



# The future of utilities: Utilities of the future

**Universidad Nacional Autónoma de México**

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Mexico City

**Fereidoon P. Sioshansi, Ph.D.**

**Menlo Energy Economics**

San Francisco CA

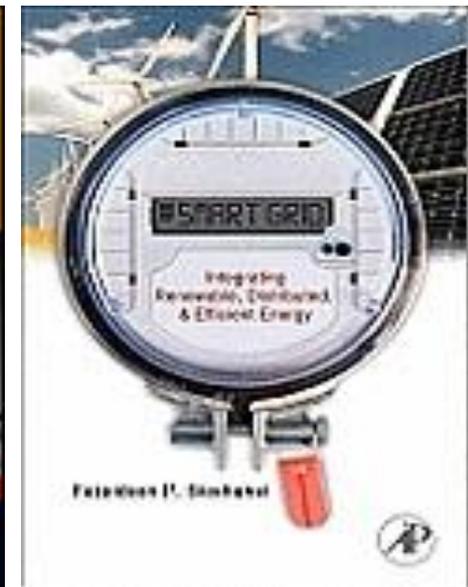
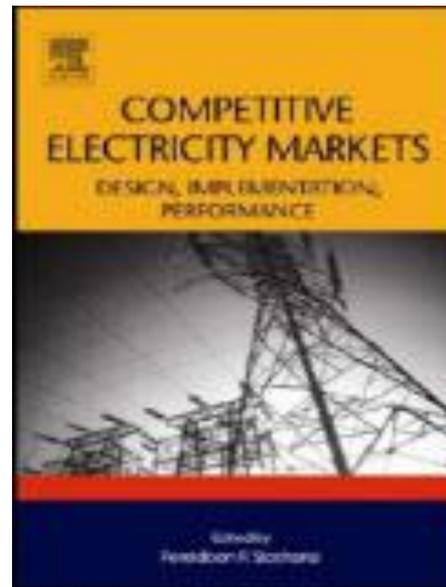
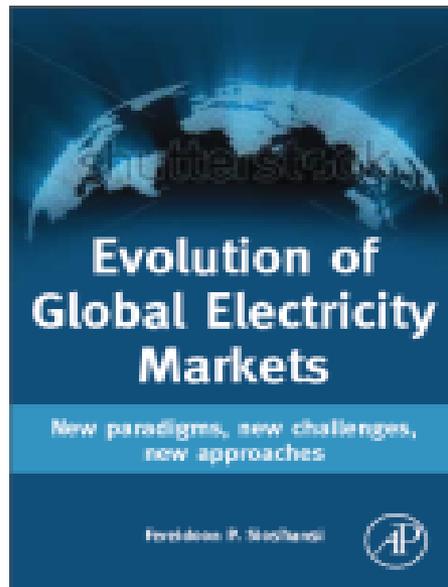
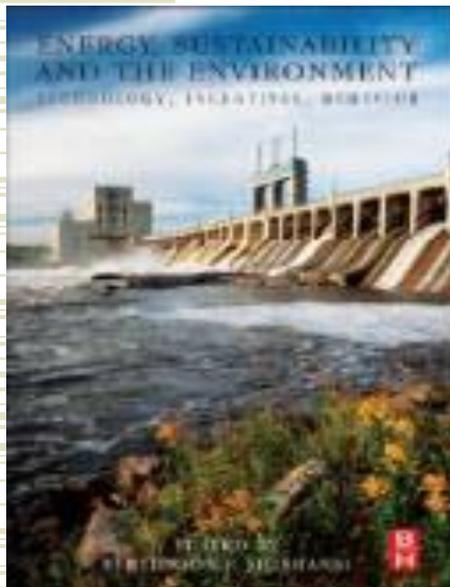
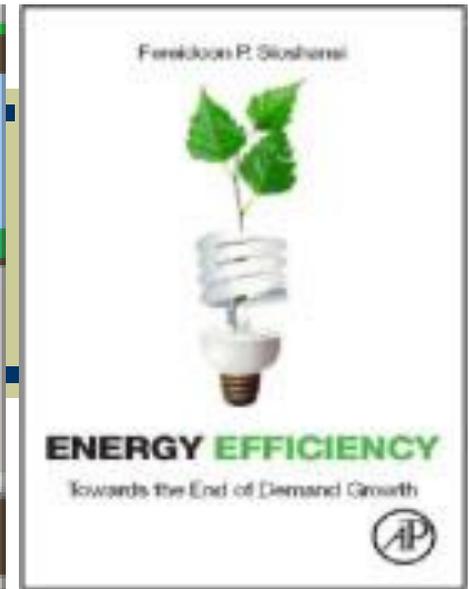
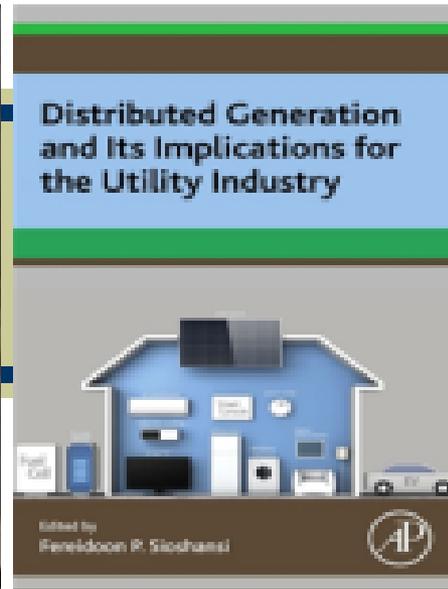
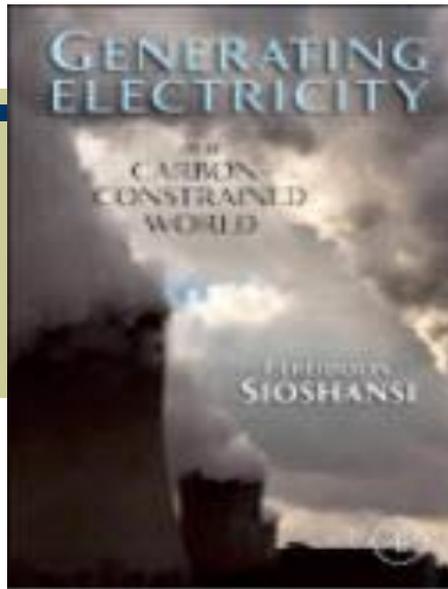
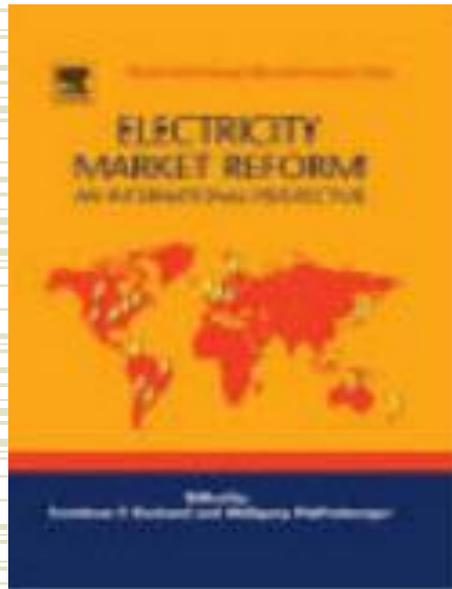
[www.menloenergy.com](http://www.menloenergy.com)

