

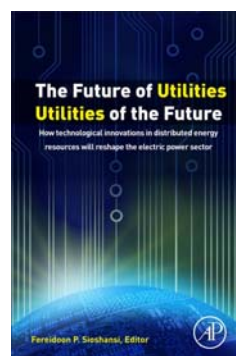
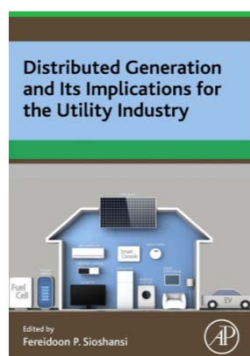
How product & service innovation lead to disruption

3rd International Hybrid Power Systems Workshop

8-9 May 2018
Tenerife, Spain

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Background



Forthcoming book

Creative destruction:

“Innovation sustains growth by destroying old business models”

Joseph Schumpeter

- ♦ My focus: How innovation leads to service disruption
- ♦ In particular: “customer stratification”
 - Consumer => prosumer => prosumager => “nonsumer”
- ♦ How/why such a scenario may materialize?
- ♦ Implications for regulated distribution utilities
- ♦ Eventual fate of distribution “network” & the “grid”
- ♦ Hopefully makes sense in “hybrid power systems workshop”

New electric company: Your home

Wall Street Journal 21 Jan 2015



Disrupters hard at work or hardly working?



Source: <http://www.yeloha.com/about>

Disrupter's business plan

- ♦ Gather bunch of smart, young innovators
- ♦ Funding from VC or similar
 - Look for inefficient, protected monopolies
 - Introduce superior service/lower cost
 - Disrupt stodgy, lethargic incumbents
 - Become a billionaire by age 30
 - Give away all & retire
- ♦ Think Uber!

Many focused on ...

- ◆ “Integrated energy services”
 - Start w a ZNE building or collection of buildings
 - Add distributed generation
 - BIPVs & “energy augmentation”
 - Add sophisticated energy management system
 - Add intelligent storage, not just batteries
 - Allow P2P trading on platforms/transactive energy
 - Aggregate, balance load & generation
- ◆ Manage & monetize the entire value chain

Integrated services?

Tesla energy: PVs, EVs & storage



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

Pieces of puzzle in place

Tesla's Powerwall and "prosumager"



Source: The Wall Street Journal 2 May 2015

Distributed storage

Tesla's \$5 billion gigafactory near Reno, NV



ZNE house: Not rocket science

CA 2020 mandate for new residential, 2030 commercial



ZNE village: Ditto

West Village, Univ. CA Davis



ZNE campus: Why not?

