

Behind & Beyond the Meter

AEMC Symposium

29 Aug 2019

Sydney, NSW

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San Francisco CA

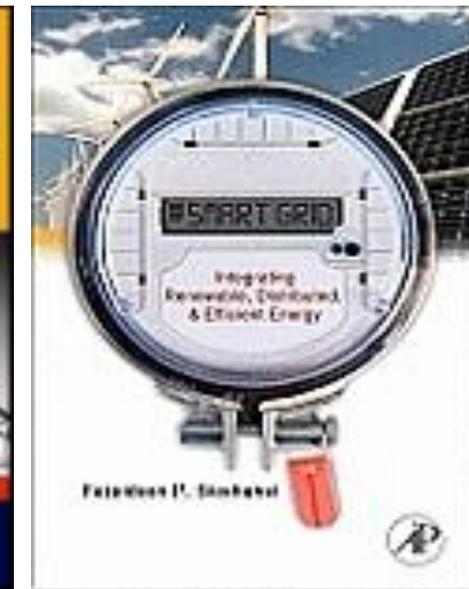
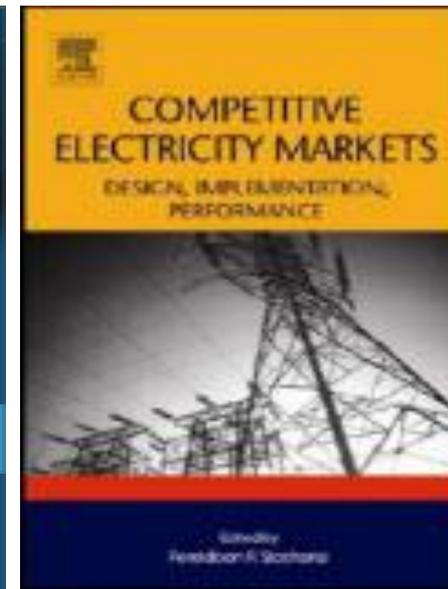
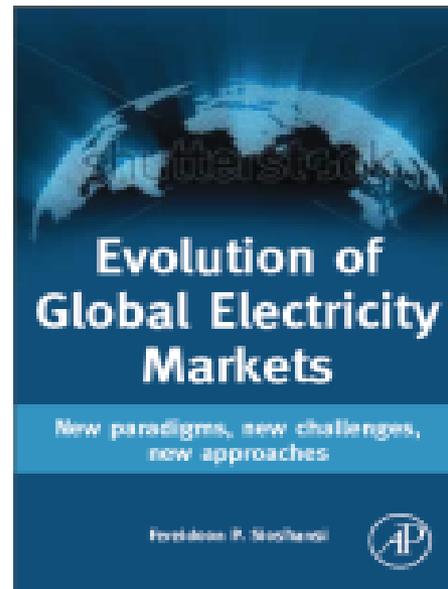