# Thank you UNAM

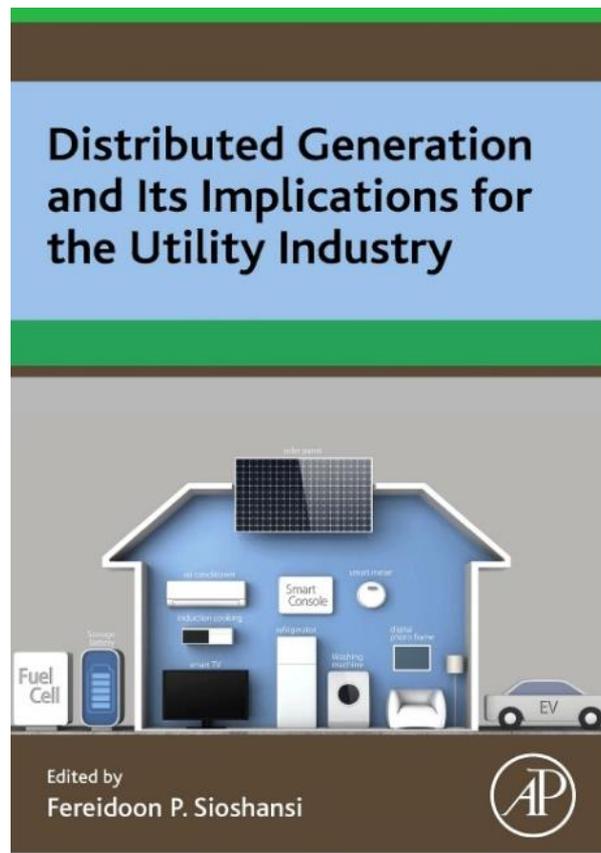
- ◆ For invitation to speak
  - Prof. Leticia Campos for organizing
- ◆ Intent
  - Rapid pace of energy transformation
  - Focusing on electric power sector
- ◆ Question
  - ◆ Relevance to Mexico?
- ◆ Preface
  - California-centric perspective

# Introduction

- ◆ **Menlo Energy Economics**
  - Consulting company, global perspective, electricity focused
- ◆ **EEnergy Informer**
  - Analysis of news, 27-years, international audience
- ◆ **Main areas of interest**
  - Intersection of energy policy, regulations & economics
- ◆ **Typical clients**
  - Regulators, utilities, energy intensive industry, research/academia
- ◆ **Typical projects**
  - Distributed generation, tariffs, renewable subsidies/integration
- ◆ **Background**
  - SCE, EPRI, NERA, Ventyx (now part of ABB)



# New business, new business model

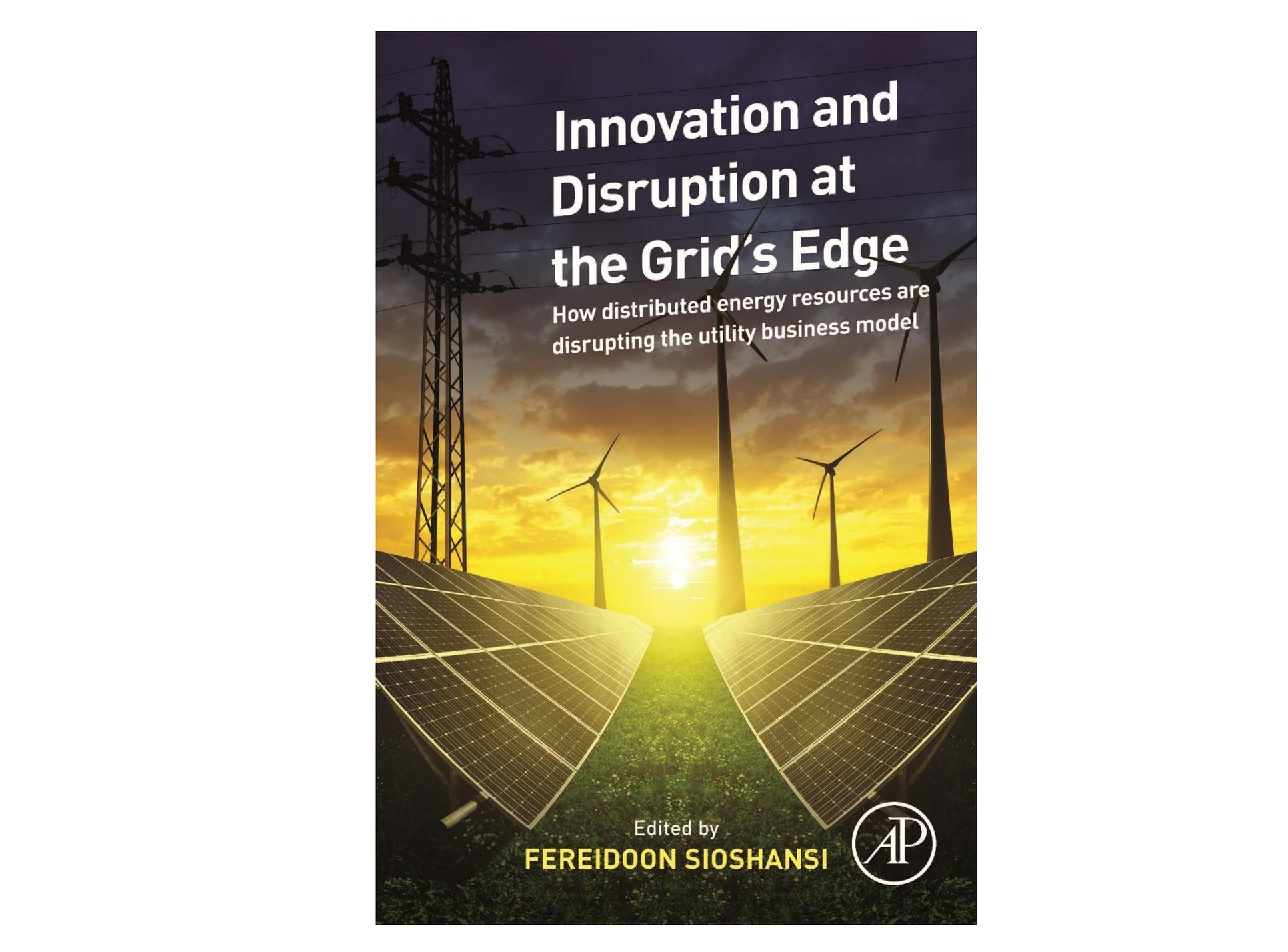


# The Future of **Utilities** **Utilities** of the Future

How technological innovations in distributed energy  
resources will reshape the electric power sector