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



Source: NREL

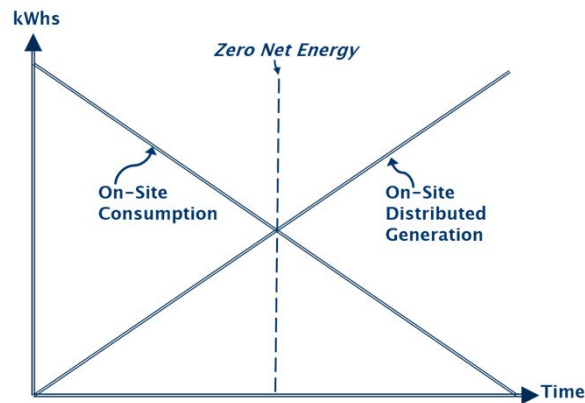
ZNE office

Apple's new headquarter going beyond ZNE



Zero Net Energy

Will apply to new residential buildings in CA starting 2020



Beyond ZNE: Solar ordinance

City of Lancaster, CA: 2 W per sq. ft. living space



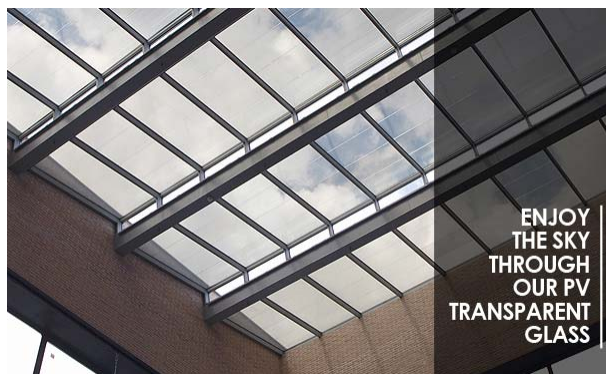
Distributed solar

700,000 solar homes in CA



BIPVs

Turning exteriors of buildings into powerhouses



Source: Onyx

BIPVs

Entire surface of buildings generates power



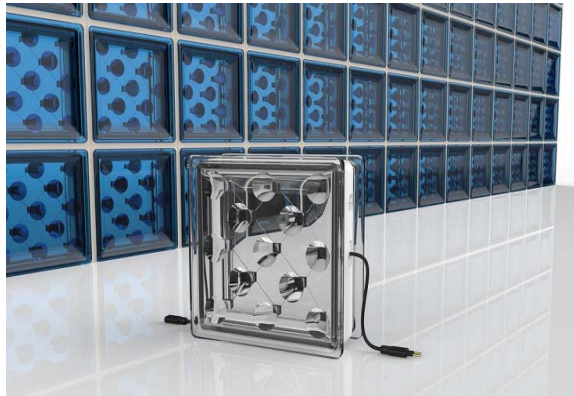
Source: Skanska

Solar tiles

In any color you like



Solar Block



Source: Univ. of Exeter

Solar window

Clearly electric



Source: solarwindow.com

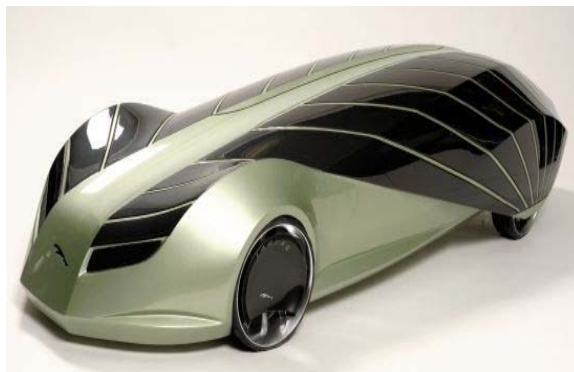
Solar car

Run on equivalent of a toaster



Source: RenewEconomy showing Univ. of Adelaide entry in solar race

Solar “augmentation”



Jaguar solar concept car, *The Energy Post*, 26 Oct 2017

Buckingham Palace



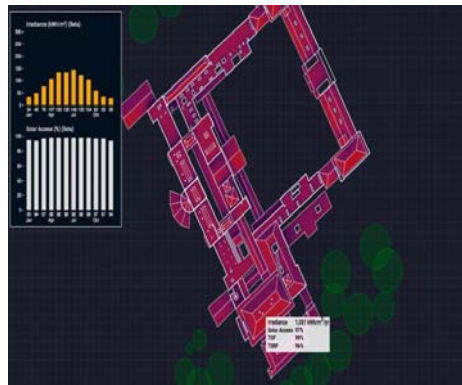
Source: Aurora Solar

Solar fit for the queen



Source: Aurora Solar

Optimally designed



Source: Aurora Solar

Portable solar



Source: SolarPad.com

End of regulated bundled tariffs?

- ♦ Key point:
 - Consumers have multiple options
- ♦ Will self-select based on
 - Retail tariffs
 - Regulations/policy
 - Product & service innovation
- ♦ This leads to “stratification”


What is there not to like?

High tiered tariffs, zero money down, generous NEM, lots of sun



Home Solar Rebates

Lower Your Electric Bills By Going Solar!

Before	After
 <p>Monthly Bill \$303.89</p>	 <p>Monthly Bill \$69.10</p>

Find out how much you can save today!

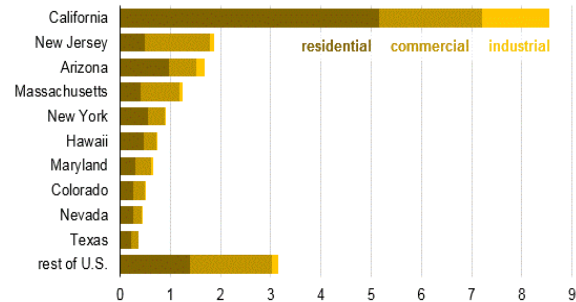
- ✓ Limited-Time 2015 Solar Rebates Available Now
- ✓ \$0 Down Leasing for Qualified Homeowners
- ✓ Protect Against Rising Energy Costs

[Click Here For FREE Quotes](#)

Guess why California leads?

