The future of utilities: Utilities of the future

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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 1st 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 virtually new world

World's largest listed companies by market capitalisation, $bn

<table>
<thead>
<tr>
<th>Sector</th>
<th>Energy</th>
<th>Financials</th>
<th>Health care</th>
<th>Industrials</th>
<th>IT</th>
<th>Telecoms</th>
</tr>
</thead>
</table>

**End 2006**

- Exxon Mobil
- General Electric
- Gazprom
- Microsoft
- Citigroup
- Bank of America
- Royal Dutch Shell
- BP
- PetroChina
- HSBC

**2016***

- Apple
- Alphabet
- Microsoft
- Berkshire Hathaway
- Exxon Mobil
- Amazon
- Facebook
- Johnson & Johnson
- General Electric
- China Mobile

Source: Bloomberg

*At August 24th 2016

Source: The Economist, 17 Sept 2016
Drivers of change?

- Millenials: 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

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

Zero Net Energy
On-Site Consumption
On-Site Distributed Generation

kWhs

Time
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
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

Lower Your Electric Bills By Going Solar!

Before
- Account Summary
- Monthly Bill $303.89

After
- Account Summary
- Monthly Bill $69.10

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

All buildings

Source: http://www.nrel.gov/docs/fy16osti/65236.pdf
What comes after posumer?

Prosumager

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

- Real
- Constructed
- Disruption
Customer pyramid

- Status Quo
- Prosumage
- Microgrid
- Off-Grid
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

Hourly Average of Renewable Resources: Sunday, March 16, 2014
System Peak Demand (one minute average): 27,286 MW
(from the California Independent System Operator)

Instantaneous Peak Solar: 4,143 megawatts at 14:28

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