Fereidoon P. Sioshansi, Editor





# Innovation and Disruption at the Grid's Edge

How distributed energy resources are  
disrupting the utility business model

Edited by

**FEREIDOON SIOSHANSI**



# Proposed outline

- ◆ Energy transformation (context)
- ◆ Implications for power sector
  - Future **is** renewables/low carbon generation mix (skip)
  - Future **may be** decentralized/distributed (skip)
  - Future of **demand**
  - Future of consumers: **Prosumers**
  - What comes after prosumers? **Prosumagers**
  - Future of **utilities**
  - Future of **regulation**
- ◆ Relevance to **Mexico?**

# What energy transformation?

- ◆ Uber, worth **\$70 billion**, offers driverless rides in Pittsburg, PA
- ◆ **Ford** to introduce driverless car in **2021**
- ◆ RMI: US car ownership to peak in **2020**
- ◆ 5 of top 10 global listed companies are **virtual**
- ◆ Renewables beat natural gas **70 to 1** in 1<sup>st</sup> Qtr. 2016 in US
- ◆ Record renewable investment despite **low oil prices** in 2015-16
- ◆ Renewables grow from 7 to 32% in 15 years in **Germany**
- ◆ Over **1 million solar roofs** in **Australia**, **5 GW** in **CA**
- ◆ **Solar** generation in 2016 to exceed coal in **UK**
- ◆ Coal consumption has peaked in **China**
- ◆ **CA & NY** 50% renewable by 2030, 100% in **HI** by 2045

# UberWorld

It is no longer about the metal & pedal

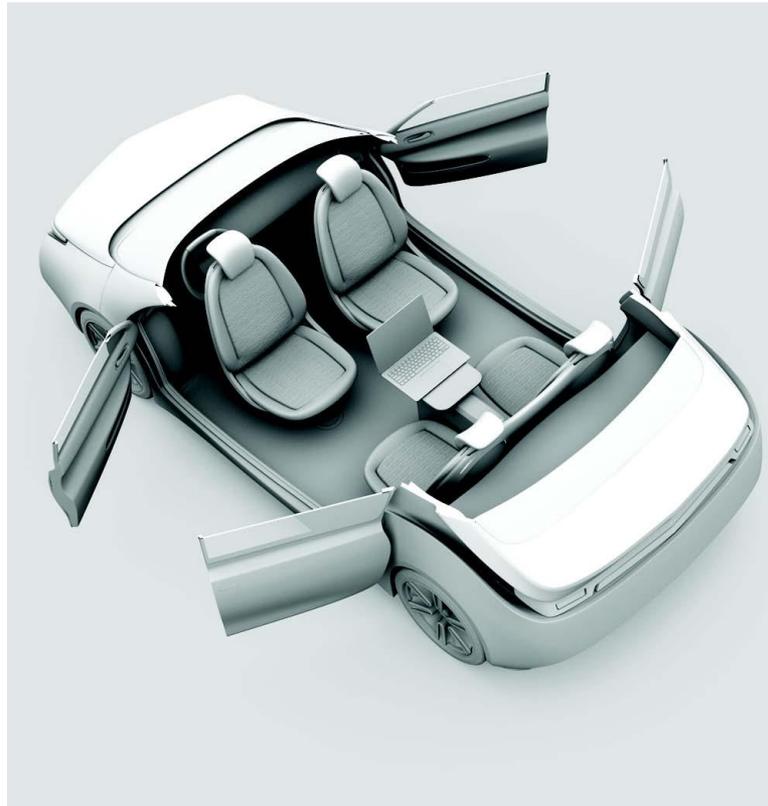


Source: The Economist, 17 Sept 2016

# Google



**No wheels, no brake, no gas  
pedal & no gas**



**No steering wheel, no gas pedal**



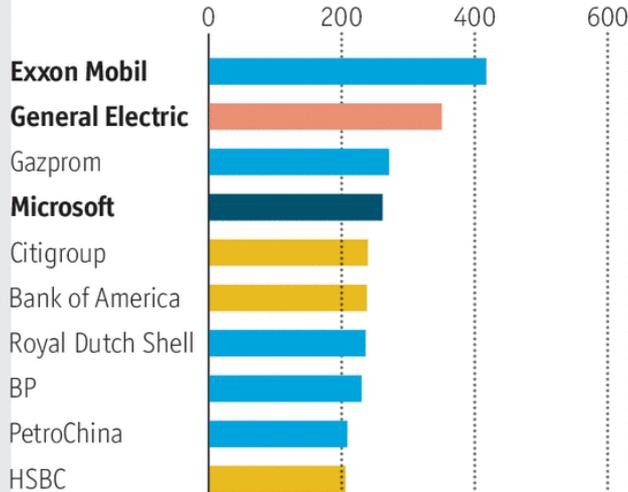
# A Virtual New World

## A virtually new world

World, largest listed companies by market capitalisation, \$bn

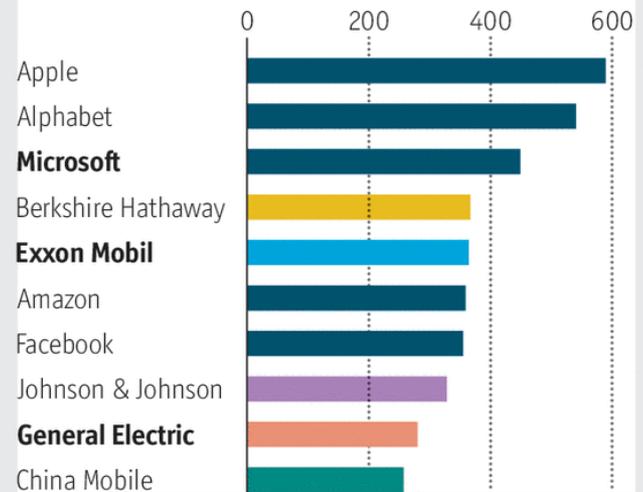
Sector: ■ Energy ■ Financials ■ Health care ■ Industrials ■ IT ■ Telecoms