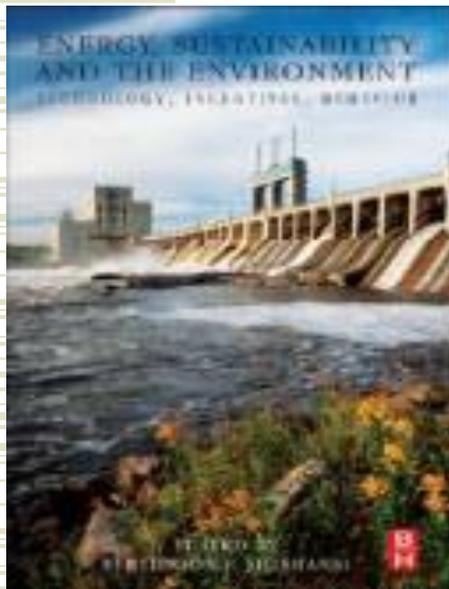
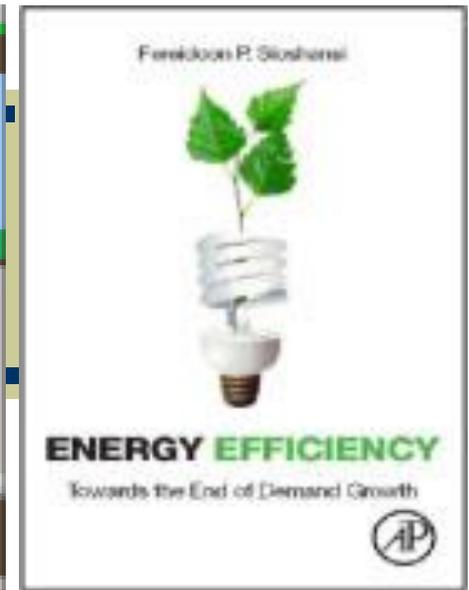
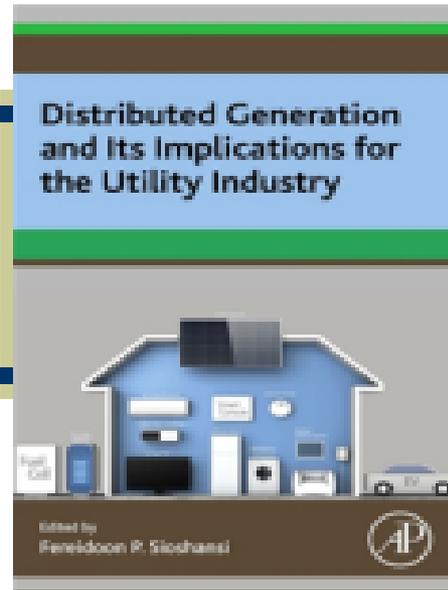
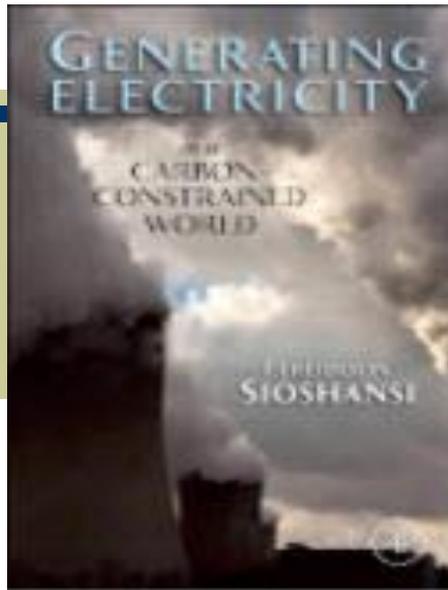
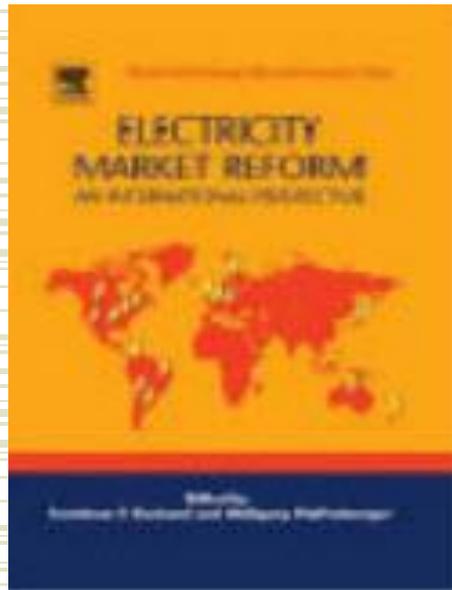
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Thank you

