



New utility business model:
Why regulation, policies & markets need to change

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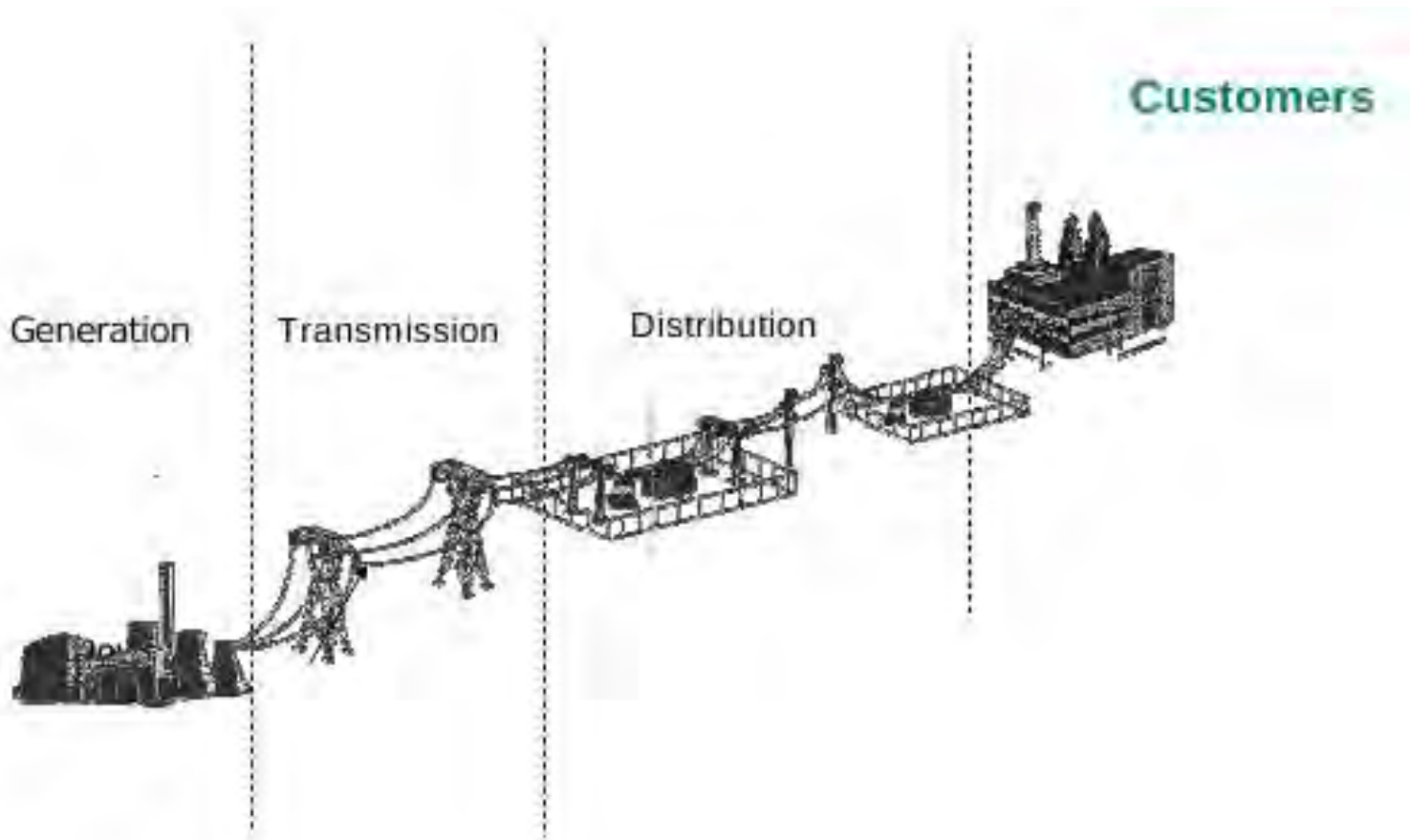
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In a nutshell

- ◆ Power sector undergoing major transformation
 - Rapid growth of renewables
 - Compounded with rapid rise of **distributed generation**
 - Massive investment in transmission
 - New role for distribution as consumers become prosumers
- ◆ Implications?
 - Traditional “utilities” challenged as revenues erode
 - Thermal generators squeezed in wholesale markets
 - T&D reconfigured to cope with added grid complexities
 - **New business model**

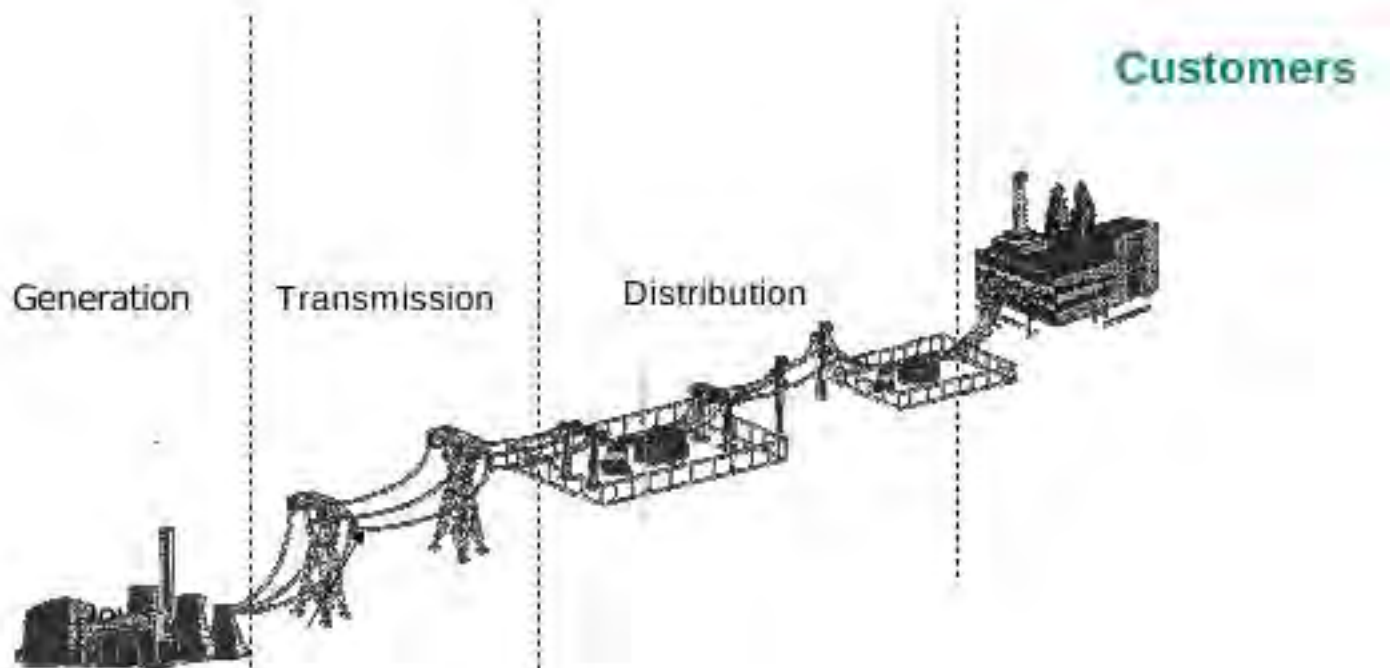
The way it was

Centralized, one-way, highly predictable & plain dull



Generation

Flooded with intermittent renewables at zero marginal cost

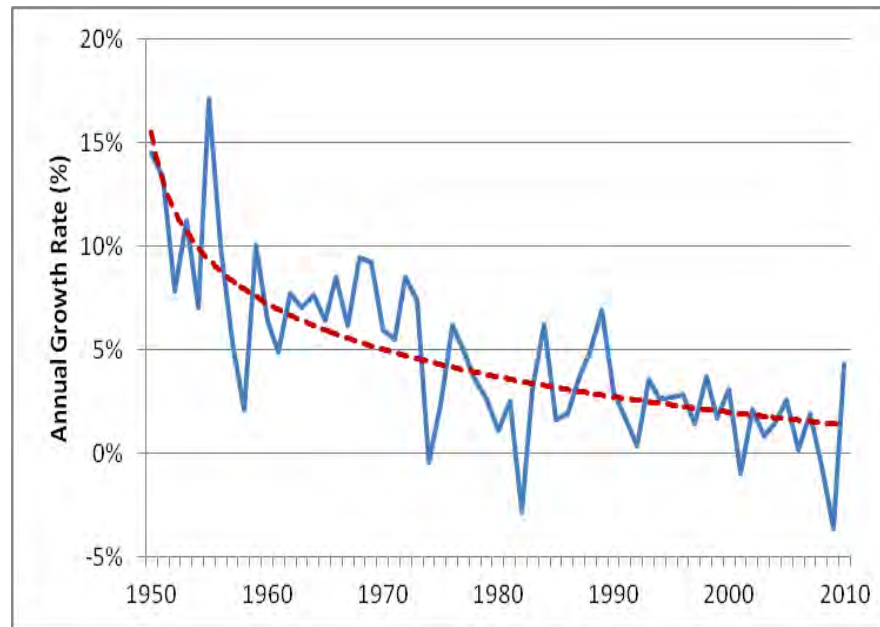


- ◆ Flat or falling demand
- ◆ Flat or falling wholesale prices
- ◆ => Not good for thermal generators

Electricity demand growth?

Pattern common to mature economies

United States 1950-2010



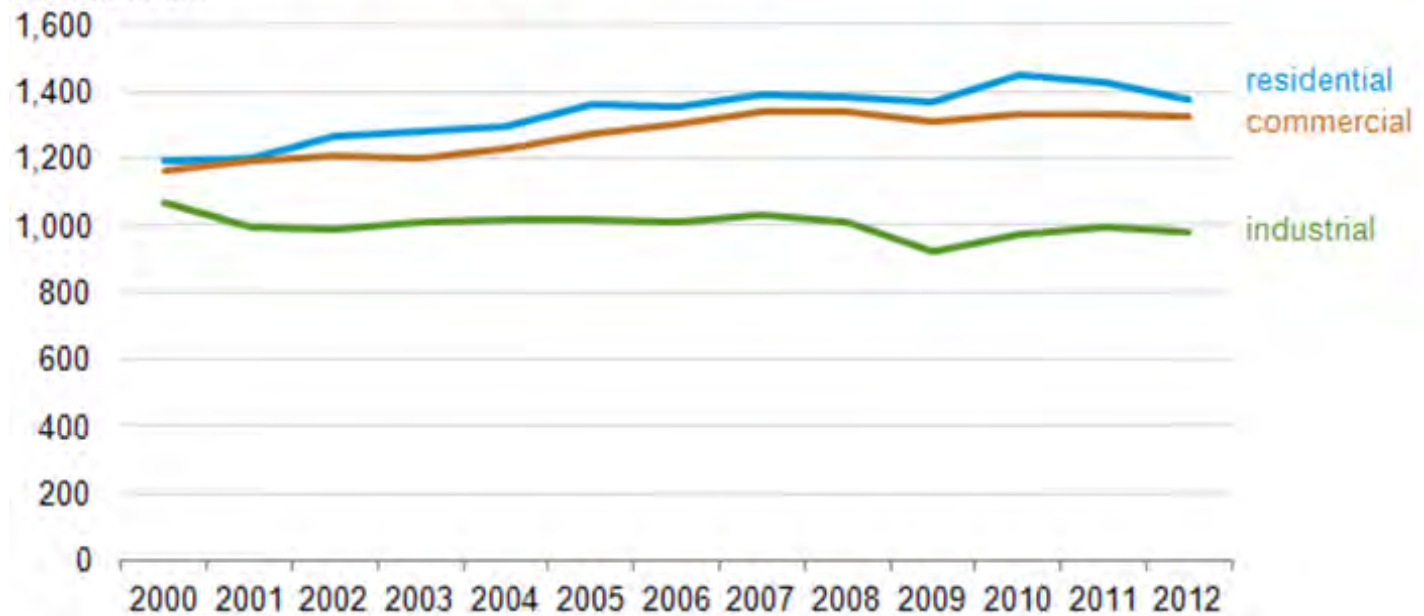
Source: US Energy Information Administration