End 2006



Source: Bloomberg

2016\*



\*At August 24th 2016

Economist.com

Source: The Economist, 17 Sept 2016

# Drivers of change?

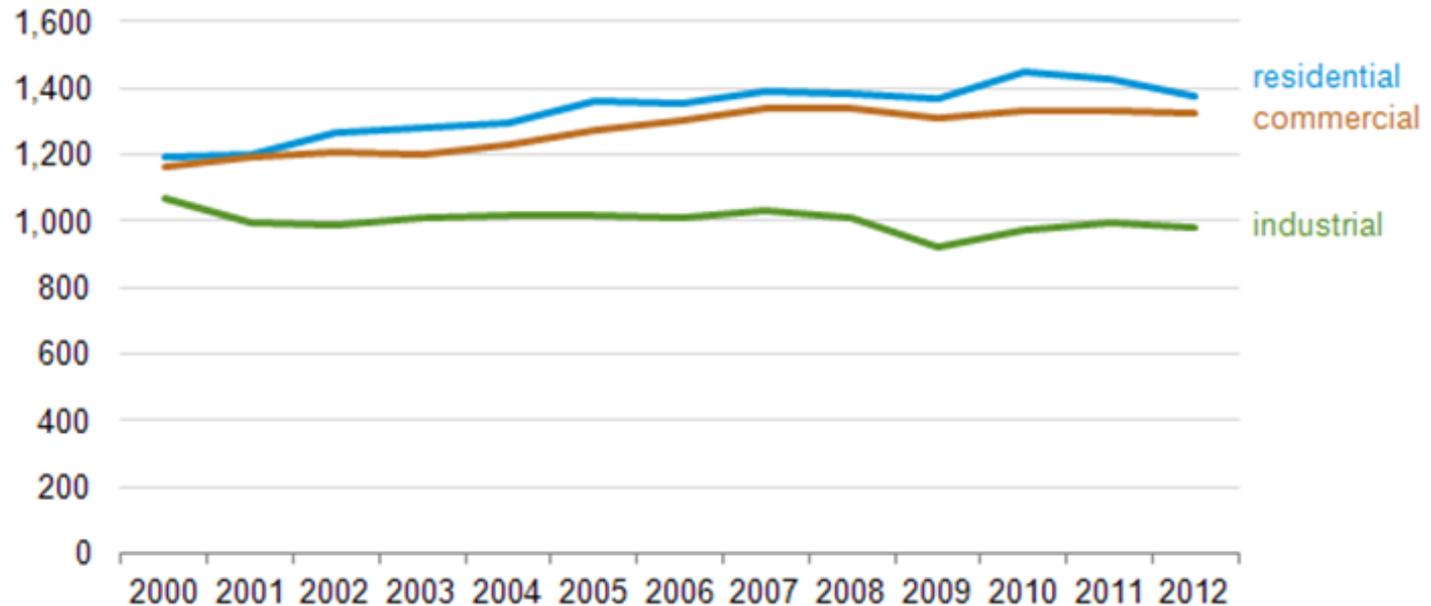
- ◆ Millennials: An entirely different species
- ◆ Shared economy, virtual enterprise
- ◆ Digitization & “third wave”
- ◆ Rise of renewables
  - Free electrons
- ◆ Re-inventing mobility
  - No driver, no wheel, no brake or gas pedal and **no gas!**
- ◆ COP21: Paris agreement is ratified
  - Phase out of fossil fuels & **“ethical” investing?**

# Future of demand?

Forget demand growth

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

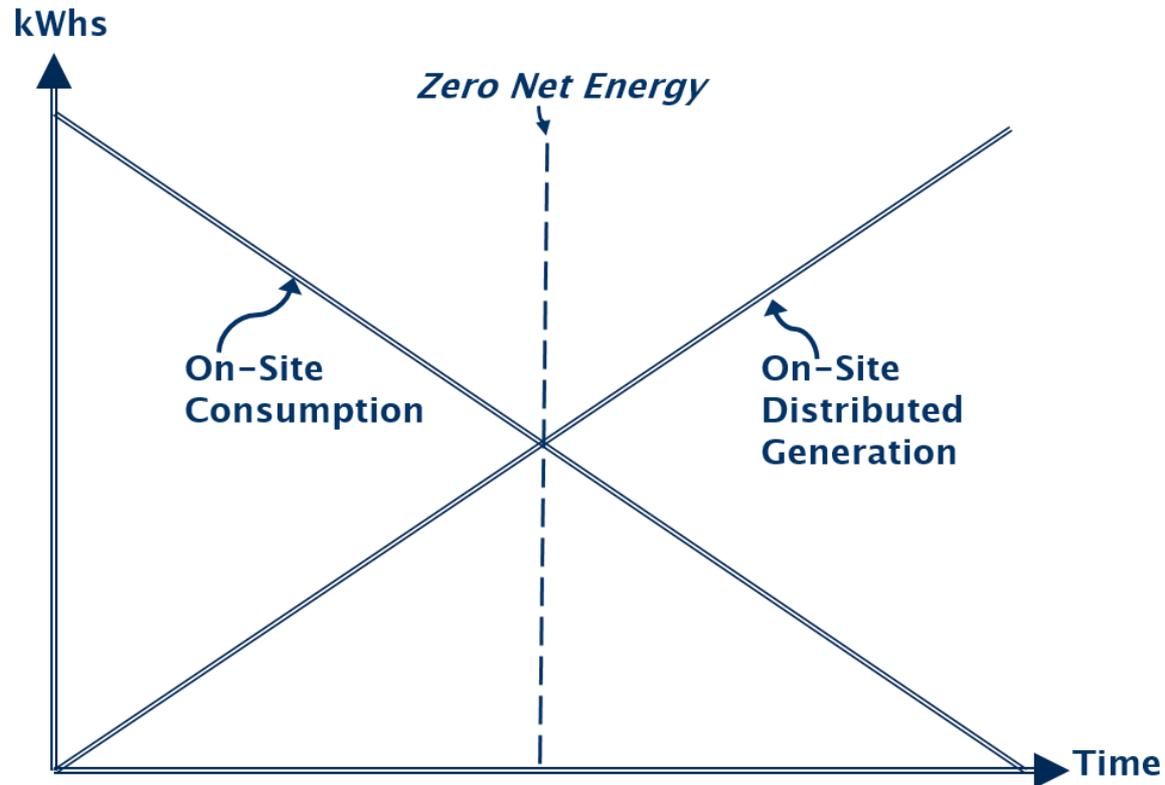
# Future of consumption?

