irrespective of the ownership of the transmission system, be it under CPSUs, State Utility or private sector.

Committee by MOP

- Gireesh Pradhan Committee *on Manpower, Certification and Incentives for System Operation and Ring Fencing of Load Despatch Centers*

Demanding Job Requirements As System Operators

- Responsible for Secure and Reliable operation
- Increased complexity due to
  - Fast growth - Interconnection size
  - System inadequacies - Deployment of new technology
  - Diversity - Increased frequency of natural calamities
  - Number of Utilities
- Future challenges
  - Deployment of new technology
  - Wide Area Measurement - Intelligent grid
  - Distributed Generation - Renewable Energy
  - Sabotage - Cyber security
- Essential requirements
  - Technical know how - Experience
  - Situational Awareness - Precision
  - Response Time

Demanding Job Requirements As Market Operators

- Energy scheduling
- Open Access, Market Information System
- Metering, Energy Accounting, Settlement
- Pool account administration
- Market surveillance
- Increased complexity due to
  - Increased number of players, Freedom and choice
  - Evolving market mechanisms, regulations
  - Commercial consciousness and Time constrained activity

Recommendations: Pradhan Committee (1)

- Separate financial accounts for all LDCs specifying the fees and charges payable submitted and approved by 31st March 2009
- Capital Expenditure (CAPEX) plans for modernization of all LDCs during 2009-12 should be submitted and the approval of the respective ERC should be obtained by 31st March 2009.
- Introduction of a system of ‘certification’ of System Operators by an independent body such as the NPC/NPTI
- A ‘Forum of Load Despatch Centres’ with secretariat by National Load Despatch Centre

Recommendations: Pradhan Committee (2)

- Suitable compensation for certified system operators
- Distinct revenue streams regulated by appropriate Commission
  - Fees and Charges for System Operation
  - Tariff for decision support system and IT infrastructure (Currently ULDC tariff)
  - Operating charges for scheduling, metering, energy accounting and settlement
  - Payments by all generating companies and licensees using services of LDCs
  - Charges for value added services

Conclusion

"Engineers like to operate sophisticated power systems, economists like to think about optimal incentives, and lawyers like to write rules and agreements. Power sector reform brings all of them into close contact. But none of them can succeed at their chosen tasks unless they work together in designing sustainable institutions.

Thank You !!

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