Flat in all sectors in US

And no prospect for a rebound except in transportation

Annual retail electricity sales by sector (2000-12)

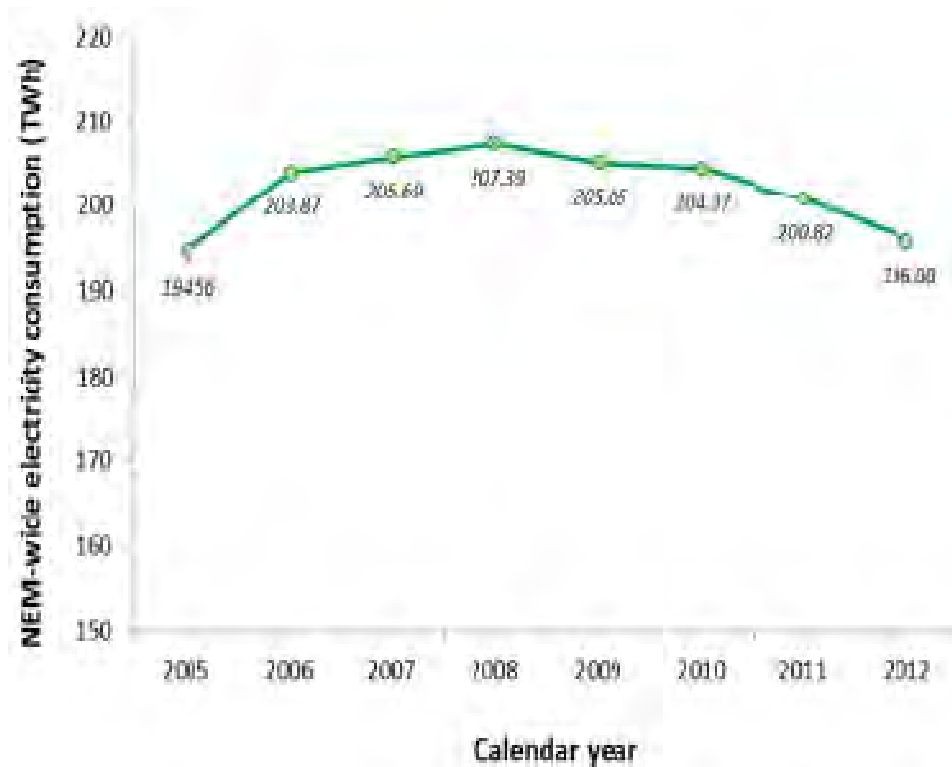
terawatthours



Source: Americans are buying less electricity. That's a big problem for utilities Brad Plumer, The Washington Post, 23 Dec 2013 based on data from EIA

Demand declining in Australia

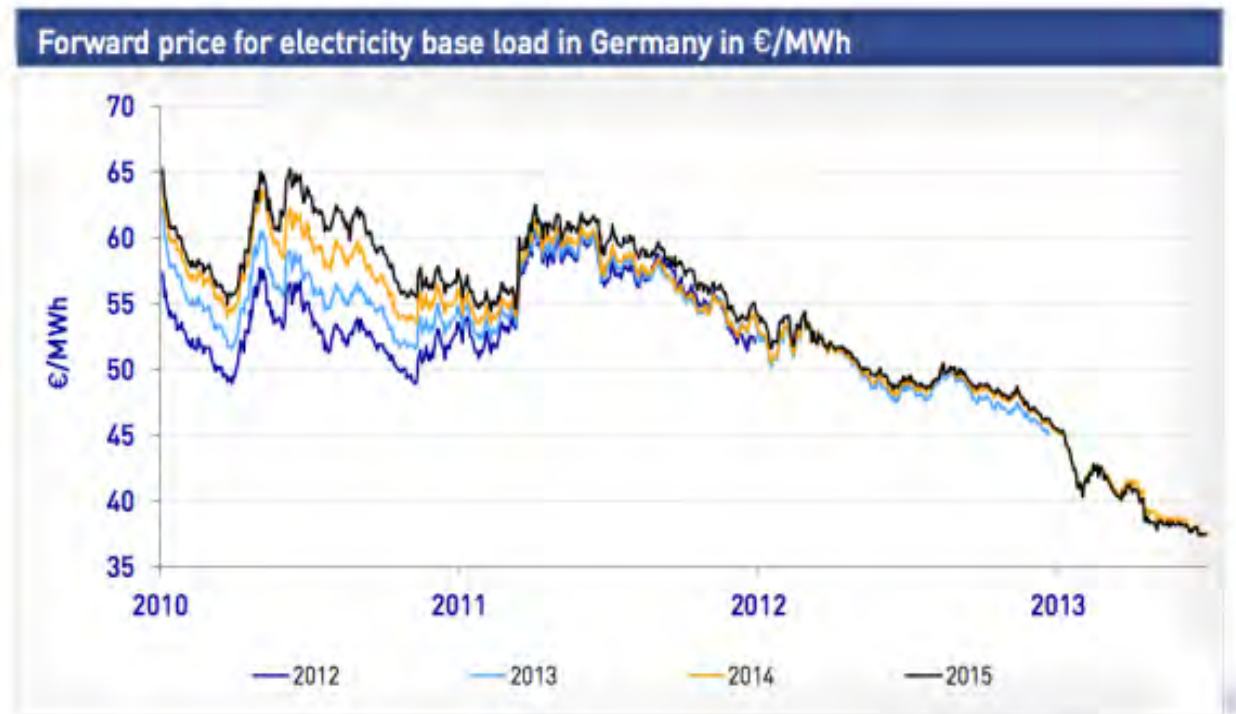
Elect. consumption in Australia's NEM, 2005-12, in TWhrs