One in 3 homes are solar in sunny suburbs of CA



# Zero Net Energy

Will apply to new residential buildings in CA starting 2020



# Not just for self-consumption



# Add solar hot water too



# Zero Net Energy

CA 2020 mandate for new residential, 2030 commercial



# ZNE Village

West Village, Univ. CA Davis



# Future is Zero Net Energy

Office parks, shopping malls, hospitals, universities, whole cities



Source: NREL

# Solar shading

Charge them from the sun



# Solar roofs

Makes no sense to build a roof and add solar panels



# Solar windows & side panels

Sun shines not just on the roofs



Source: Lawrence Berkeley National Laboratory's FLEXLAB

# Rooftop power generators

5 GW in CA and counting

**Residential Retrofit**



**New Production Homes**



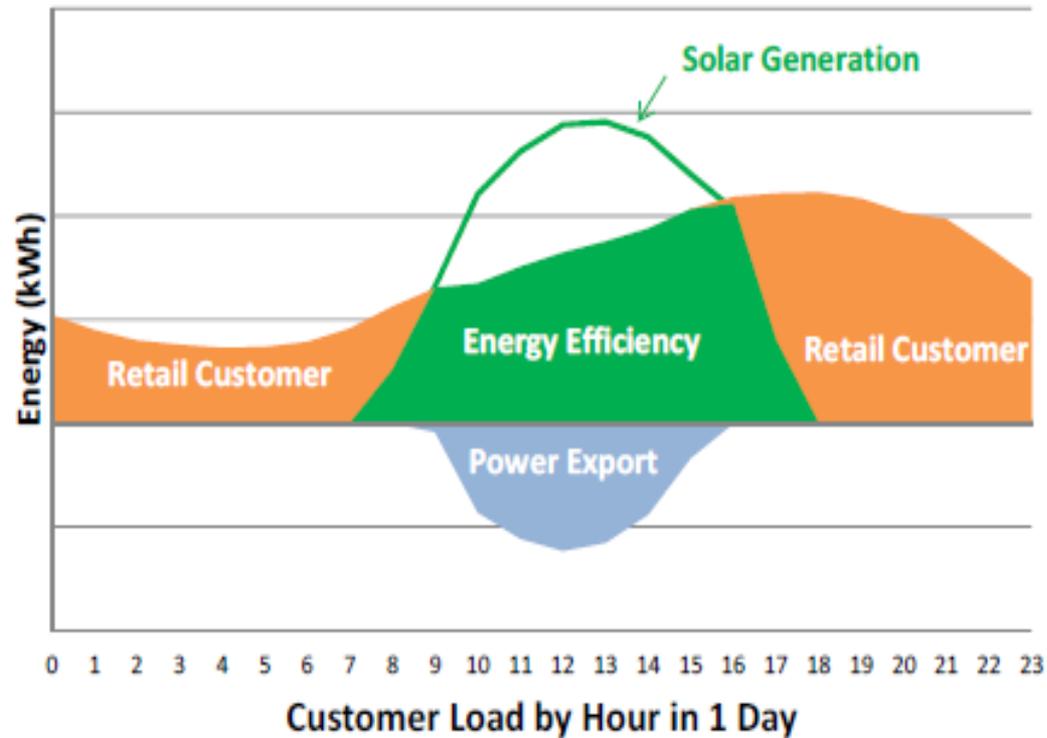
**Commercial & Public**



**Power Plants**



# Future of consumers? Prosumers



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

# Disruption: Solar leasing

An offer few customers can refuse



**Home Solar Rebates**

Lower Your Electric Bills By Going Solar!

Before	After
 <p>electricbill Account Summary Bill for 09/16/15 -\$314.23 Payment Received 09/20/15 -\$314.23 Bill for 10/16/15 -\$303.91 Payment Received 10/19/15 -\$303.91</p> <p>Monthly Bill <b>\$303.89</b></p>	 <p>electricbill Account Summary Bill for 09/16/15 -\$30.15 Payment Received 09/20/15 -\$30.15 Bill for 10/16/15 -\$26.55 Payment Received 10/19/15 -\$26.55</p> <p>Monthly Bill <b>\$69.10</b></p>

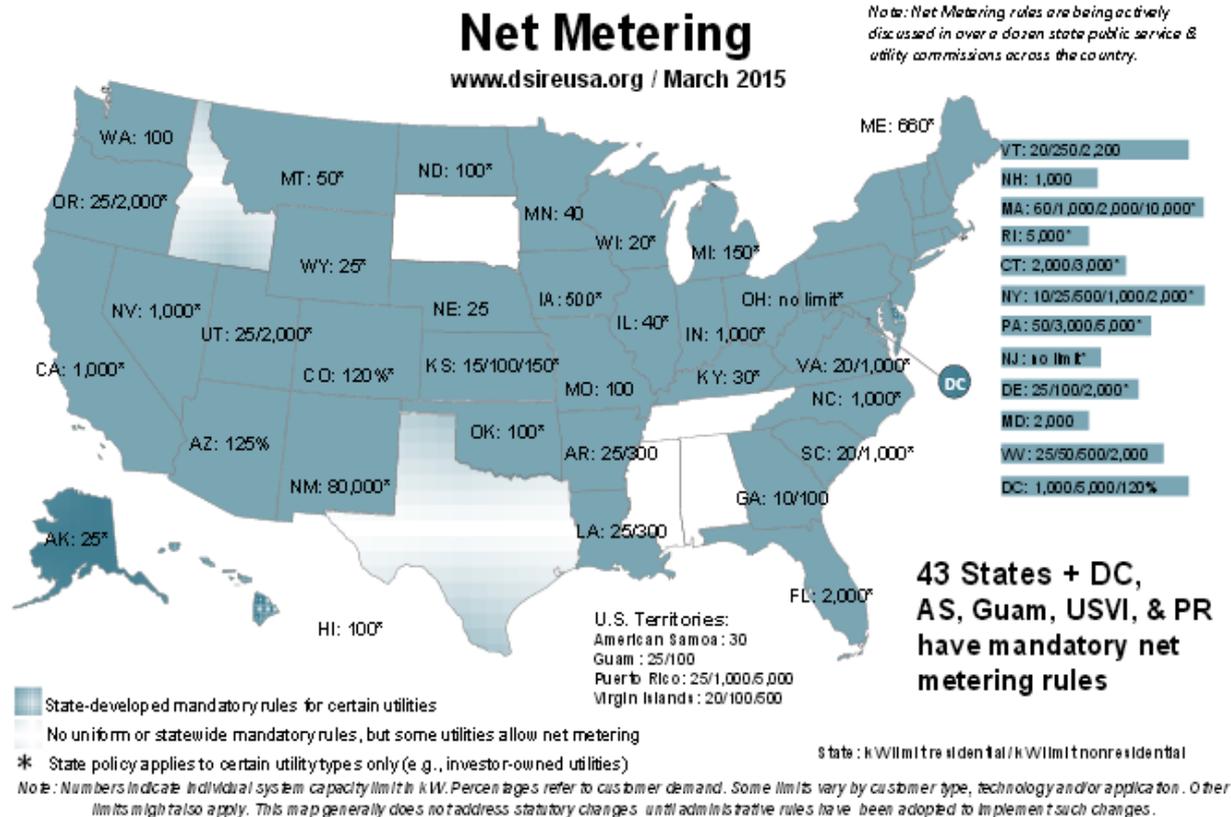
**Find out how much you can save today!**

- ✔ Limited-Time 2015 Solar Rebates Available Now
- ✔ \$0 Down Leasing for Qualified Homeowners
- ✔ Protect Against Rising Energy Costs

[Click Here For FREE Quotes](#)