- ◆ To the organizers for making this possible
- ◆ To fellow speakers for contributing
- ◆ To attendees for participating
- ◆ Objectives
 - Share views, perspectives, experiences
 - Explore opportunities to collaborate
 - Discuss next steps

Outline

- ◆ Background on BTM book
- ◆ Set the stage
- ◆ Objective
 - Encourage active participation/dialogue
 - Keep to schedule



Consumer, Prosumer, Prosumager

How service innovations will
disrupt the utility business model



Edited by
Fereidoon Sioshansi



BEHIND AND BEYOND THE METER

DIGITALIZATION, AGGREGATION,
OPTIMIZATION, MONETIZATION



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Menlo Energy Economics
San Francisco, CA, USA



Symposia

- ◆ Four major ones focused on BTM
 - Florence, Italy 15 Feb
 - Silicon Valley, CA 26 Feb
 - Sydney, NSW 29 Aug
 - Schönau, SW Germany 23 Sept
- ◆ Few others partially focused on BTM
 - Micro-grids, Crete 22-23 May
 - Micro-grids, Ft. Collins, CO 10-12 Aug
- ◆ Other collaborative exchanges
 - ◆ Oxford, MIT

Questions

- ◆ What is behind-the-meter & why does it matter?
- ◆ How can individuals or communities be aggregated?
- ◆ Role of intelligent intermediaries or “orchestrators”
- ◆ What are key enabling technologies?
- ◆ How can value be created BTM?
- ◆ Transactive energy, P2P trading, VPPs
- ◆ Customer value, behavior & capacity to choose/decide
- ◆ Tariffs & BTM governance
- ◆ Network regulation & efficient BTM investment
- ◆ What’s in it for customers, for the network , for society

What is BTM?

- ◆ Potentially all **energy** using devices
 - Lights, HVAC, washers/dryers, electronics, pumps, motors
 - Natural gas assets replaced by all-electric
- ◆ Distributed generation
 - Rooftop solar PVs, ground-source heat pumps, other
- ◆ EVs
 - Charging (G2V) &/or discharging (V2G)
- ◆ Distributed storage
 - Batteries, hot/cold water tanks, other storage media

What is driving BTM?

- ◆ Mandates
- ◆ Markets
- ◆ Enabling technology
- ◆ Cost/economics
- ◆ Inefficient tariffs
- ◆ Disruptions
- ◆ Supportive/discouraging regulations

No gas hookups in Berkeley

Starting 2020 no more gas hookups allowed



You want a building permit?

Mayor of Lancaster, CA: 2 Watts per sq. ft.



Source: <https://www.eenews.net/stories/1059977514>

How many Powerwalls?

CA leads the way



Source: PG&E Blackout Plan Energizes Rivals, The Wall Street Journal, 16 Jul 2019
<https://www.wsj.com/articles/pg-e-braces-for-power-cuts-and-rival-providers-see-an-opening-11563193150>

Window with IP address?

Does that count as BTM asset



Rooftop power plants

Definitely BTM



Dawn of perpetual motion machine?

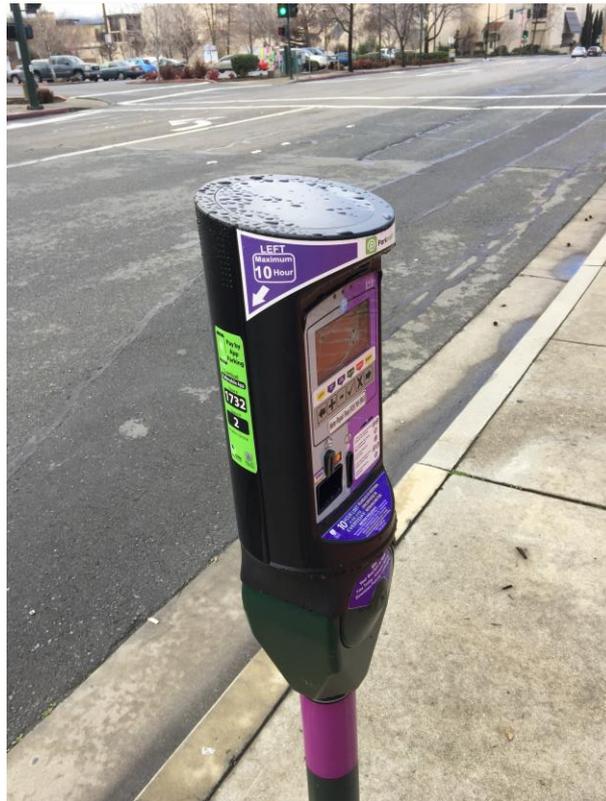
- ◆ Technology increasingly allows self-generation, storage & consumption w minimal reliance on the network
- ◆ Next: P2P trading?