Source: AEMO data; graph courtesy of greenmarkets.com.au

Depressed wholesale prices

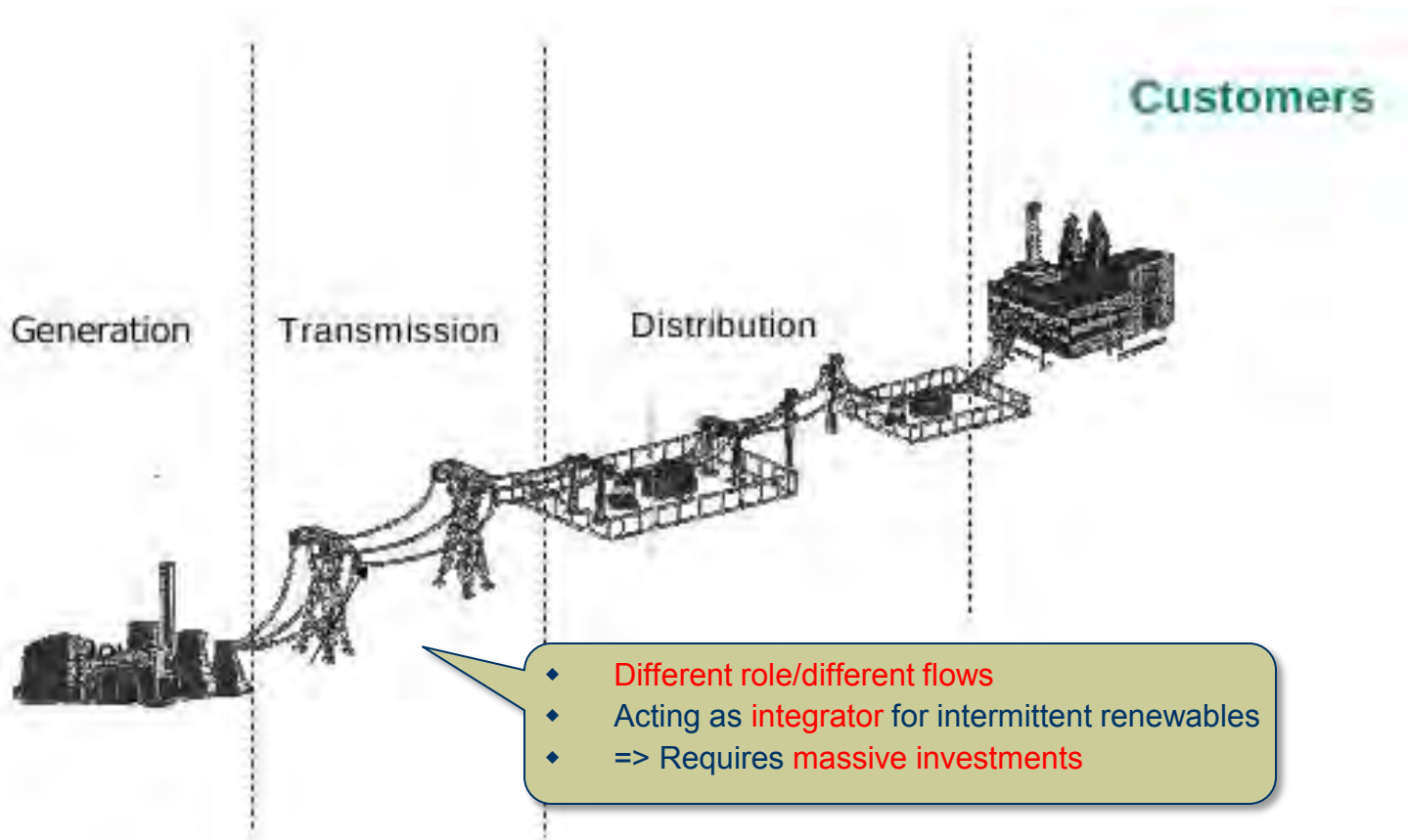
German experience not atypical



Source: European exchange

Transmission

New role: integrating massive amounts of renewables



Stromautobahn

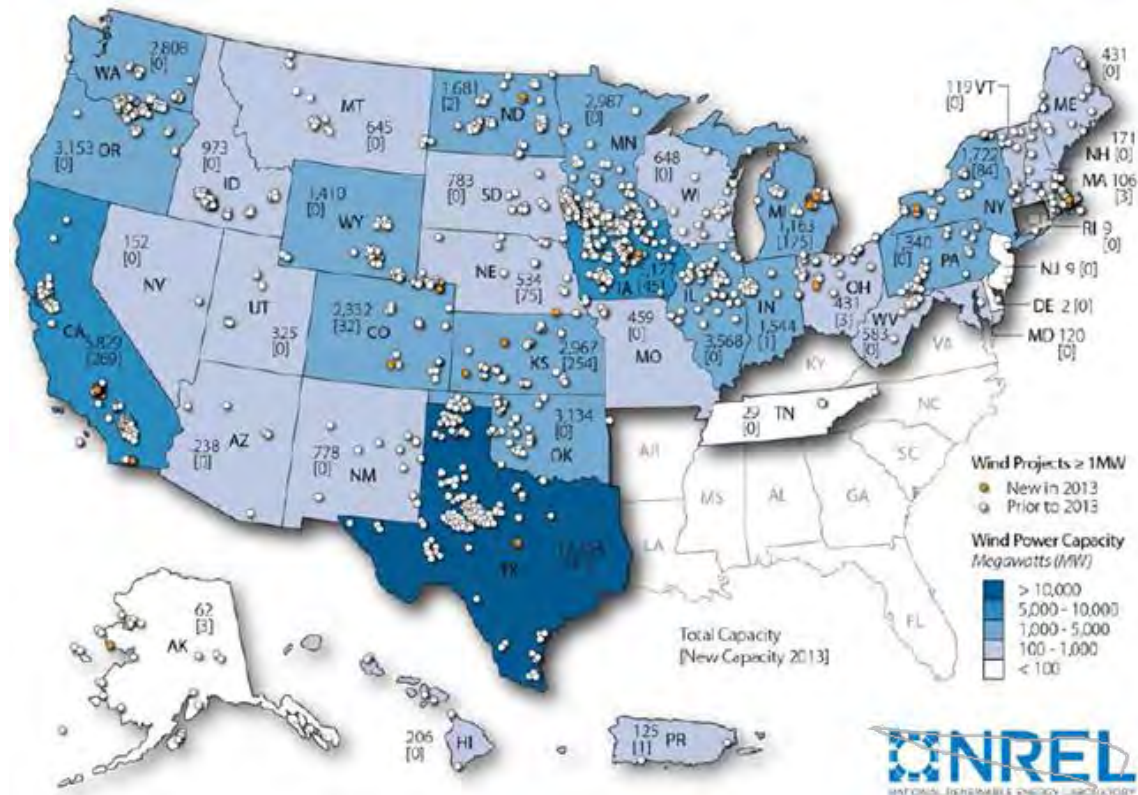
Transmission re-defined in context of rising renewables



Source: Germany's expensive energy gamble, The Wall Street Journal, 27 Aug 2014

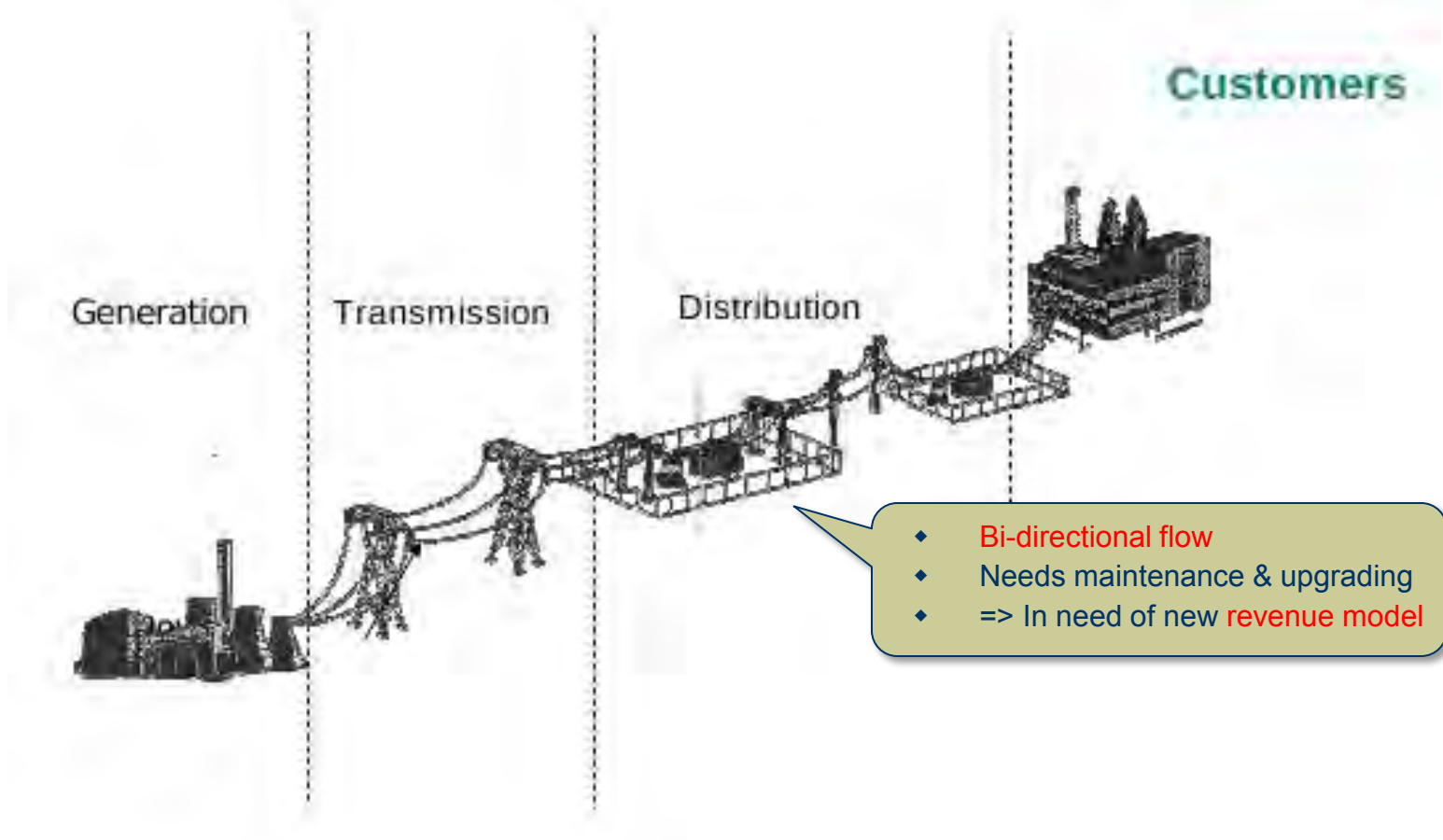
Wind blows in wrong places

Massive investments needed to transmit to load centers



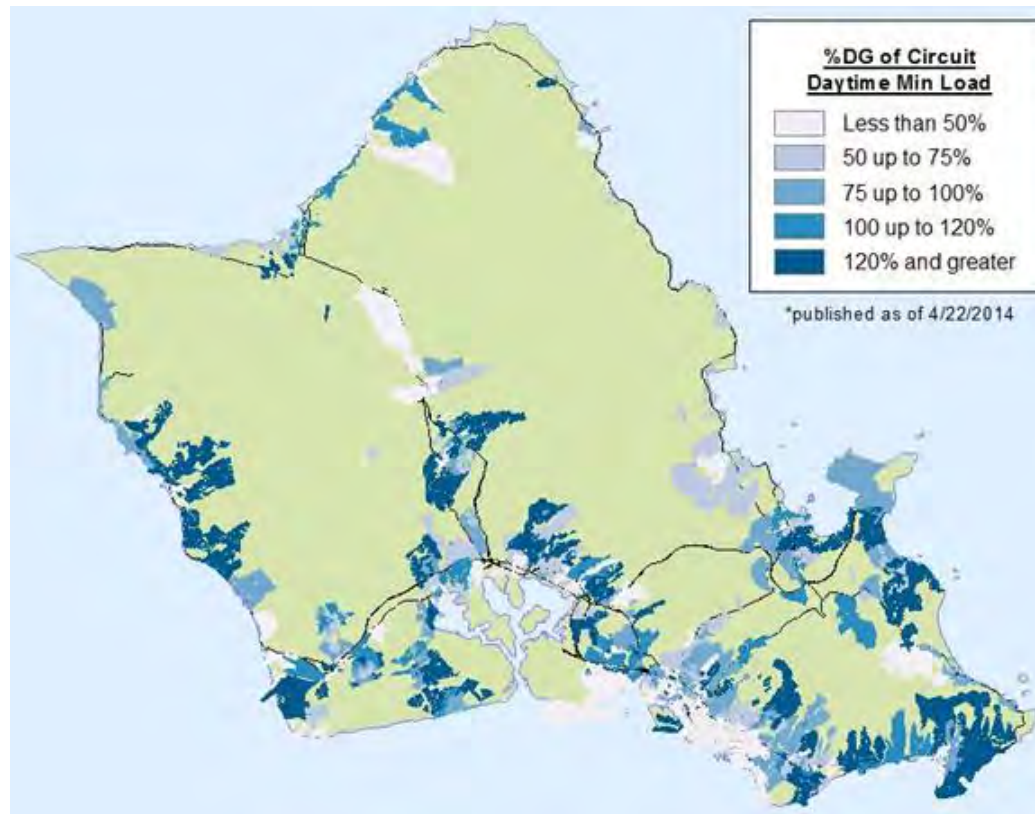
Distribution

Changing radically in response to decentralized generation



Overloaded circuits in Oahu

Ditto in Queensland, etc., etc.



Rooftop power generators

Lennar Corp. 100% solar subdivision, solar housing codes

Residential Retrofit



New Production Homes



Commercial & Public



Power Plants

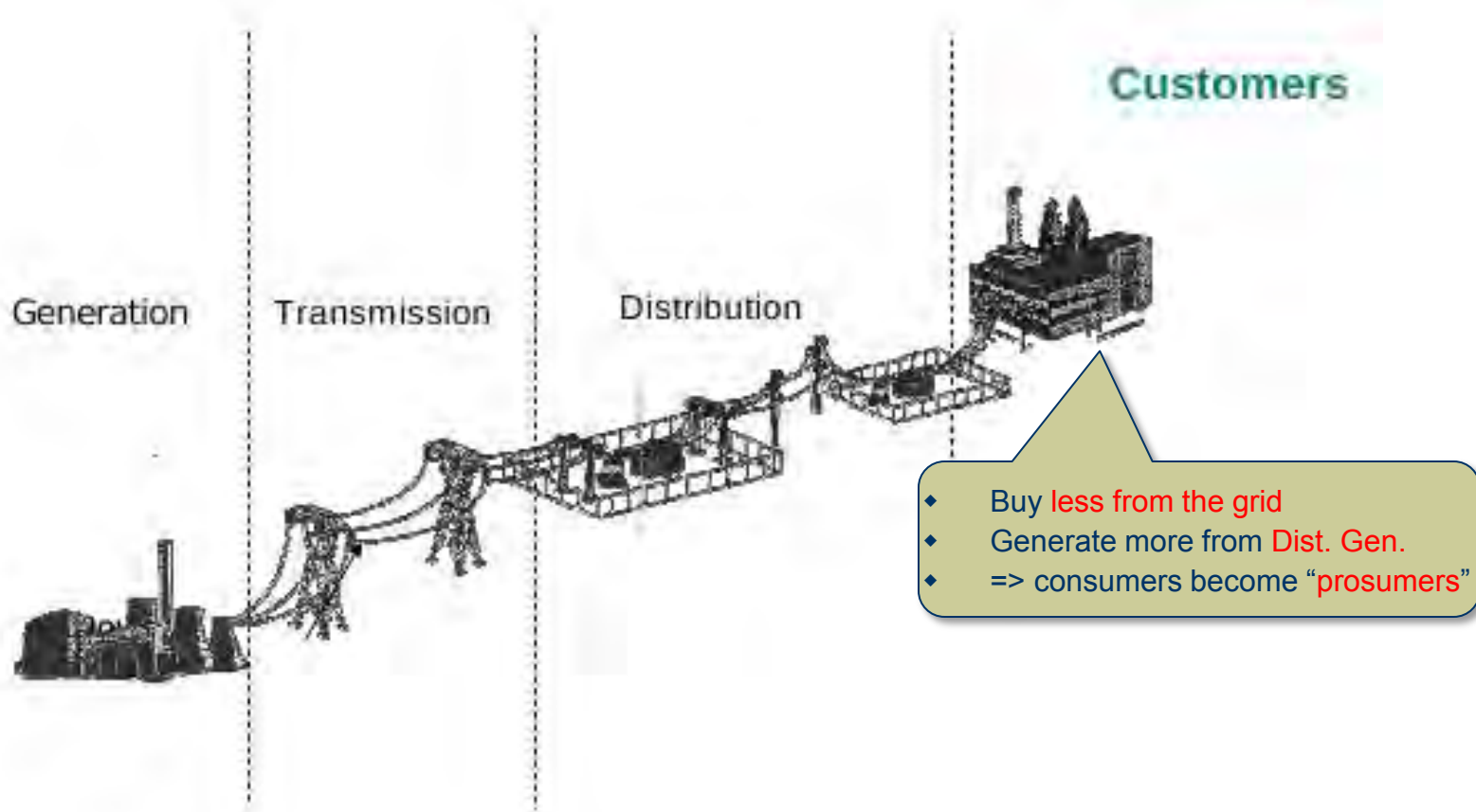


Coming next: BIPVs

Add to your vocabulary: “Building integrated PVs”



