

Tapping Your Inner Futurist

The Future of Energy Services

Follow up Webinar

Garry Golden
March 19, 2015

Start

End



**IoT + Energy
Value Creation & Capture**

**Many Paths of
*Distributed Power***

Questions?

Baseline Future: 2015 – 2040

The Compliance Scenario



Independent Statistics & Analysis
U.S. Energy Information
Administration



International
Energy Agency

**The Future of U.S. Utility
Customer-Funded Energy
Efficiency Programs:**
Projected Spending & Savings through 2025

Report Summary
January 2013

Galen Barbose, Charles Goldman
Ian Hoffman, Megan Billingsley
Electricity Markets and Policy Group
Lawrence Berkeley National Laboratory

This work was supported by the National Electricity Delivery Division of the U.S. Department of Energy's Office of Electricity Delivery and Energy Reliability under Lawrence Berkeley National Laboratory Contract No. DE-AC02-05CH11231.

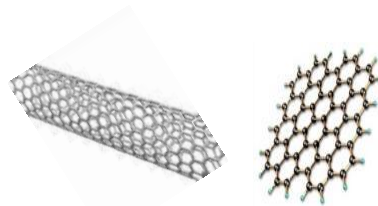
The logo for Lawrence Berkeley National Laboratory, featuring a stylized building icon above the text 'BERKELEY LAB' and 'Lawrence Berkeley National Laboratory' in a smaller font below it.

Alternative Future: 2015 – 2040

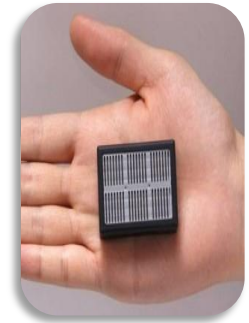
The Networked Scenario



**Outcomes &
Adaptive Design**



**Energy Products
via Nano-materials**



Does Distributed = Disruption?

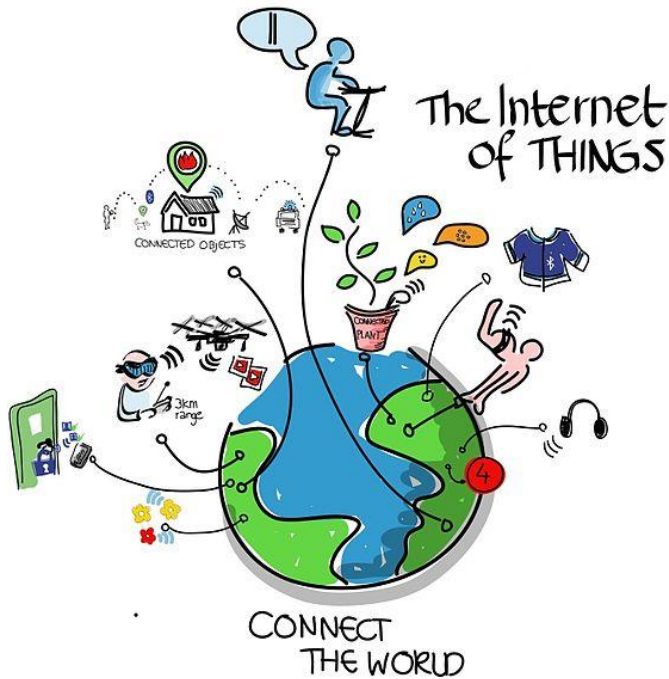
Output Customer Experience:
**Access to
Electricity Grid**



Outcomes Customer Experience:
**Managed Services
& Behavior Change Solutions**

Slow Pace of Fast Change.... IoT & Connected Devices

Internet of Things (IoT) = Confusion on Business Models



Uncertainties to Explore

- Forecast full impact on energy demand
- Regulatory framework
- Who creates value? (Benefit over cost)
Who captures it? (Business Model)
- What new players are capable of pushing utilities off value chain?