Stand-alone light pole



Stand-alone parking meter



Generate & store where you use

Self-contained bus stop in Zaragoza, Spain



Source: Onyx Solar newsletter, Nov 2018

Charge it from the sun

BTM?



Free solar EV charger



EV charging

No network?



House boat



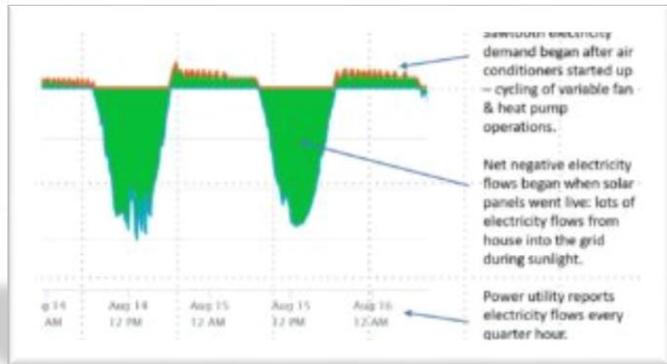
Ben Schlesinger's ZNE home

- ◆ Goal: Affordable low carbon lifestyle
 - Ground source heat pump
 - 18 kW of rooftop solar
 - 3 Tesla Powerwall batteries
 - 2 Tesla EVs
 - Plus thousands in HVAC, lighting, appliances
- ◆ Charge EVs from the sun
- ◆ More on website <http://bsaenergy.com/wordpress1/>



What makes it ZNE?