Consumer to “prosumer”



A man's home is his castle

Largely beyond regulator's reach



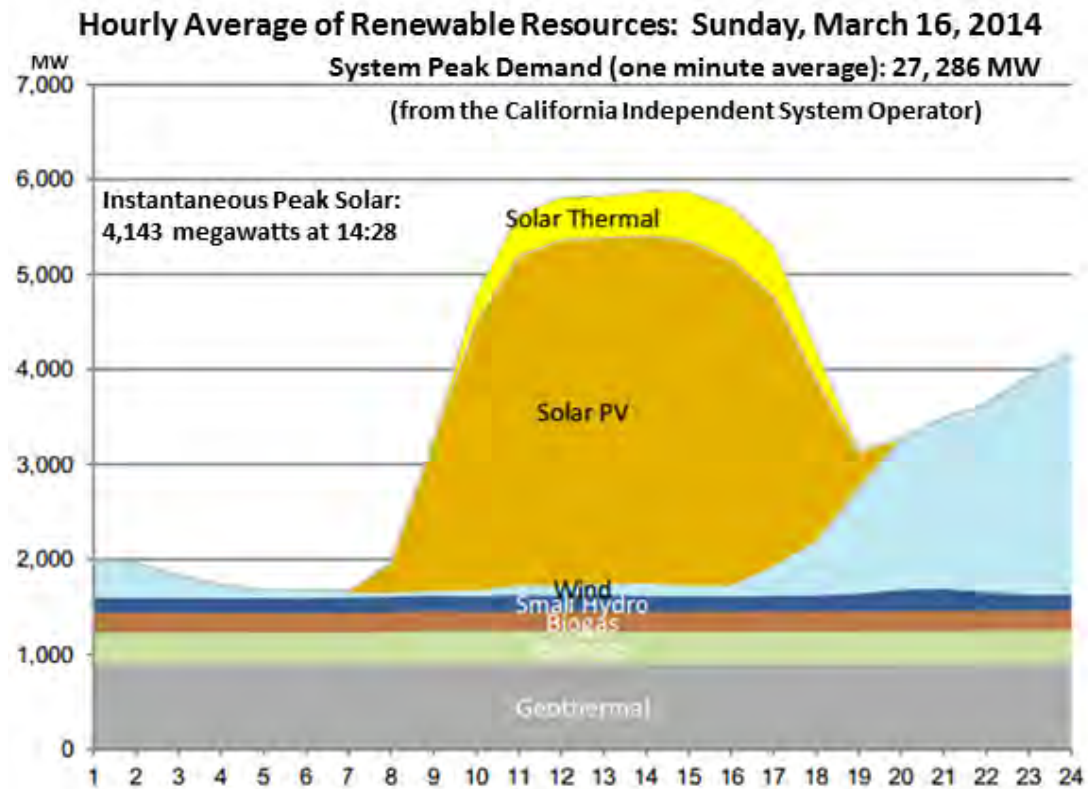
Source: The economics of grid defection: When & where distributed solar generation plus storage competes with traditional utility service, Rocky Mountain Institute et al, 2014

Big customer, no revenues

Apple's new office building under construction in Cupertino, CA



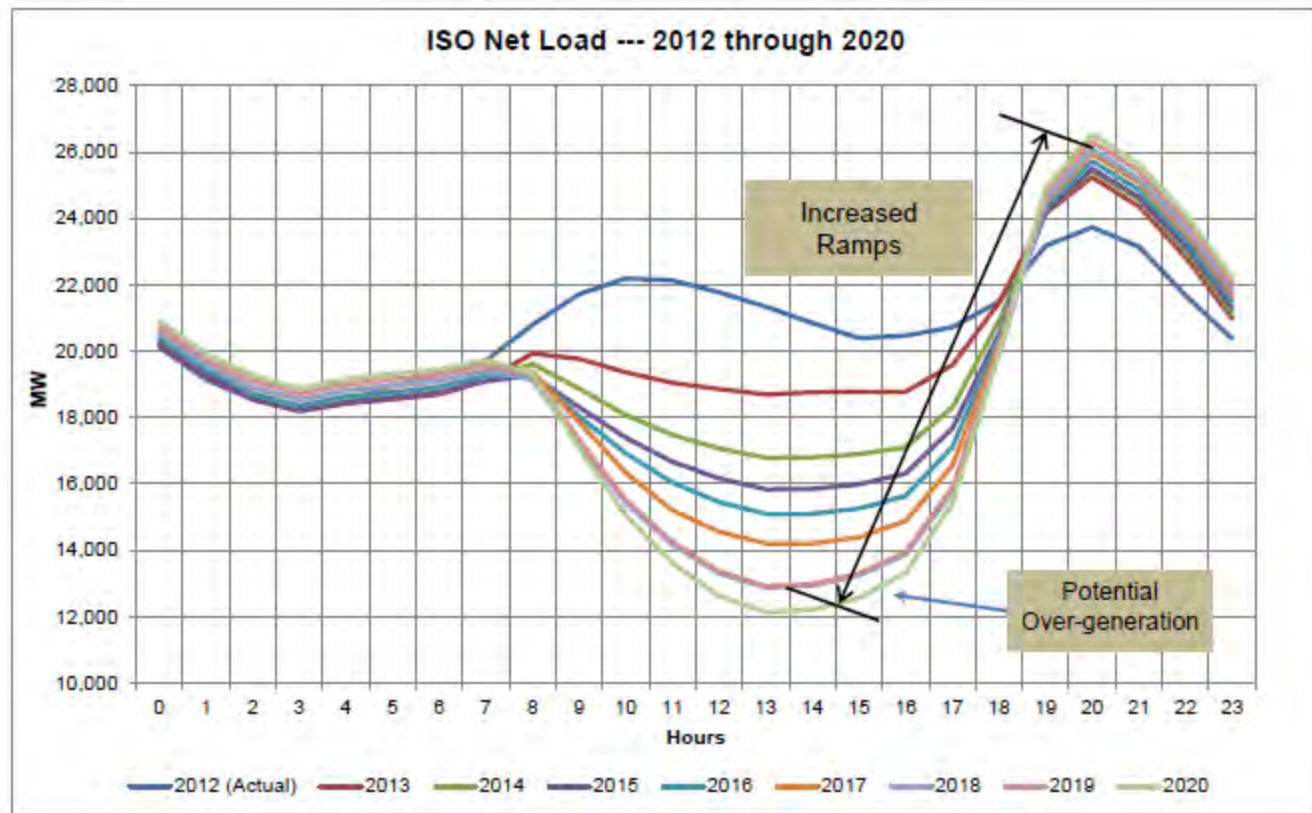
Mid-day sun = “over-generation”



Source: ISO

CA Duck curve

ISO's net load curves for March 31 – 2012 through 2020



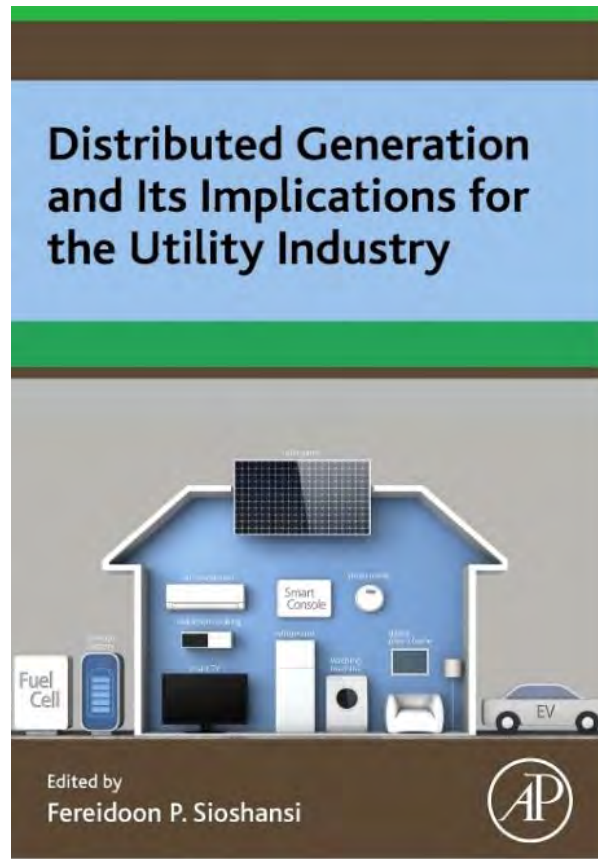
Source: CAISO Discussion of Markets, Mark Rothleder, 3 June 2014

Old vs. new

What is changing & why?