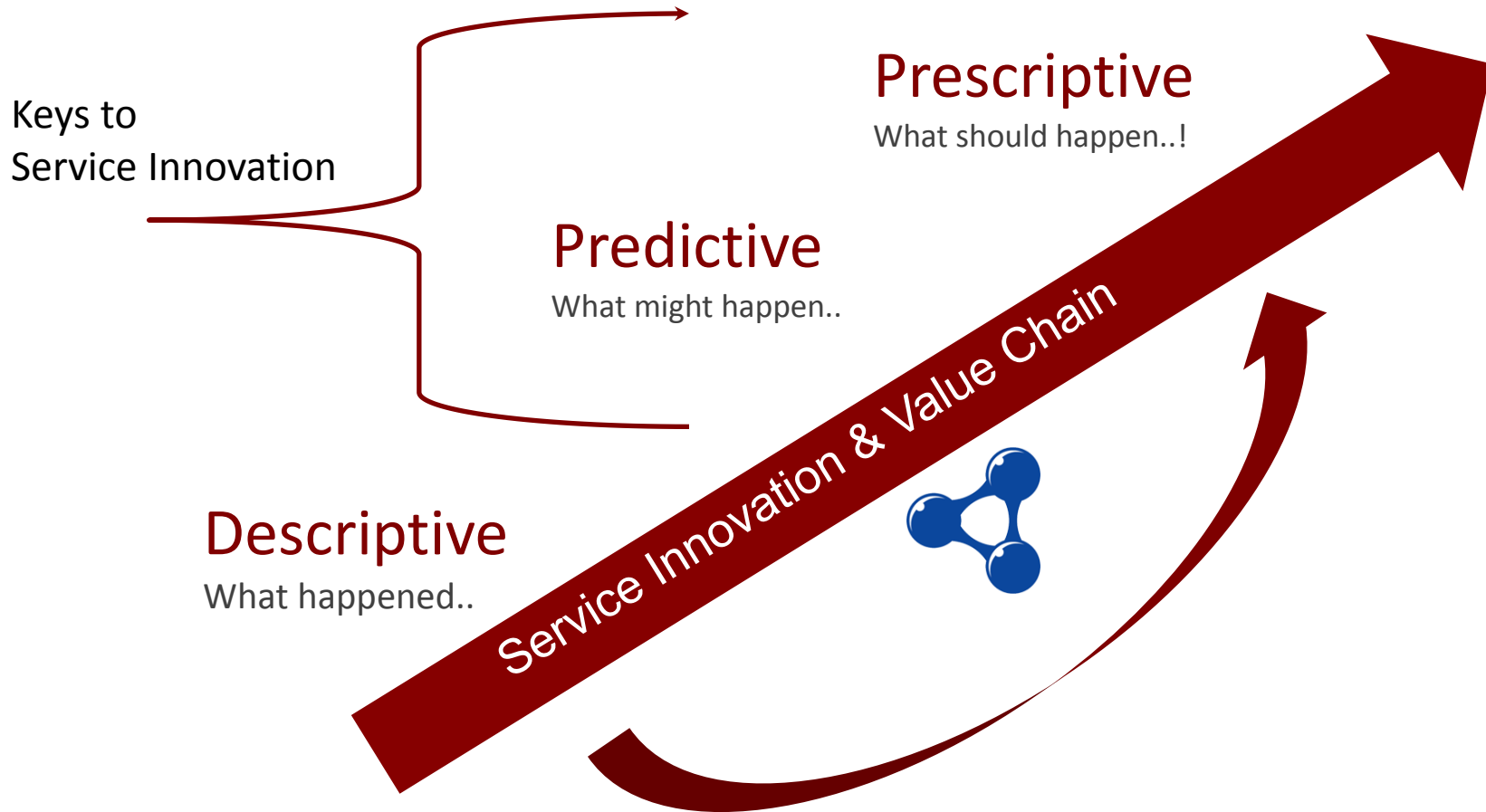
THE INTERNET OF THINGS REQUIRES A MINDSET SHIFT

Because you'll create and capture value differently.

		TRADITIONAL PRODUCT MINDSET	INTERNET OF THINGS MINDSET
VALUE CREATION	Customer needs	Solve for existing needs and lifestyle in a reactive manner	Address real-time and emergent needs in a predictive manner
	Offering	Stand alone product that becomes obsolete over time	Product refreshes through over-the-air updates and has synergy value
	Role of data	Single point data is used for future product requirements	Information convergence creates the experience for current products and enables services
VALUE CAPTURE	Path to profit	Sell the next product or device	Enable recurring revenue
	Control points	Potentially includes commodity advantages, IP ownership, & brand	Adds personalization and context; network effects between products
	Capability development	Leverage core competencies, existing resources & processes	Understand how other ecosystem partners make money

Utility Pathway:

Efficiency Gains via Behavior Change & Managed Services



Utility Pathway:

Platform or Trust Gateway via IoT Energy + Crypto Applications

Emerging Signal: *Blockchain* as distributed authentication database for IoT

IBM Reveals Proof of Concept for Blockchain-Powered Internet of Things

Stan Higgins | Published on January 17, 2015 at 19:12 GMT

21 Inc., Secret Bitcoin Startup Raises \$116M In Latest Funding Round

By Luke Villapaz [@lukeydukey](#) [✉ l.villapaz@ibtimes.com](mailto:l.villapaz@ibtimes.com) on March 10 2015 12:23 PM EDT

Qualcomm's involvement could spur speculation that 21 has its sights on the so-called "Internet of Things." That's the idea that a myriad of smart, Internet-connected appliances will in the future communicate with servers, networks and each other to optimize their operation, maintenance and energy usage without direct human involvement.

What do we need to learn about...?

- Utility vs Company created *blockchains* to manage privacy concerns
- Utility vs Company created Smart Contracts for energy appliances (Smart contracts for maintenance, billing, marketing campaigns, behavior change rewards)
- Regulatory dynamics of acting vs not-acting

Slow Pace of Fast Change.... IoT & Connected Devices

Internet of Things (IoT) = Confusion on Business Models



IoT Business Models



Crypto-Blockchain

Related Links & Resources: www.garrygolden.com/aespwebinar/

IoT + Energy
Value Creation & Capture

**Many Paths of
*Distributed Power***

Questions?

End



Slow Pace of Fast Change: Distributed Generation

Is there 'Disruption' ahead with Distributed Power?

May 23, 2014, 11:45 A.M. ET

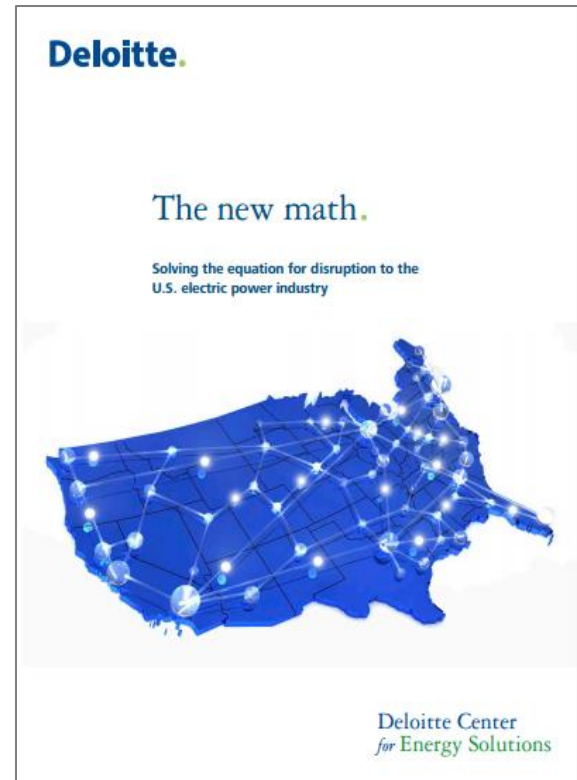
Barclays Downgrades Electric Utility Bonds, Sees Viable Solar Competition

On Rooftops, a Rival for Utilities

Solar panels north of Los Angeles. Power companies say such systems are draining away their customers and profits.

By DIANE CARDWELL

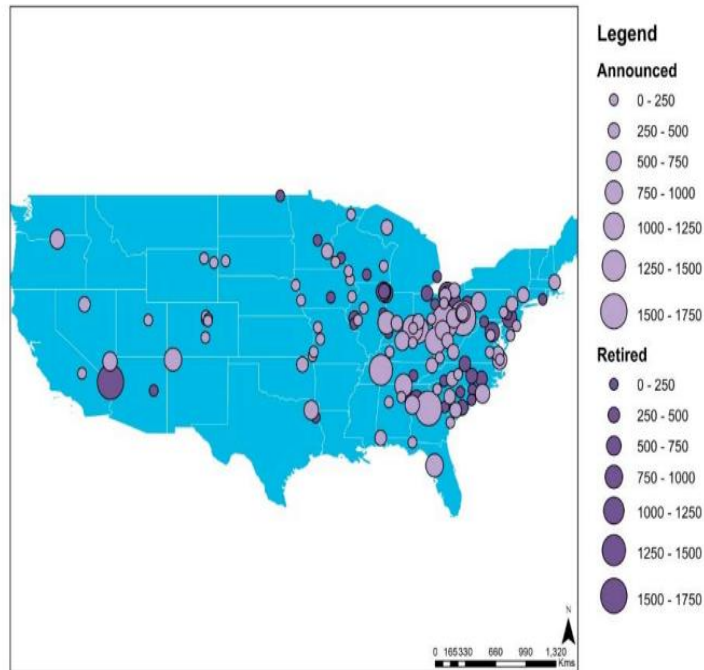
Published: July 26, 2013



Slow Pace of Fast Change: Distributed Generation

Is there 'Disruption' ahead with Distributed Power?