# Net Energy Metering (NEM)

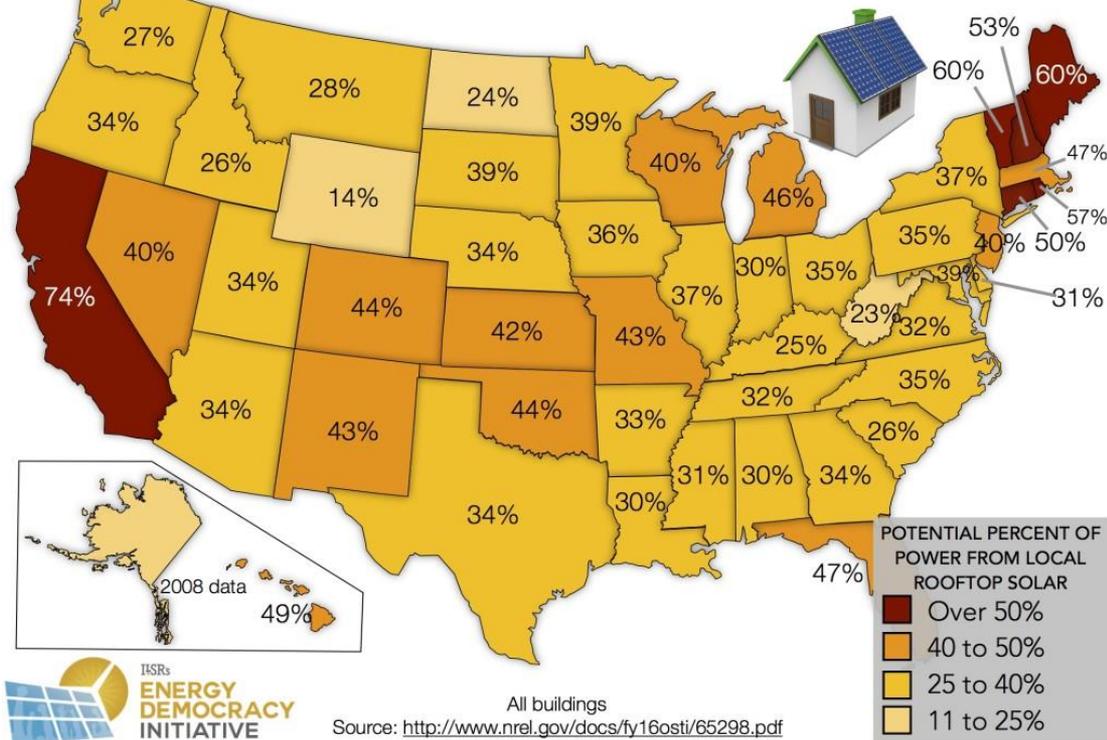
Current net energy metering schemes, subject to change w/o notice



Source: Database of State Incentives for Renewables & Efficiency (DSIRE)

# Rooftop energy

## ROOFTOP SOLAR POTENTIAL 2016



Source: John Farrell, Institute for Local Self-Reliance

# What comes after posumer?

## Prosumager



Source: The Wall Street Journal 2 May 2015

# Tesla's gigafactory

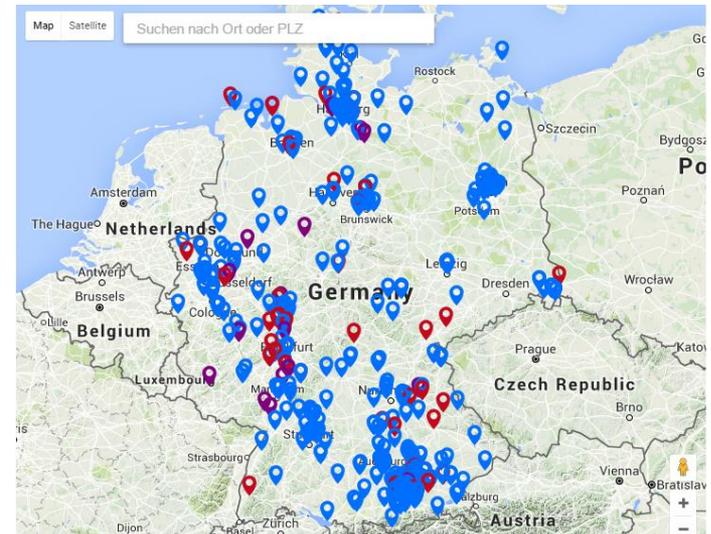
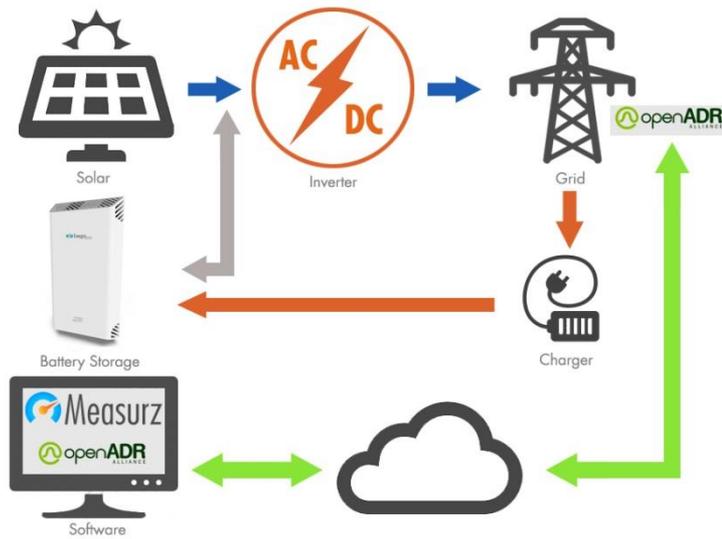


# Tesla Car



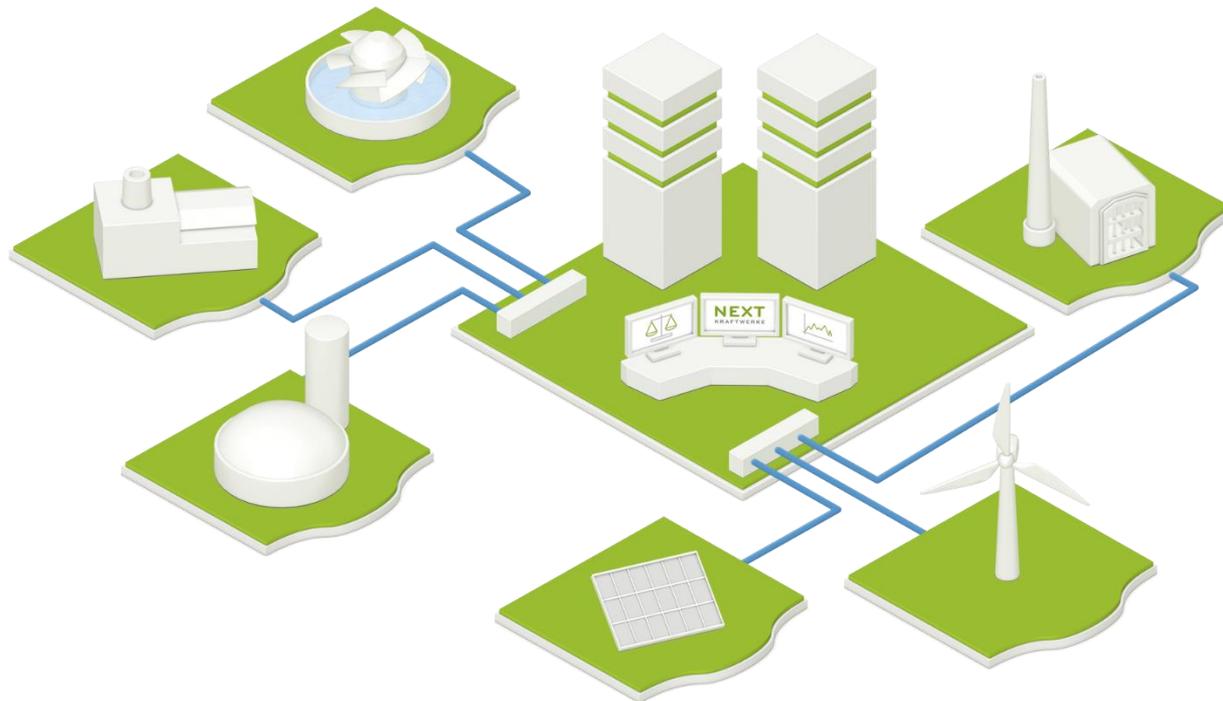
Source: CAISO Discussion of Markets, Mark Rothleder, 3 June 2014