	<u>Old</u>	<u>New</u>
◆ Demand	Growing	Flat or falling
◆ Bus. Paradigm	Centralized	Decentralized
◆ Generation	Dispatchable	Intermittent
◆ Flow	One-way	Bi-directional
◆ Customers	<i>“Consumers”</i>	<i>“Prosumers”</i>
◆ Tariffs	Volumetric	Transactive
◆ Load	Inflexible	Price-responsive

We need a new business model

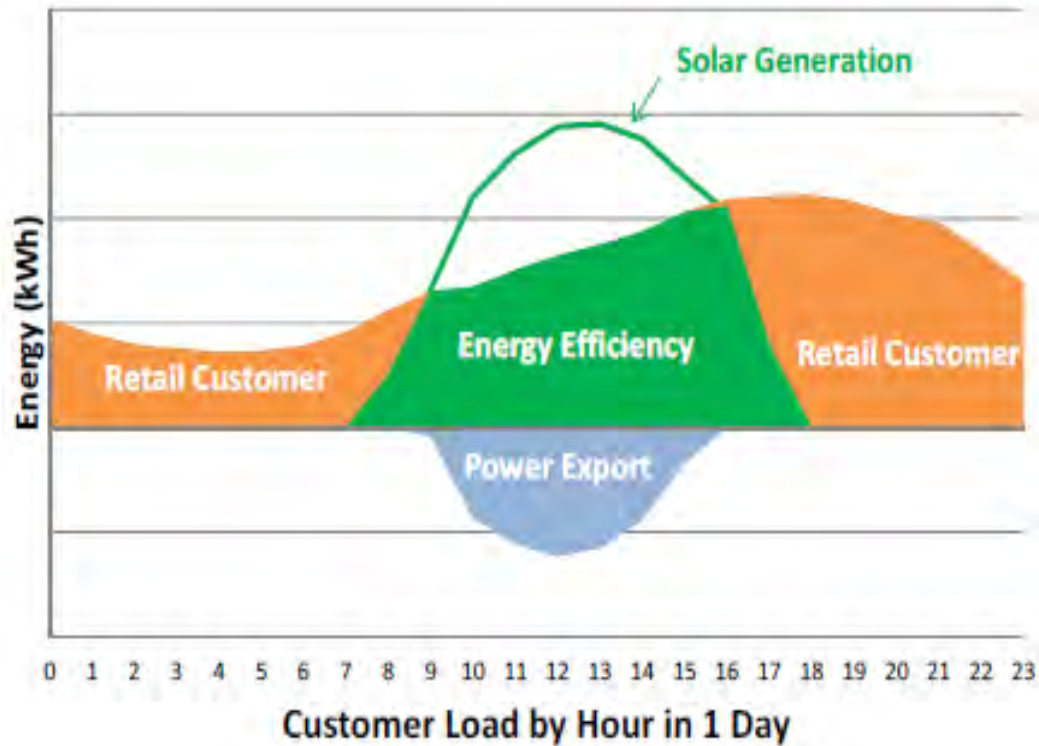


Thank you



Source: CAISO Discussion of Markets, Mark Rothleder, 3 June 2014

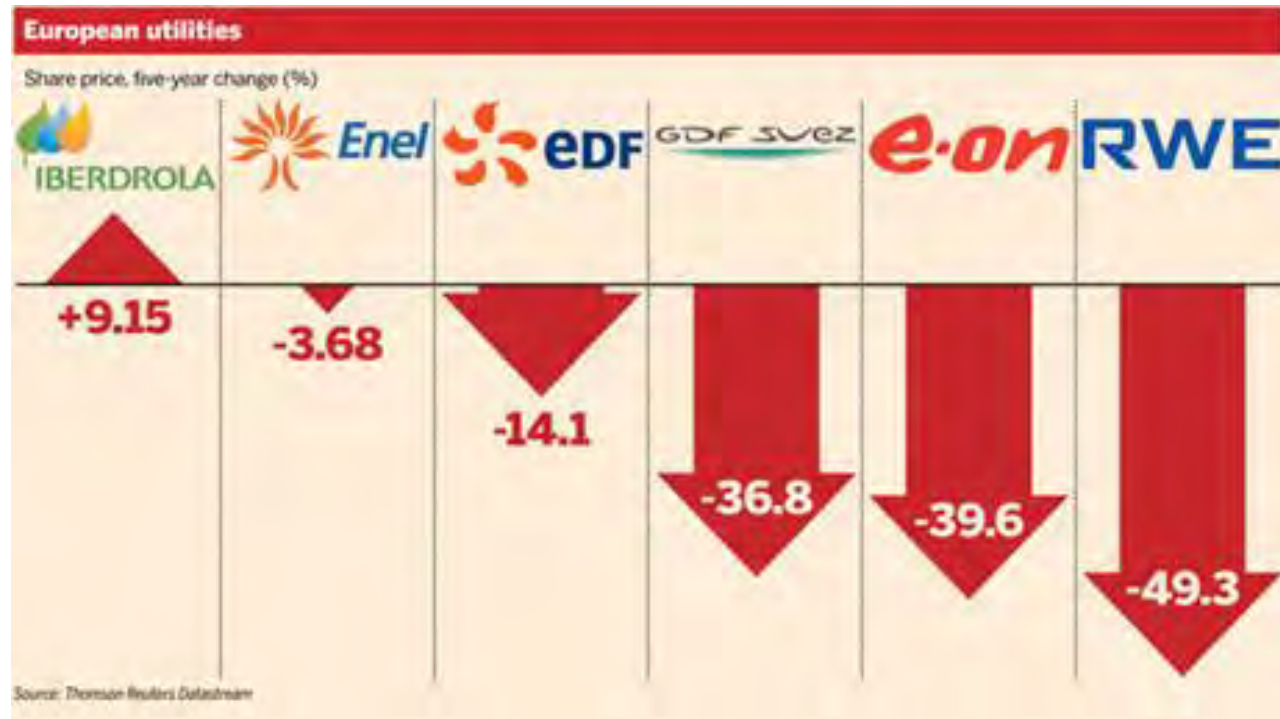
Bi-directional



Source: Evaluating the benefits and costs of NEM laws in California, prepared for Vote Solar, Jan 2013