Figure 19: US coal power plant retirements completed and announced, 2011-2013



Source: Bloomberg New Energy Finance, ESRI, EIA Note: Includes capacity which has retired in 2011-13 or announced a date for retirement as of December 2013.

Key Uncertainties to Explore

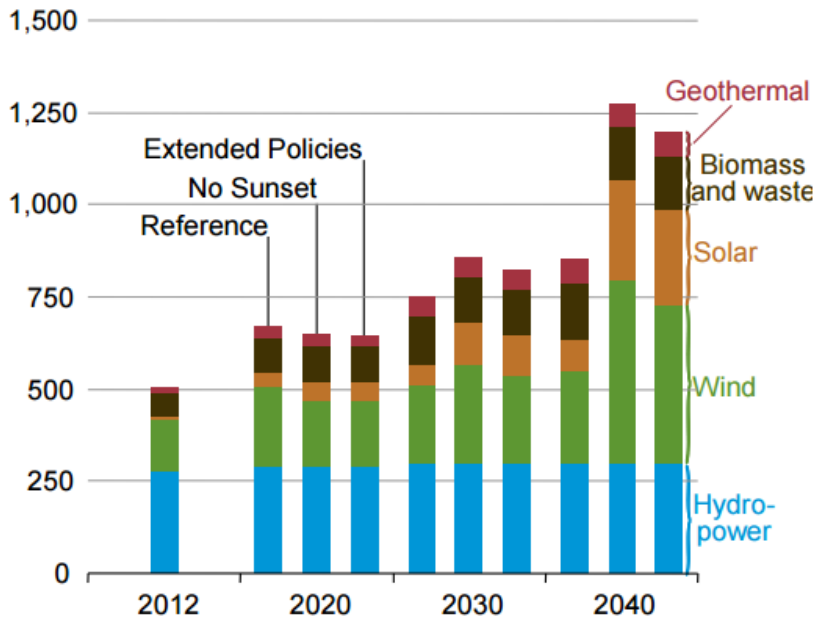
- Regulatory framework vs Market Opportunities
- Regional Dynamics
- DG for GHG Reduction vs Network Mgmt
- What new players are capable of pushing utilities off value chain?

The EPA New Source Performance Standards for GHG emissions from new power plants will further support power sector gas demand by effectively preventing any new coal build without CCS storage (Section 5.7). New CCGTs, in contrast, are already largely compliant with the standard.

I  Solar...

but

Figure IF1-4. Renewable electricity generation in three cases, 2012, 2020, 2030, and 2040 (billion kilowatthours)



Assumptions that Temper My Love:

- Disconnect between early adopter regions & dynamics of rest of nation-world (e.g. urban, cold-cloudy, values, appetite)
- Underestimate homeowner concerns
- Solar might be a slower path to GHG reduction vs Electrochemical use of existing resource base
- Utilities will find stronger cultural fit with Fuel Cell based Distributed Generation
- Homeowners embrace 'control' appeal in 'appliance' (fuel cells) vs 'structural' options (rooftop solar)

Distributed Policies Aligned with Diversified Fuel Mix (& Resource Base)

Figure IF6-3. Cumulative additions of electricity generating capacity by fuel in four cases, 2012-40 (gigawatts)