# Prosumager



# Virtual utilities

## Germany's Next Kraftwerke shows the future



Source: Next Kraftwerke

# Future of utilities?

RWE: Desperate times; desperate measures



# New electric company: Your home

Wall Street Journal 21 Jan 2015





# Big customer, no revenues

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



# Future of regulation?

Reading the regulator's mind



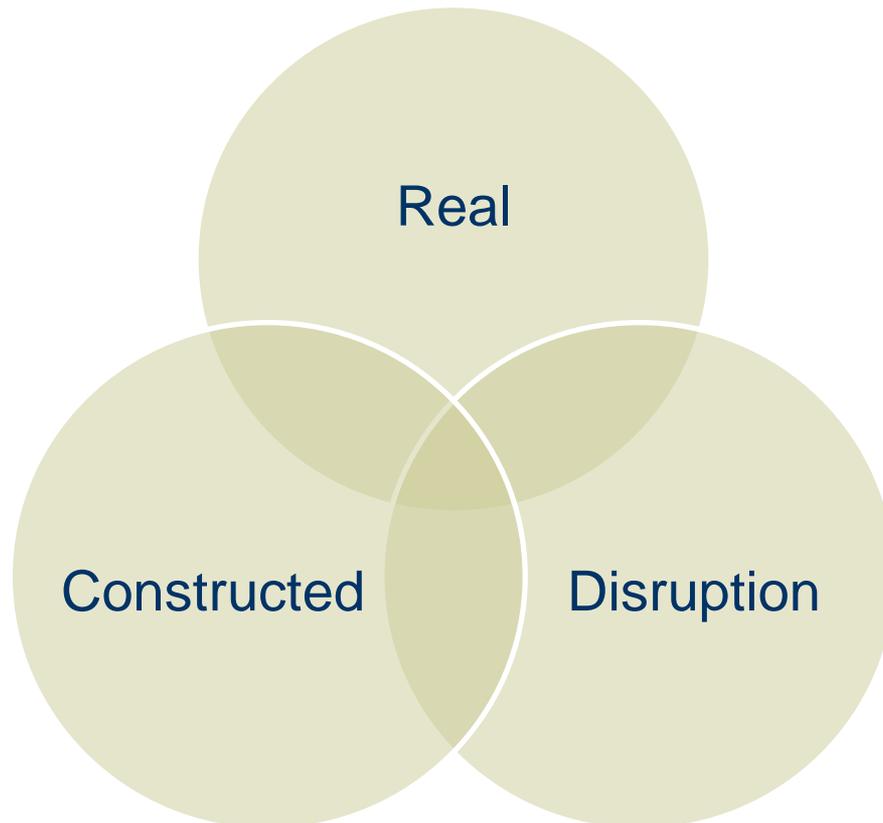
# Energy is political

Gavin Newsom

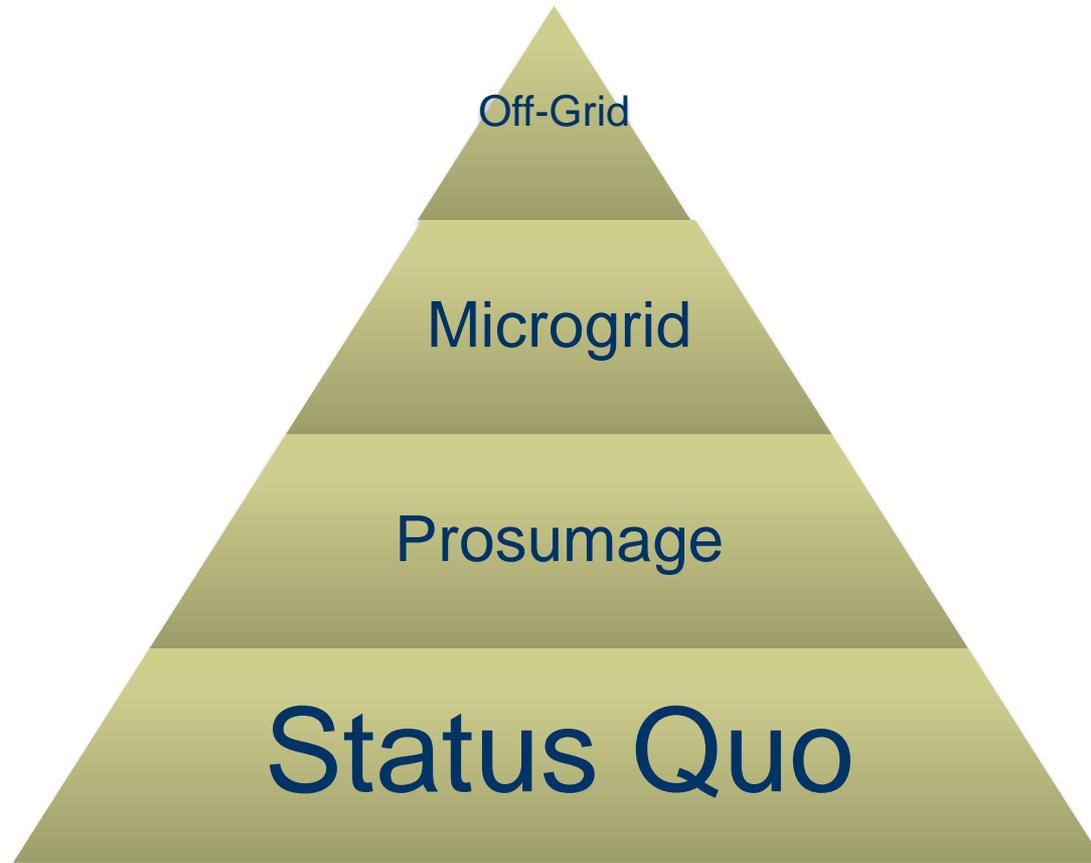


# Outcome?

Confluence of 3 factors



# Customer pyramid



# Relevance to Mexico?

- ◆ Much of this may be coming
  - Perhaps sooner than you may think
- ◆ Mexico's energy reforms?
- ◆ Mexico's new electricity market?
- ◆ Mexico's new politics?