Falling generator share prices

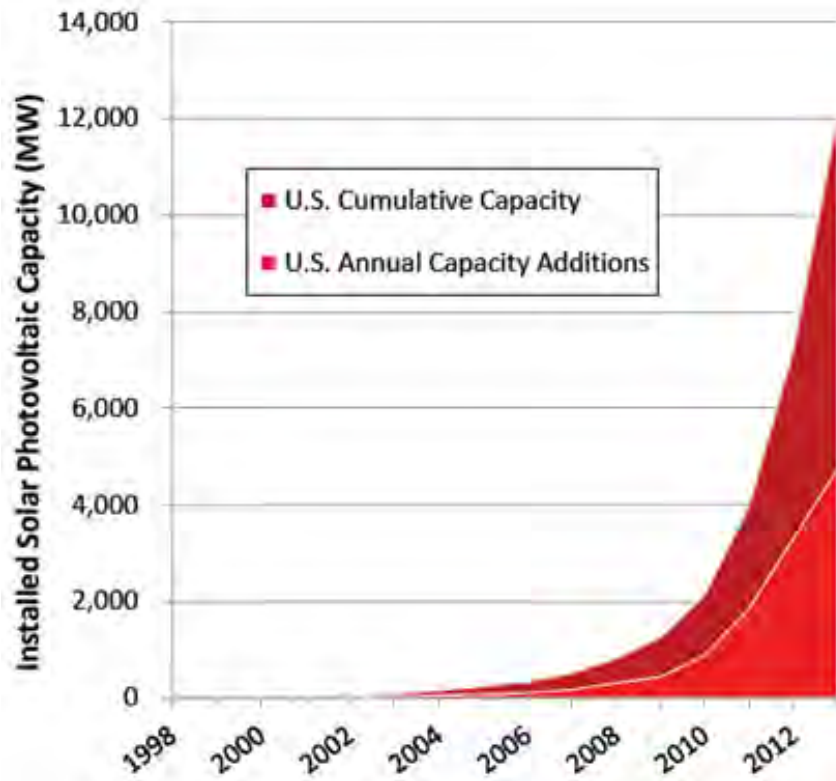
5-year performance



Source: Financial Times, 14 Feb 2014

US solar PVs on the rise

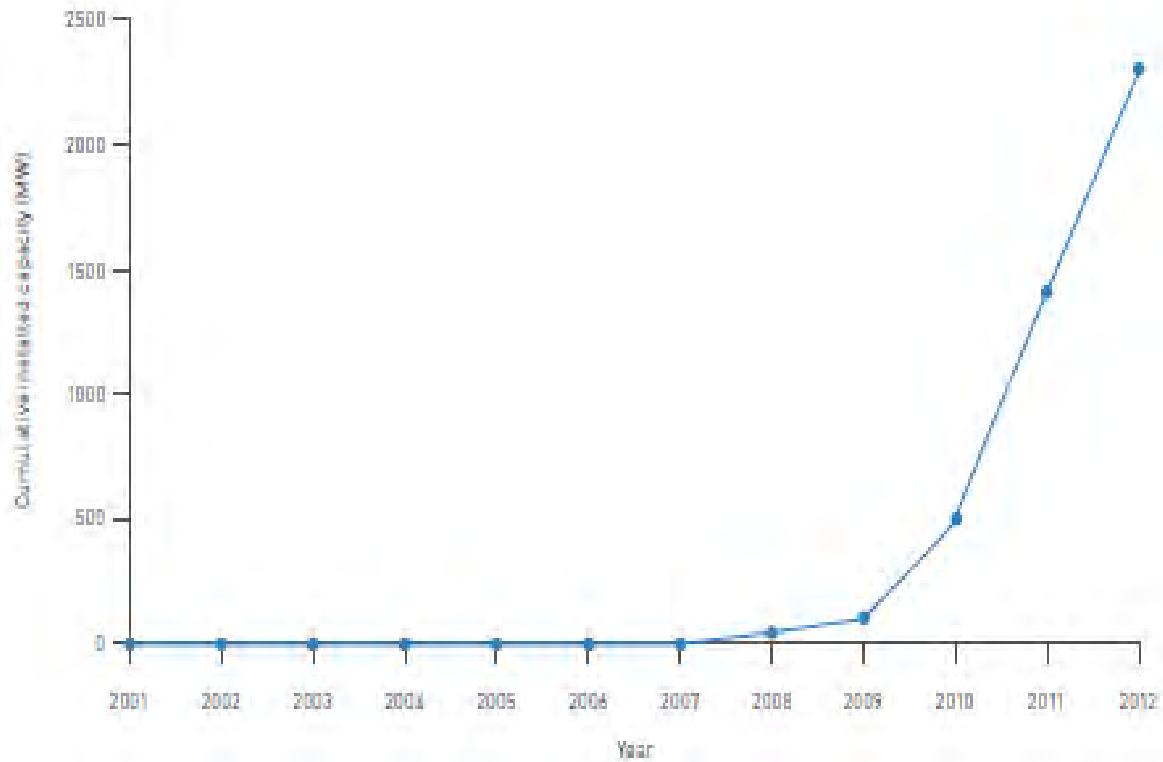
Germany has over 35 GW already



Source: Lighting the way, Environment America Research & Policy Center, Aug 2014

Australian PV uptake

Cumulative installed capacity of solar PVs in Australia, 2001-2012, in MW



Source: Clean Energy Council of Australia

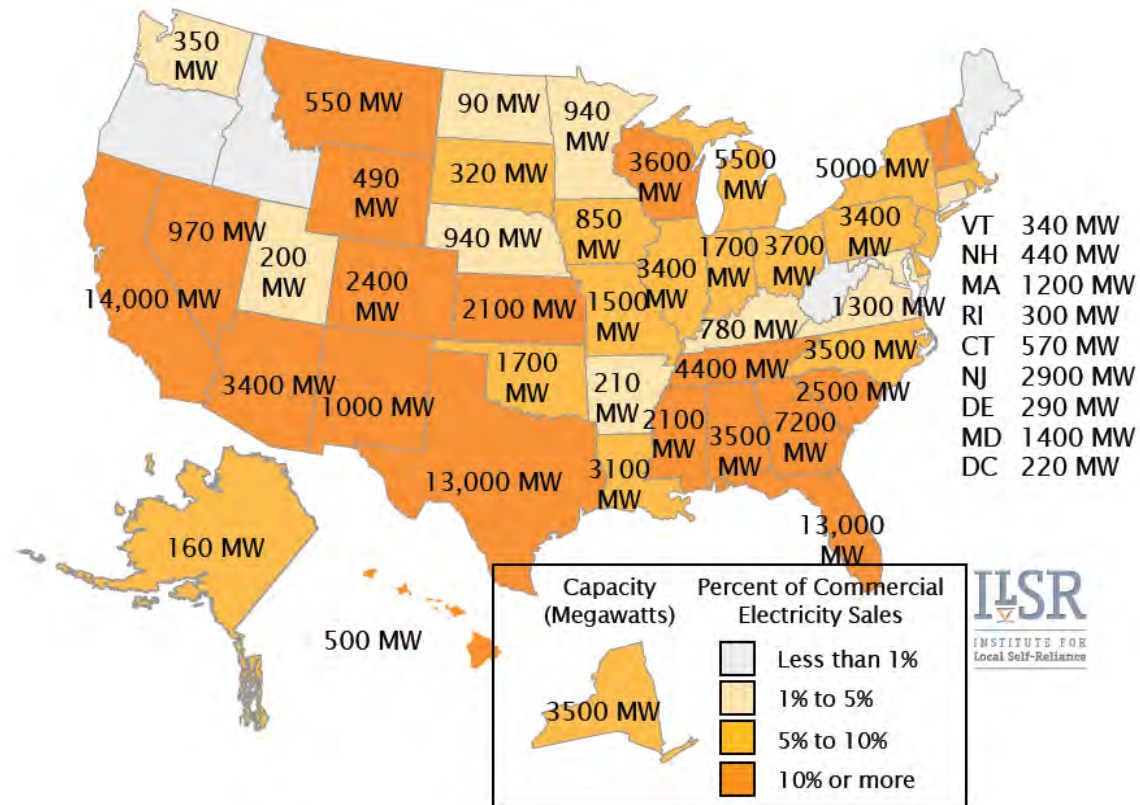
If I were in *your* shoes ...

... what would I be focusing on?

- ◆ Solar “**grid parity**”
 - Near or already here?
- ◆ Renewable/Dist. Gen **subsidies/policies**
 - The genie is already out
- ◆ **Zero net energy** (ZNE) buildings/codes
 - Look up Lancaster & Sebastopol, both in CA
- ◆ **Storage** technology & cost -- not just batteries
 - PVs + EVs = Game over?
- ◆ Evolution of “**distribution network**”
 - Regulators in NY & CA are redefining

Solar grid parity

Energy Potential from Unsubsidized \$3/W Commercial Solar (Capacity and % of Sales)



Source Commercial Rooftop Revolution, Institute for Local Self-Reliance (ILSR), Dec 2012

Winners & losers?

◆ Incumbents

- Traditional “utilities” as the “Kodaks?”
- Thermal generators not dinosaurs yet *seriously* challenged
- T&D to gain from transformation of business

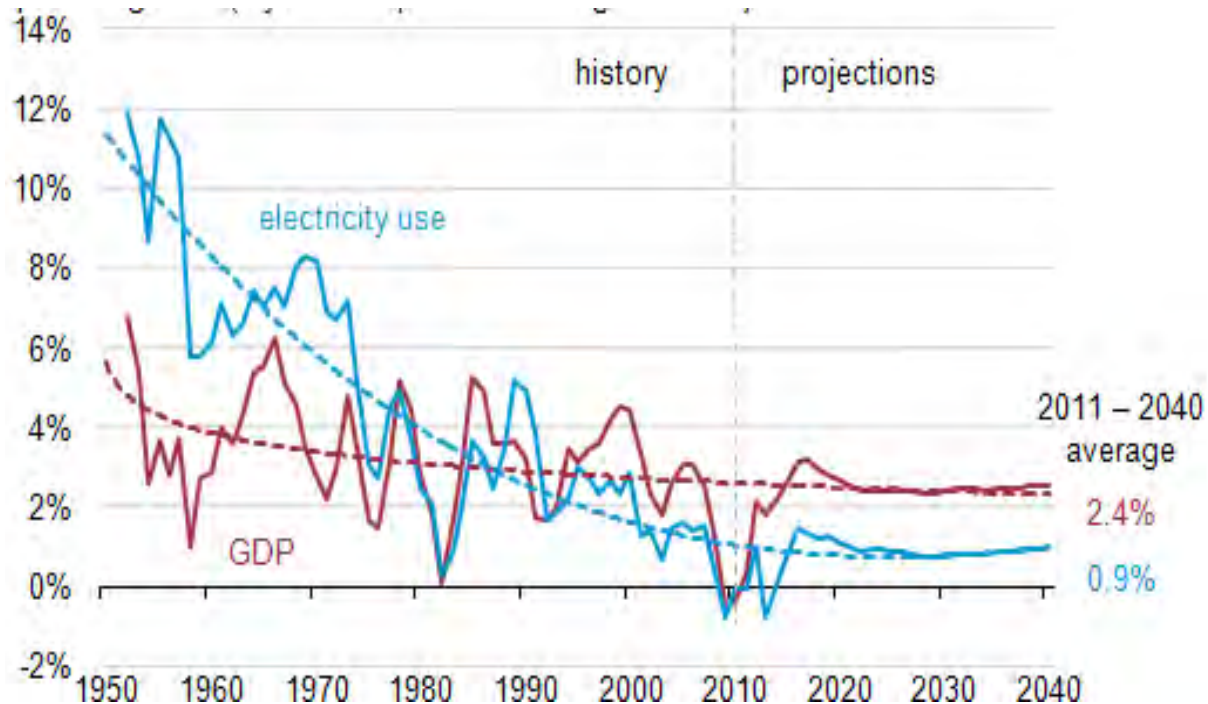
◆ New players/Innovators

- Renewables, distributed generation & EE have room to grow
- Tesla/SolarCity: EVs + PVs make sense
- Google/Nest: Monetizing home energy management?

Declining growth rates

Economic growth sustained w minimal electricity growth

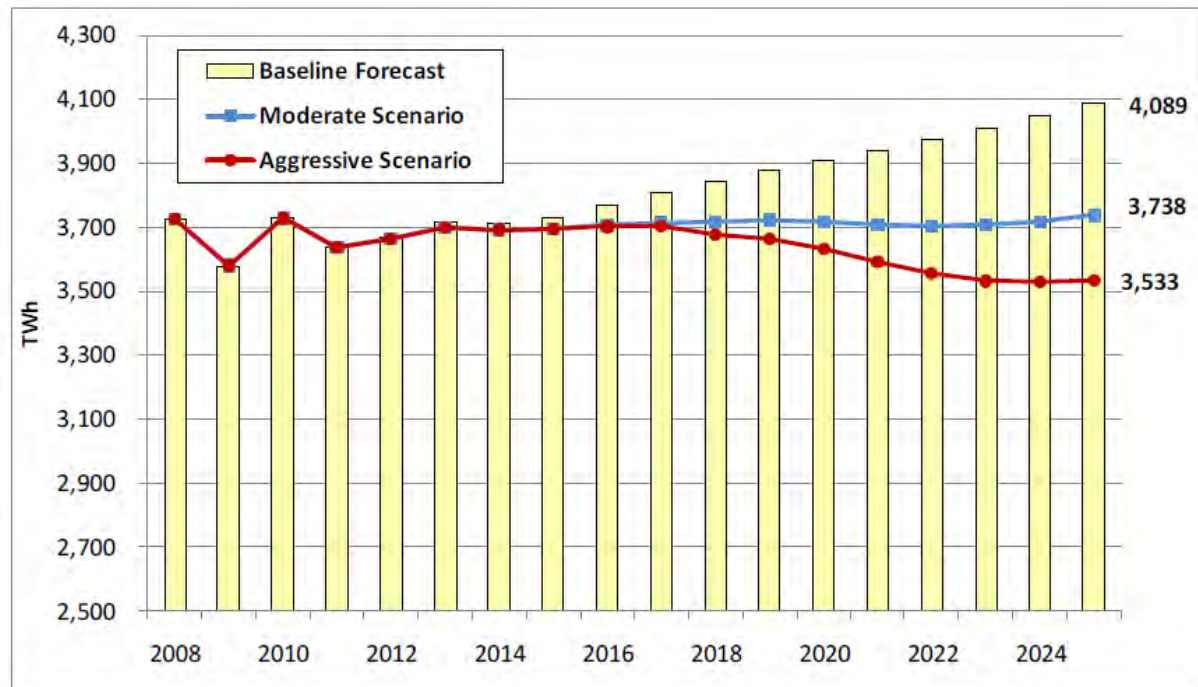
U.S. electricity use and economic growth, 1950-2040, percent growth (3-year compound annual growth rate) and trend lines



Source: U.S. Energy Information Administration, Annual Energy Outlook 2013 Early Release

Flat or declining demand?