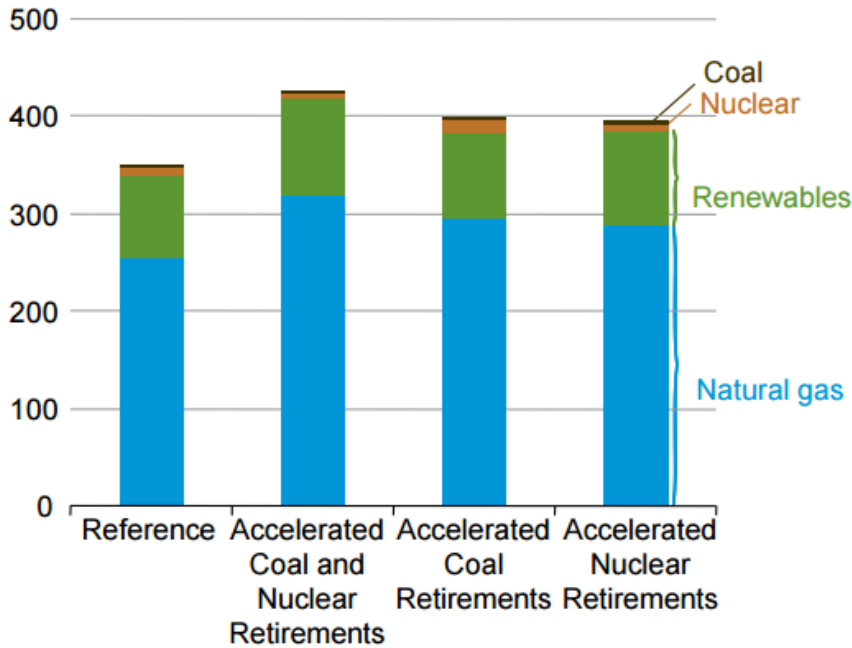
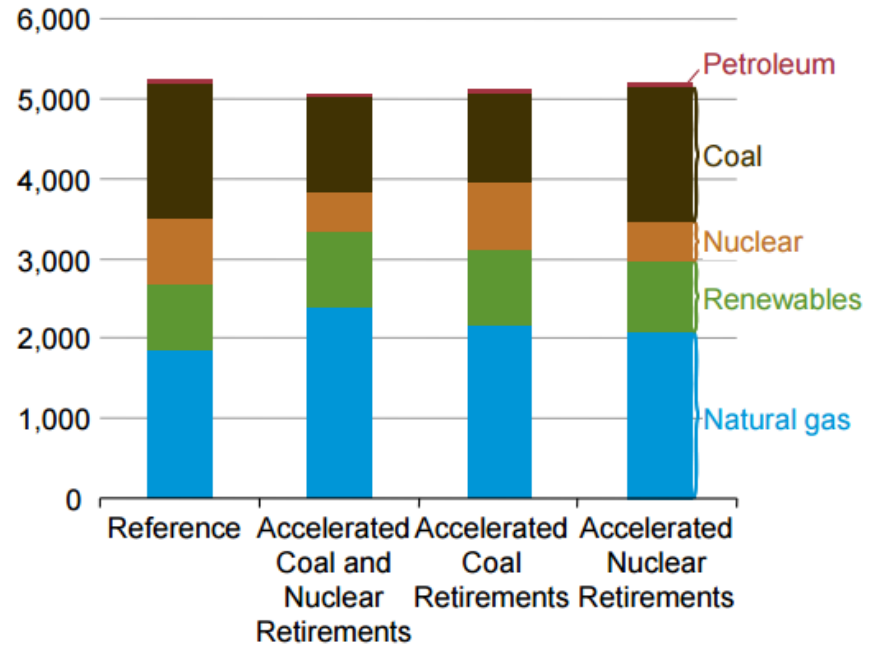


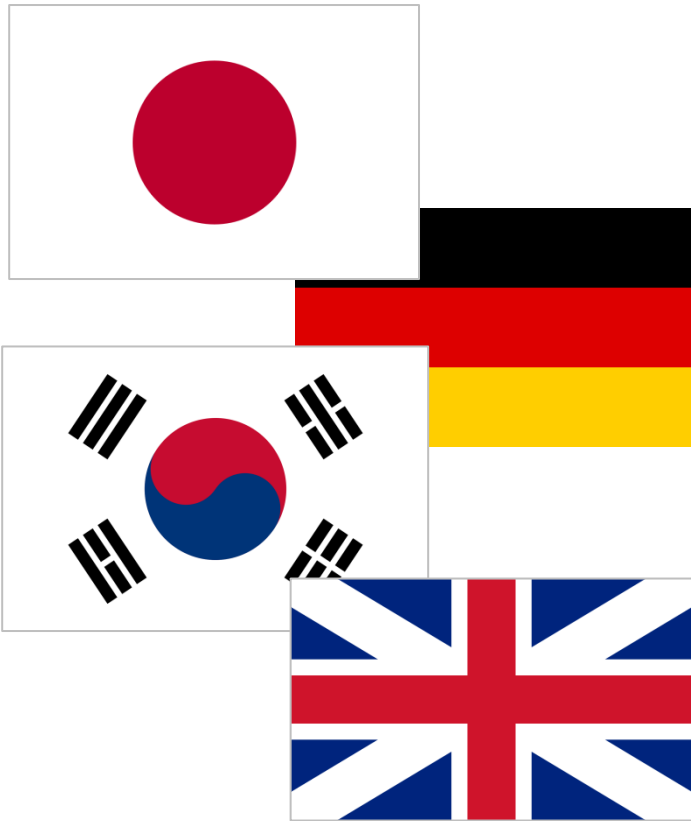
Figure IF6-4. Electricity generation by fuel in four cases, 2040 (billion kilowatthours)