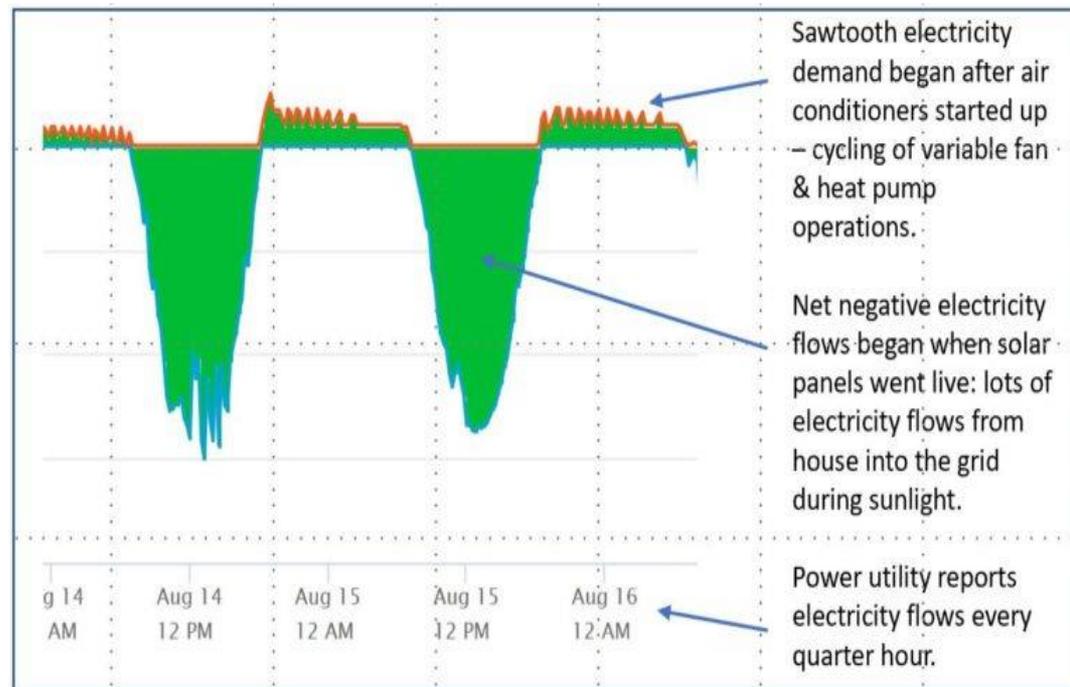


2 Teslas & 3 Powerwalls



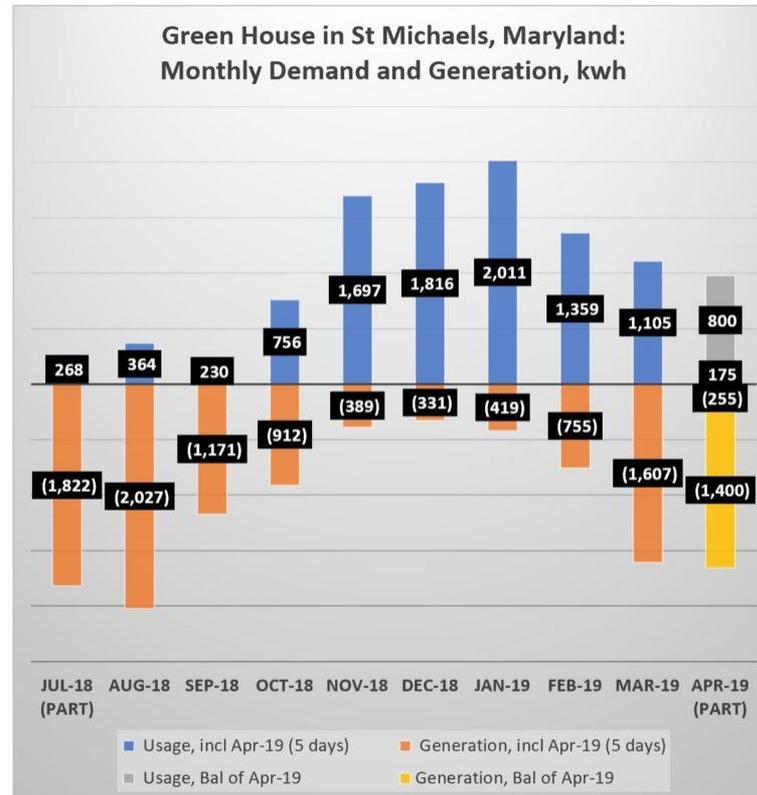
Beyond ZNE

Net load centers



Source: <http://bsaenergy.com/wordpress1/>

Prosumer most of the time



Source: Choptank Electric Cooperative

New electric company: Your home

Wall Street Journal 21 Jan 2015

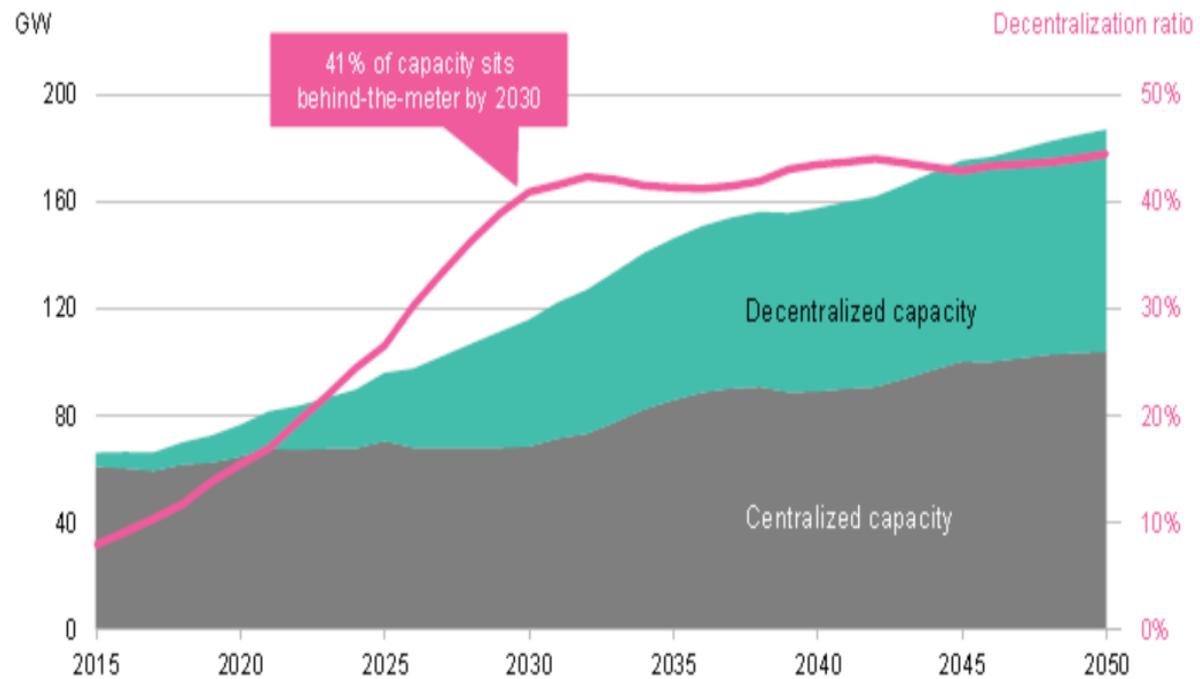


Totally off grid “nonsumer”



Source: Off Grid Electric

2+ million Australian solar roofs



Source: Annabel Wilton, BNEF, presented at Australian Clean Energy Summit, Sydney, July 2018

Mike Swanston may explain?

- ◆ Why 2 m in a country of 25 m?
- ◆ What is driving consumers to become prosumers?
- ◆ What does so many PVs do the network?
- ◆ What are the equity/subsidy implications?
 - Who is subsidizing whom?
- ◆ What about storage & EVs?
- ◆ What new business models?
- ◆ What is the reaction of suppliers?
- ◆ What is the role of regulators?

It is already happening

Sales not same as consumption

- ◆ CEC's 2030 demand forecast for California, GWhs

| | <u>2018</u> | <u>2030</u> |
|-------------|-------------|-------------|
| Consumption | 260,000 | 340,000 |
| Sales | 260,000 | 290,000 |

P2P trading?

Any solar roof can be an EV charging point



Integrated?

Tesla energy: Generation, storage, consumption + mobility



Source: Tesla unveils residential solar roof and new Powerwall battery, Utility Dive, 28 Oct 2016

Major trends ...

- ◆ Balance of power ...
 - ... shifting to **consumers**
- ◆ Future of electricity ...
 - ... is **behind-the-meter** as both mechanics & economics of consumption, generation & storage is radically altered
- ◆ Innovation ...
 - ... leads to **disruption** with emergence of intelligent aggregators & platforms allowing P2P trading, VPPs, etc.
- ◆ ... using an outdated T&D infrastructure

Today's agenda

- ◆ Mountain BTM prospects: do prices matter?
- ◆ Cormack Title
- ◆ Swanston What's in it for customers?
- ◆ Shaw-Williams Potential & perils of HEMS
- ◆ Kuiper BTM Governance
- ◆ Ryan Digital platforms to enable BTM service
- ◆ Mouchaileh Consumers exchanging value with the grid
- ◆ Rai & Chai SAPS
- ◆ Jamason Consumer choice & DG control
- ◆ Nelson & Sioshansi Wrap up