0.9% growth may turn out to be 0.0%

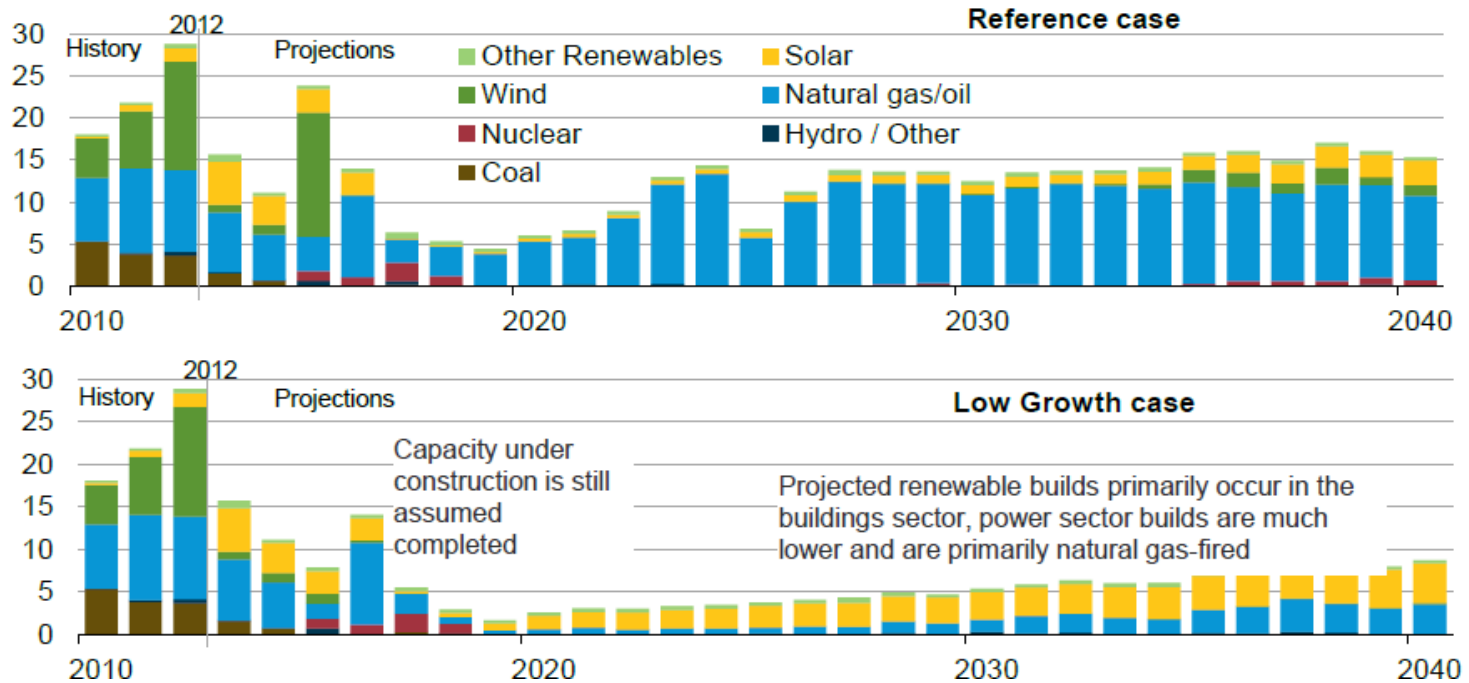


Source: IEE white paper, May 2011

No coal, little gas in forecast

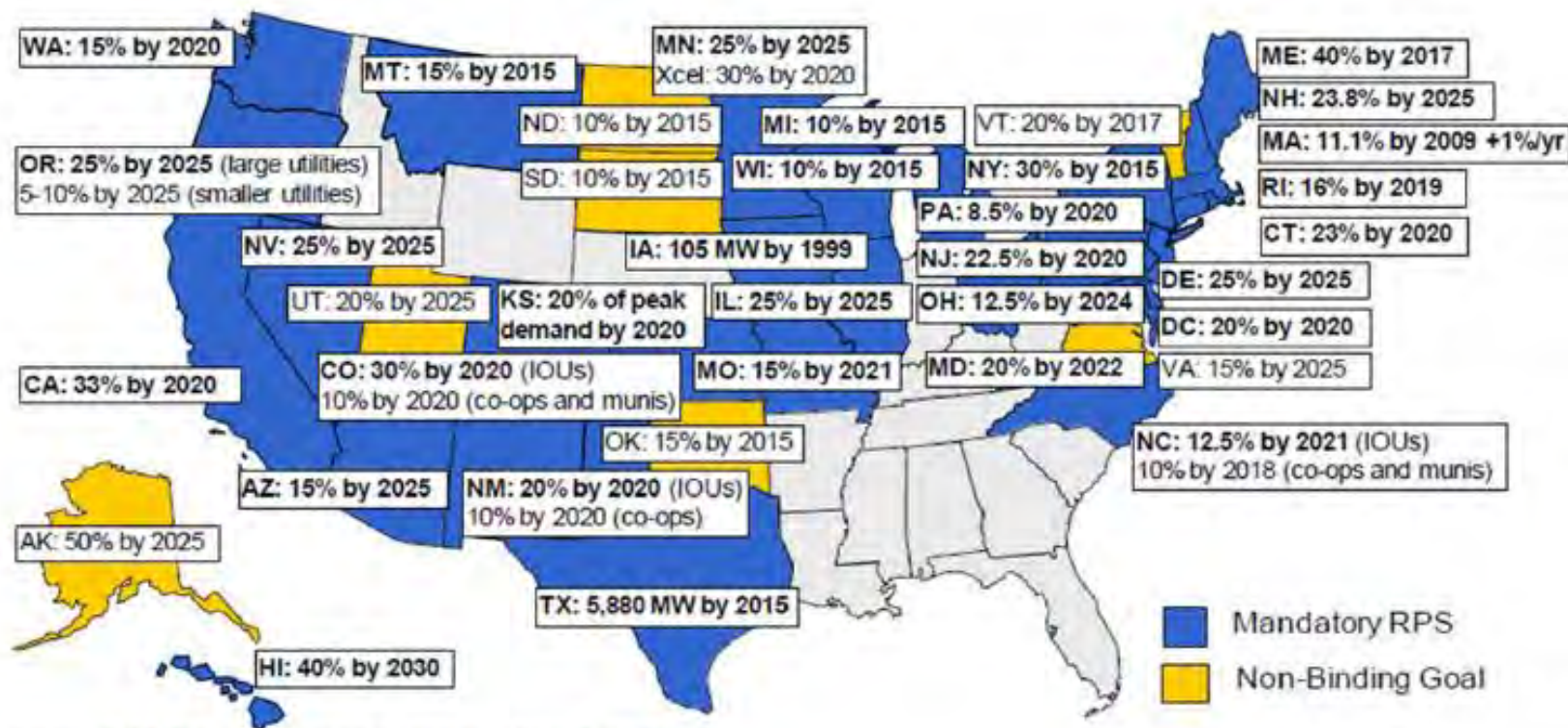
More likely: low demand growth scenario

U.S. electricity generation capacity additions
gigawatts



Renewable Portfolio Standards

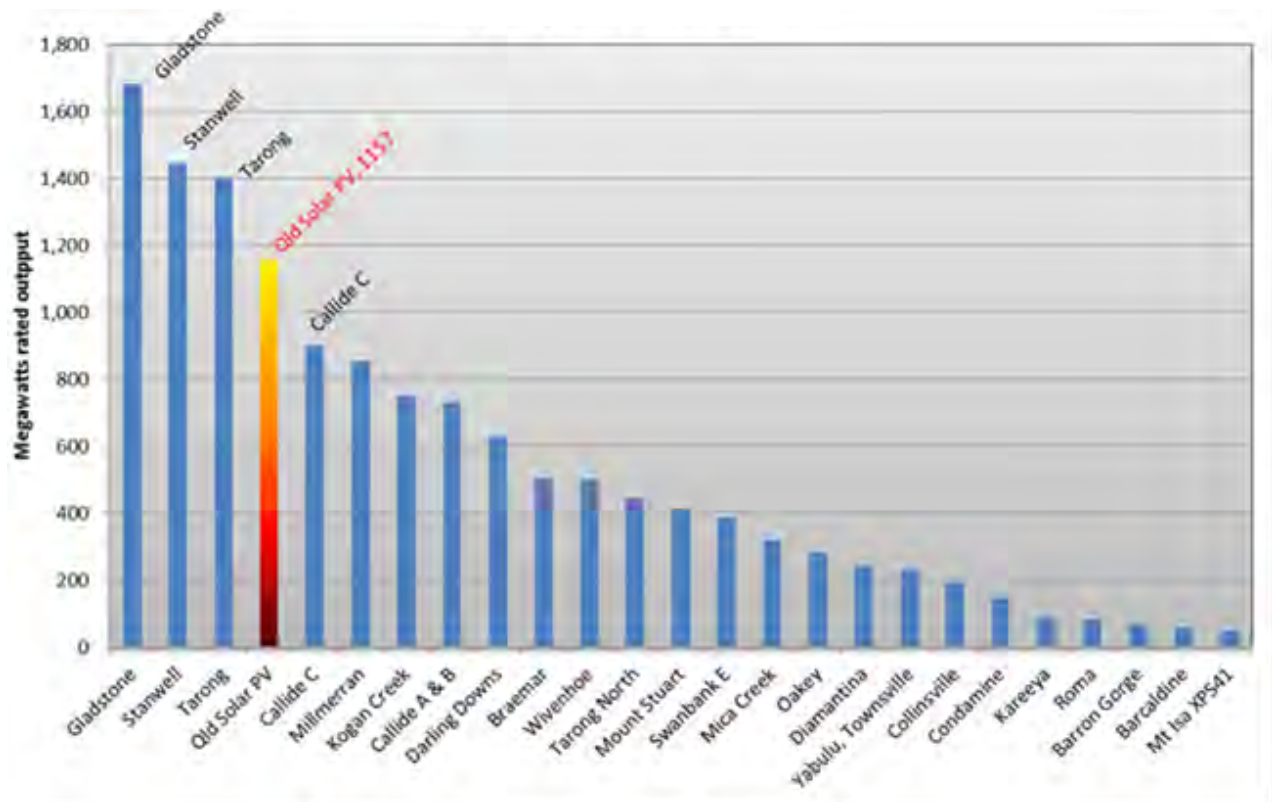
Demand for renewables driven by **mandates**, not **markets**