Strengthening Signals on State-sponsored Industrial Policies

Distributed Scenario: Global Market Expansion as Energy Appliance

Look Beyond California & Elon Musk...



Panasonic and Viessmann to Launch Fuel Cell System in Germany in April 2014



**Technology Shift in Micro-CHP:
Fuel Cell Outsell Engines for the First Time**



Delta-ee

Strengthening Signals but Lingering Scars

Distributed Scenario: Cheap Solar Fails to Scale vs Energy Appliances



Bloomenergy

Redox Power Plans To Roll Out Dishwasher-Sized Fuel Cells That Cost 90% Less Than Currently Available Fuel Cells



**Plausible Scenarios: 1) Localized *Power Parks (Micro Grids)*
2) NatGas + DG = *Clean Energy as Service***

Scenario: Utilities Embrace Power Parks

Distributed Driven by: Cost/Capital & Control



33%
LESS
Up-Front Cost



15%
LESS
CO₂ Emissions



NATURAL GAS FUEL CELLS

Big enough to power a large retail facility onsite, a scaled-up version based on PNNL's fuel cell design could cost less to build and emit fewer greenhouse gases than a natural gas combined cycle power plant.


Pacific Northwest
NATIONAL LABORATORY

The PNNL study showed that for the same power output, a natural gas solid oxide fuel cell would cost almost one-third less to build than a centralized natural gas combined cycle plant.

Scenario: DG as Managed Service

Distributed Driven by Product Platform of Solid-state Power Plants



Bringing Value in Competitive Managed Services Future

Design-Build-Manage (Finance to Fuels)

- ✓ Accelerate Regulatory Reforms
- ✓ Fuel contracts & management
- ✓ Restructure Partnerships
- ✓ Align Talent & Culture Change
- ✓ Develop Roadmap Adoption Rollout