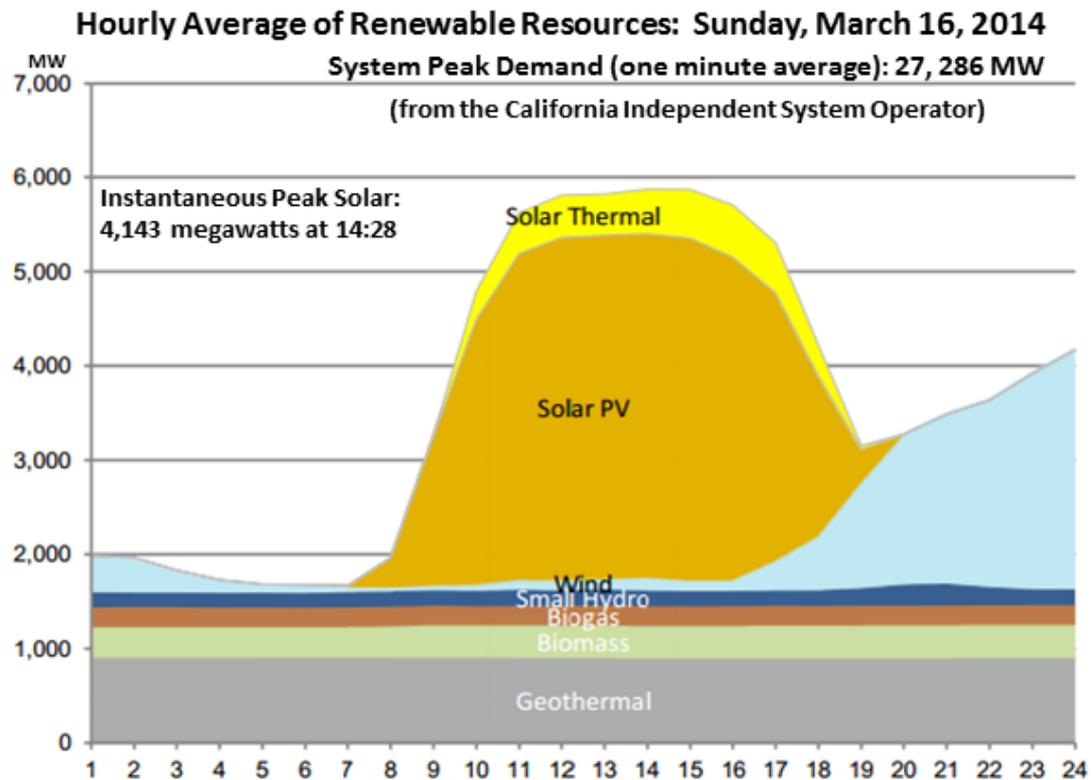


# Thank you

- ◆ Questions?

# Mid-day sun = “over-generation”

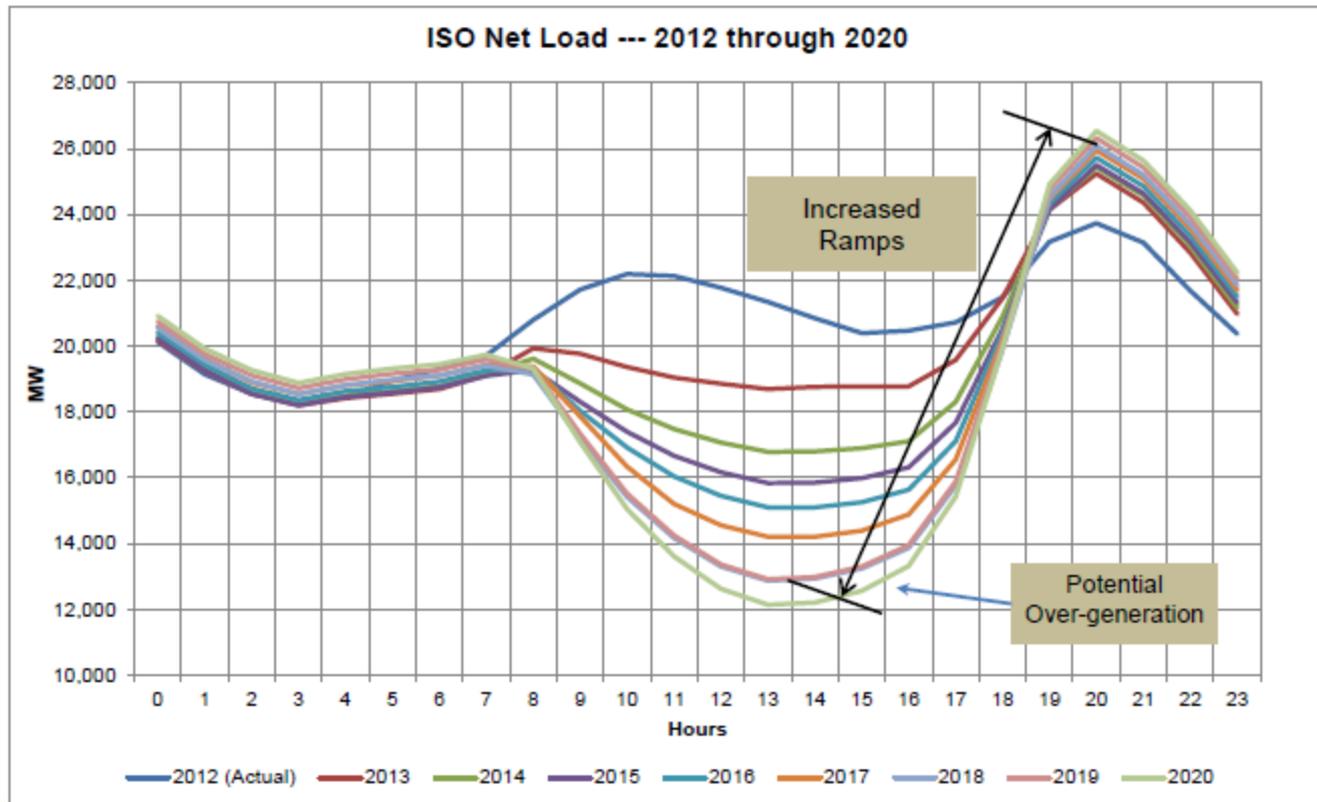
In many networks mid-day peaks have disappeared



Source: ISO

# CA Duck curve

ISO's net load projection for 2012 through 2020



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

# CAISO

Is this a dispatch center or weather forecasting station?



Source: CAISO