Source: 2011 Wind Technologies Market Report, DOE

PVs 4th largest source of capacity in QLD

Capacity in MW, April 2014



Source: Mike Swanston, Energex

Tesla: Battery on wheels



Source: www.tesla.com

Home energy management

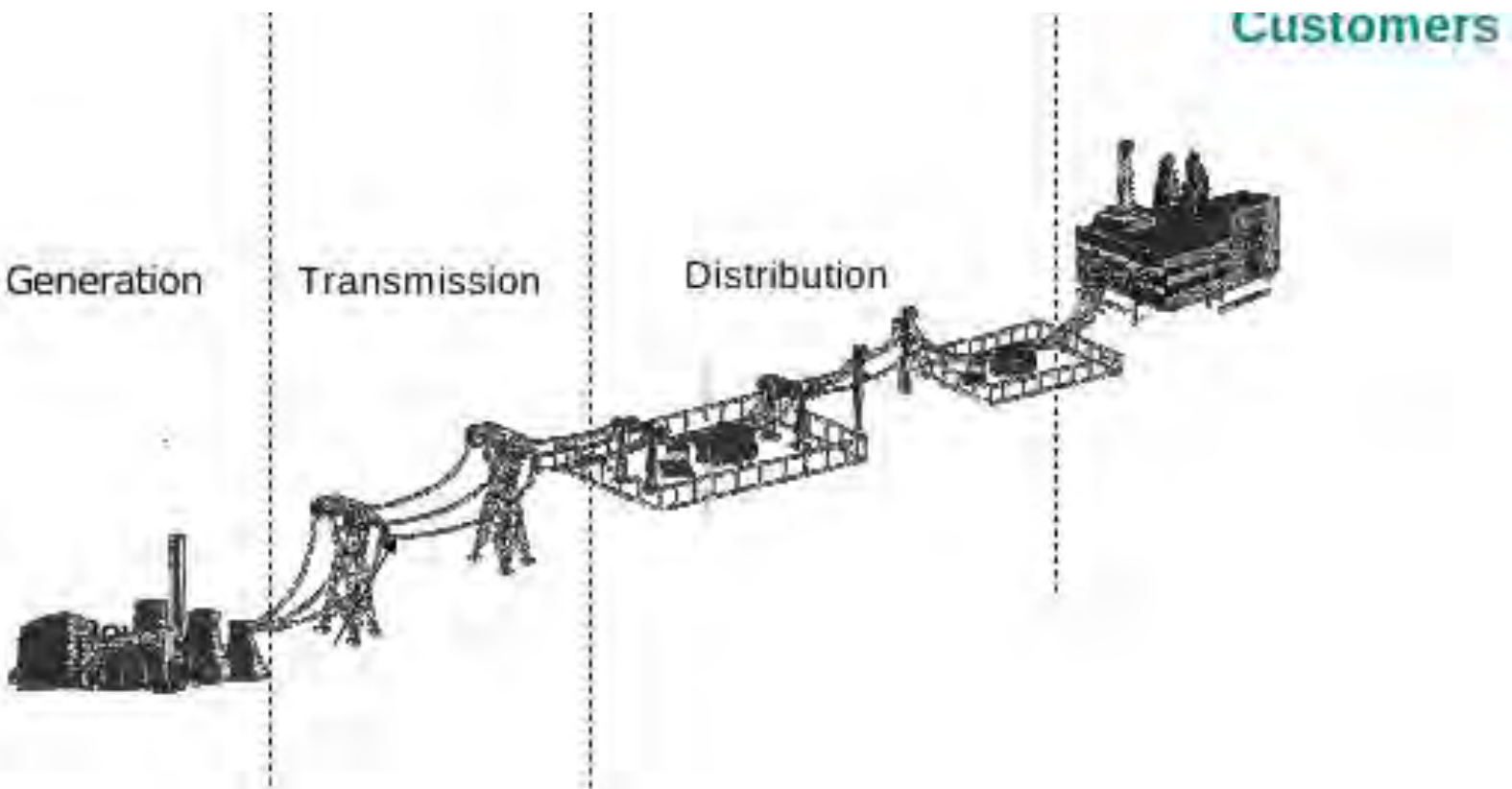


Source: Google.com

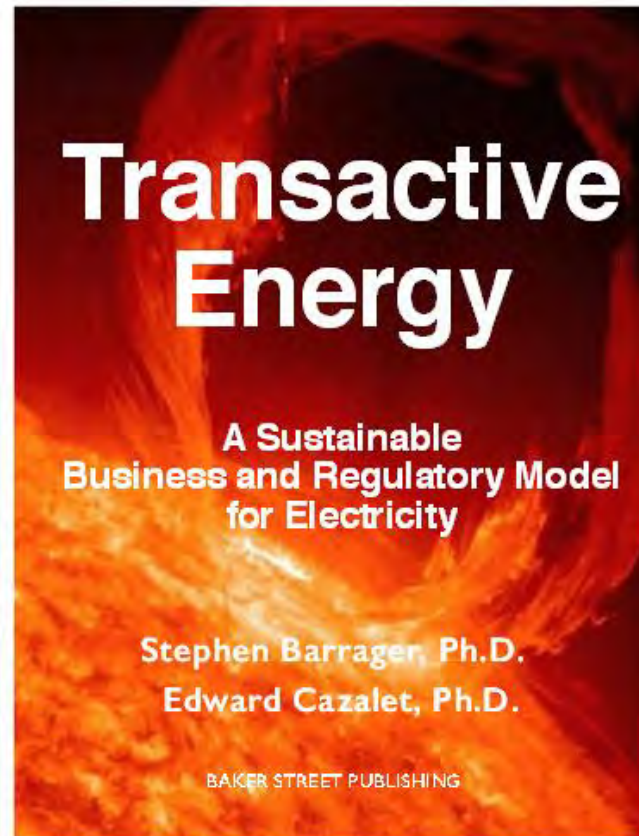
Zero Net Energy



Source: NREL

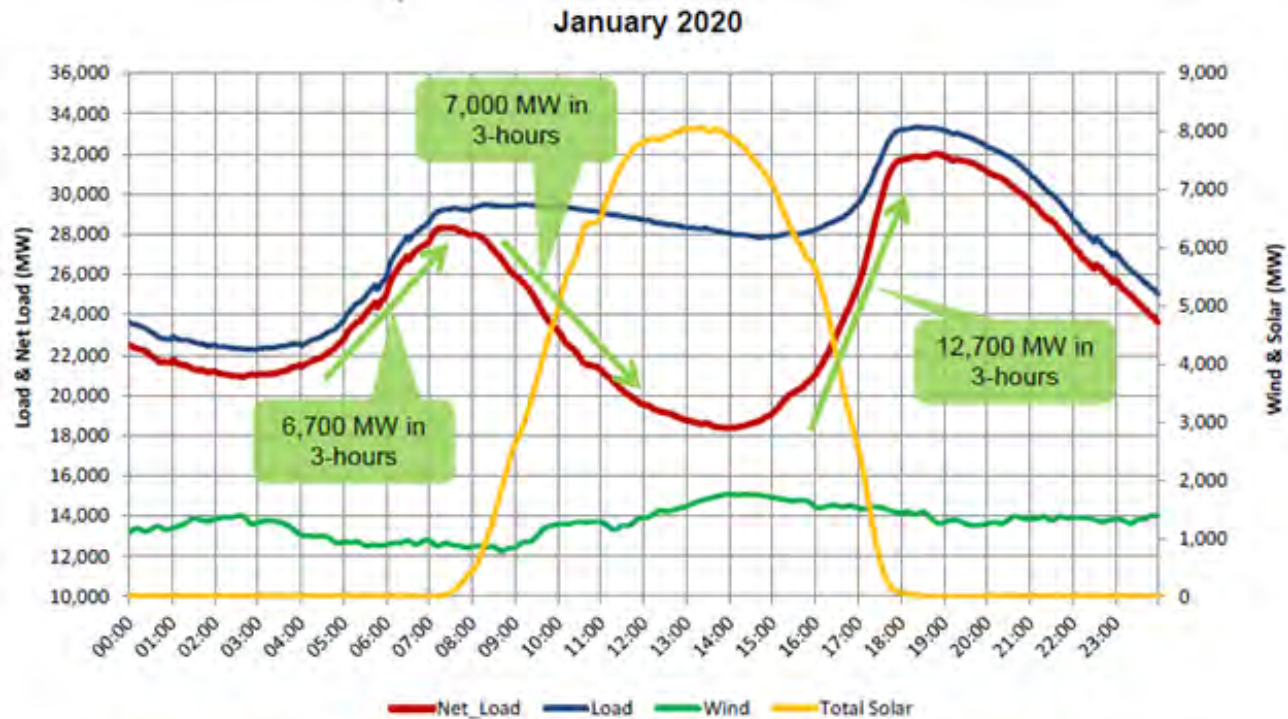


“Transactive”



Price responsive demand

CA will need 13 GW ramping in 3 Hrs by 2020

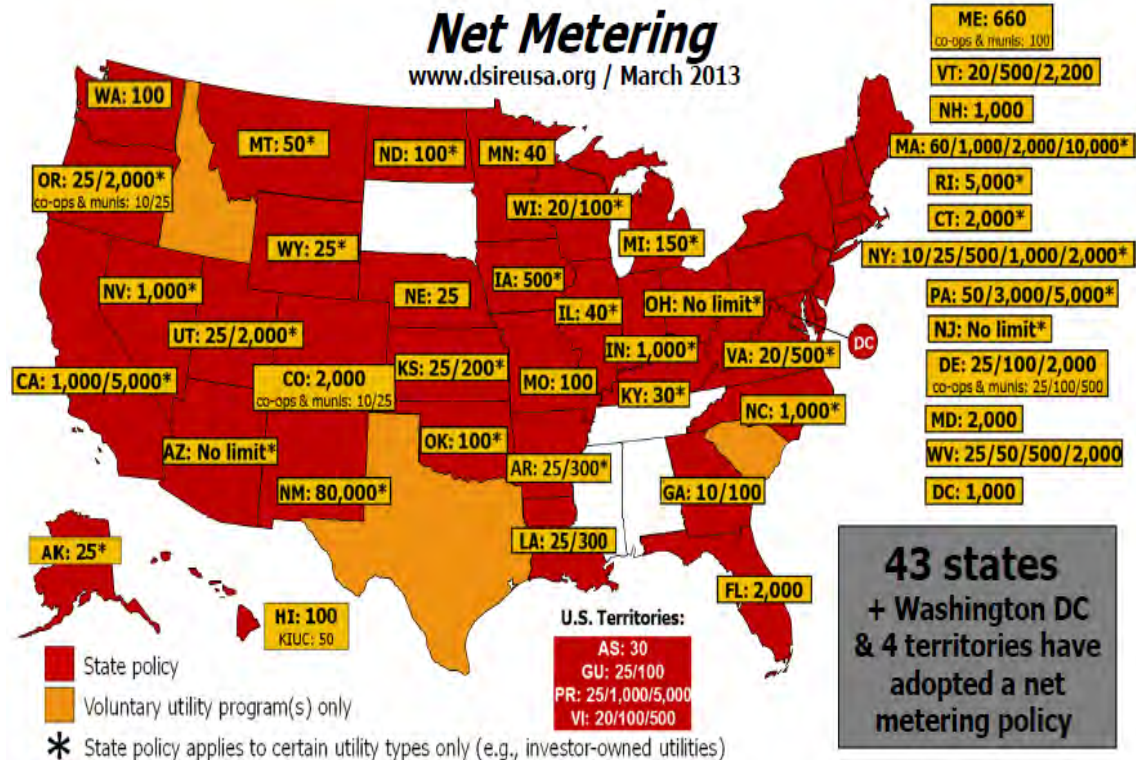


Source: Maintaining Bulk-Power System Reliability While Integrating Variable Energy Resources – CAISO Approach, Nov 2013

Net Energy Metering (NEM)

The industry's nemesis

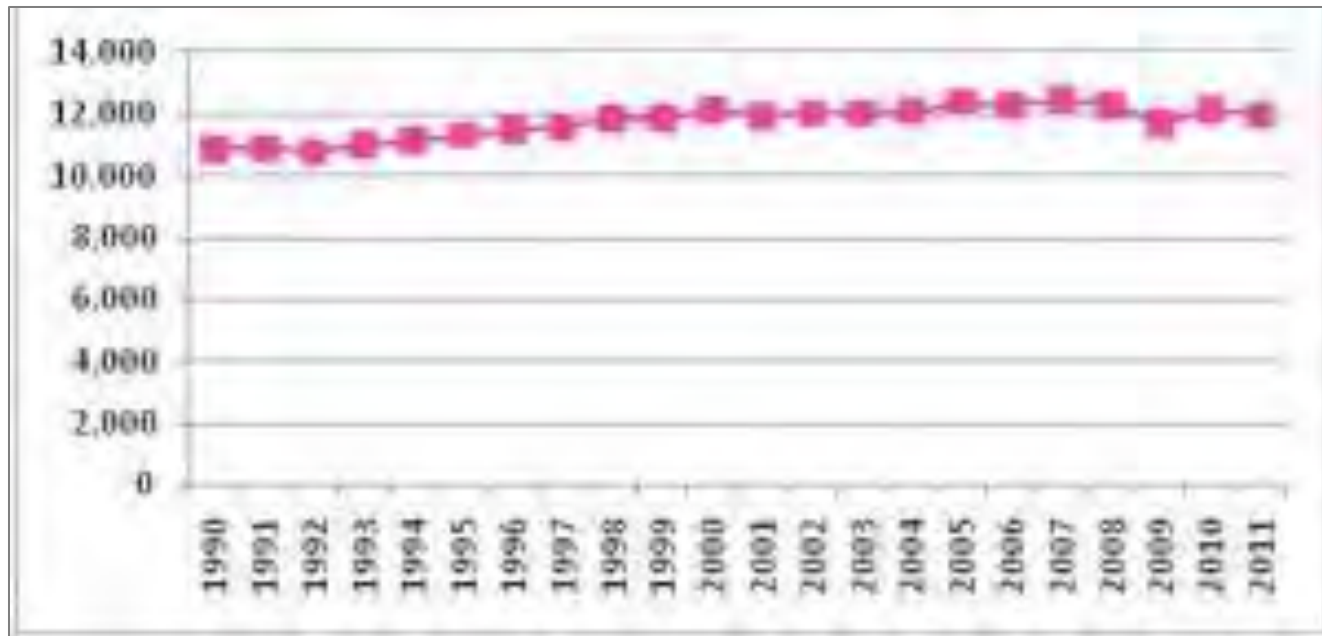
Net metering spreading across the land



Source: DSIRE USA

US Per Capita Elect. Consumption

1990-2011, kWh/pp



Source: Smart Grid Watch, *How fast is U.S. electricity consumption growing?* April 6 2012