High & tiered retail tariffs, NEM + ample sunshine

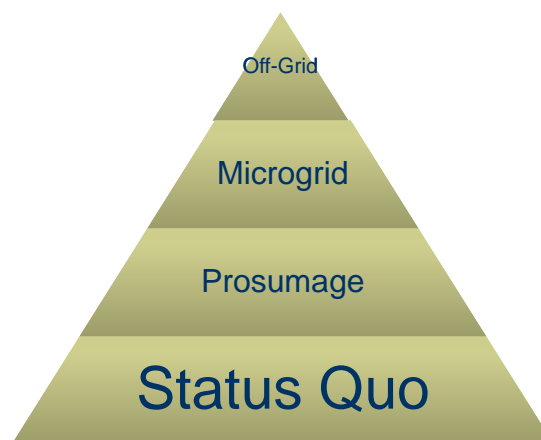
Estimated small-scale solar photovoltaic generation by state, 2016
billion kilowatthours



Source: Energy Information Administration, [Electric Power Monthly](#)

Customer stratification

Over time, consumers will self-select what works best



New interface/relationships

Different needs/different cost causalities

- Consumers** Content with status quo: Bundled, regulated tariffs
ALL kWhs provided by/thru existing network
Maintain existing relationship/interface/tariffs
- Prosumers** Take few/fewer *net* kWhs from network
Require different pricing/service relationship
- Prosumagers** Ditto, but even more so
Radically different pricing/service/interface relationship
- More exotic?** Service aggregated/enabled/assisted by intermediaries
Semi-autonomous micro-grids
P2P trading & transactive energy
Integrated energy services

Who makes money in flower delivery business?

- ♦ **Not** the farmer who grows flowers in Kenya
- ♦ **Not** the airline that flies it to Europe/US
- ♦ **Not** the wholesaler or the auctioneer
- ♦ **Not** the distributor who delivers to shop
- ♦ **Not** the shop owner who arranges flowers
- ♦ **Not** the delivery man who drops it at door
- ♦ But the one who takes the order, collects money & manages delivery: Think Uber

Ditto for storage business

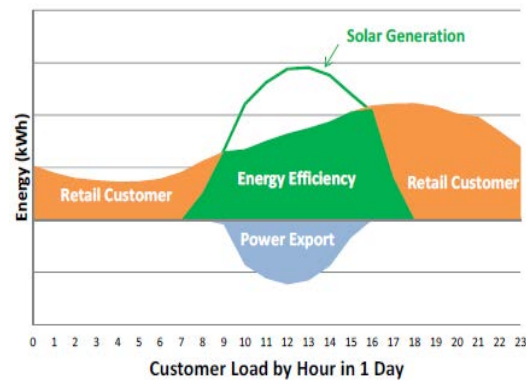
... or, for that matter any other business

- ♦ Not the battery manufacturer
- ♦ Not the distributor
- ♦ Not the installer
- ♦ But the company that
 - Aggregates storage capacity of many devices
 - Manages when & how much energy is stored
 - Manages when & how much is released
 - Monetizes & maximizes value along the value chain

New business, new business models

- ♦ First
 - Consumer => prosumer => prosumager
- ♦ Next
 - “Aggregators” & “intermediaries”
 - Platforms for trading & exchange
- ♦ New business, new business models

Consumer => Prosumer



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

Transactional energy?

Business models & enabling platforms are emerging daily



Sonnen's Project in Prescott, AZ

3,000 homes, 11.6 MW; 23 MWh



Source: <https://www.mapsofworld.com/usa/states/arizona/maps/arizona-state-map.jpg>

Flower analogy instructive

Where is the value in the value chain



Get demand to Tango with generation

German Next Kraftwerke: 3.4 GW; 4,824 participants



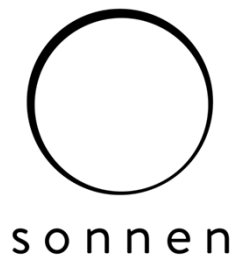
Source: <https://www.next-kraftwerke.com/wp-content/uploads/2015/09/Next-Kraftwerke-Building.jpg>

It takes two to Tango



Source: <https://www.cleanenergywire.org/sites/default/files/images/dossier/50-hertz-transmission-control-centre.jpg>

Who is in this space, today?



stem

Thank you

- ◆ Questions?