Competition overwhelms Utilities

Vision of Portable Fuels & Micro Fuel Cells



**Unplug
Refuel**



**5 Year Plan
Fuel-based Devices**



**Fuel-cell
on a Chip**



**House Construction
without Wall Sockets**



#1 Fuel Distributor

2019

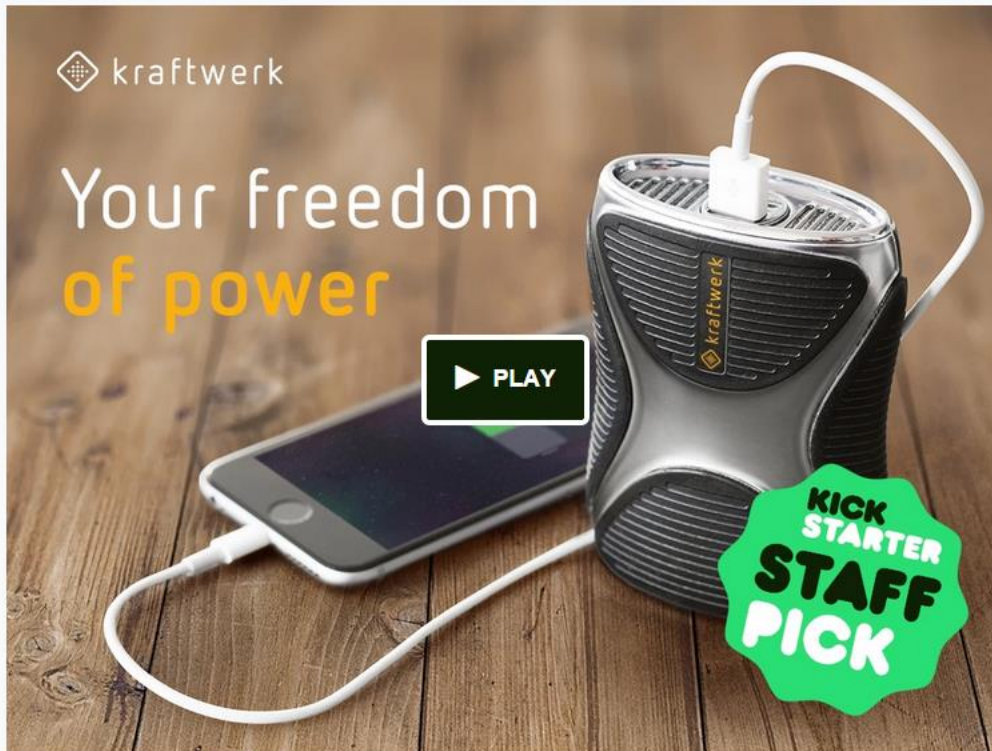
2020

2025

2030

kraftwerk - highly innovative portable power plant

by eZelleron Inc.



11,660

backers

\$1,529,561

pledged of \$500,000 goal

0

seconds to go

Funded!

This project was successfully funded on March 5.

A totally new energy supply technology for mobile electronic devices. Efficient and remains independent from the power grid.

📍 Storrs, CT

🔧 Design

🔗 Share this project

eZelleron Inc.

🕒 First created | 4 backed

🌐 hellokraftwerk.com

[See full bio](#) [Contact me](#)





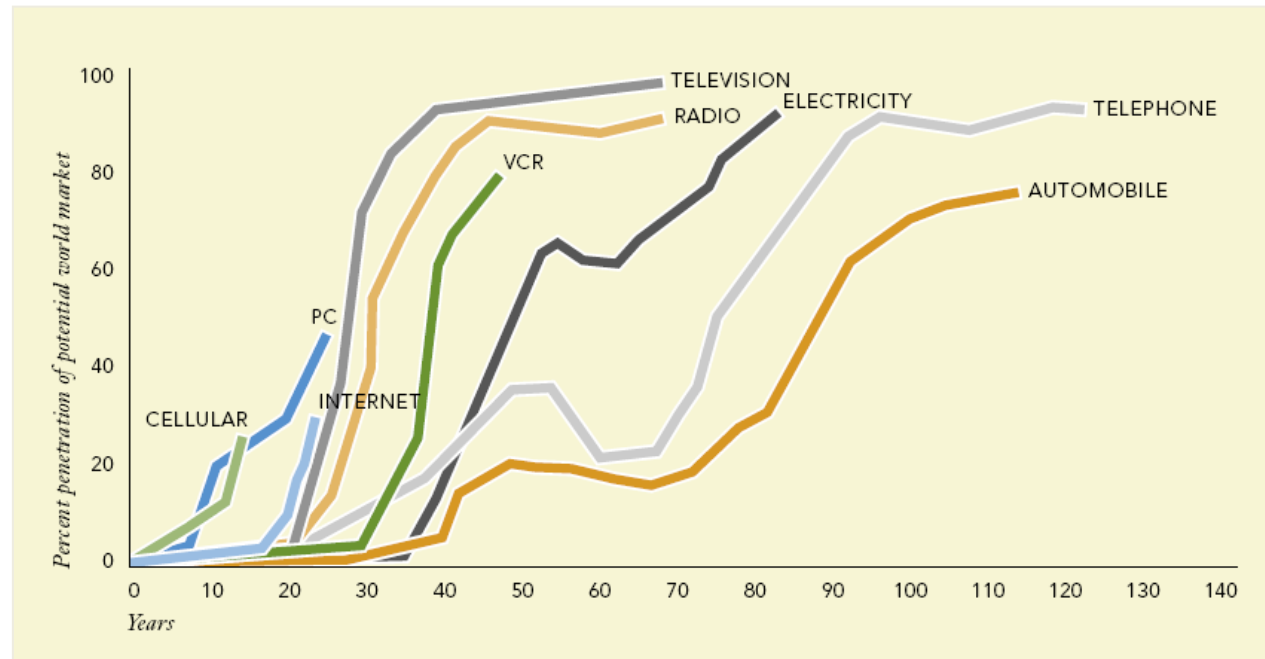
MyFC Jaq fuel-cell charger jacks up your phone in style (hands-on)



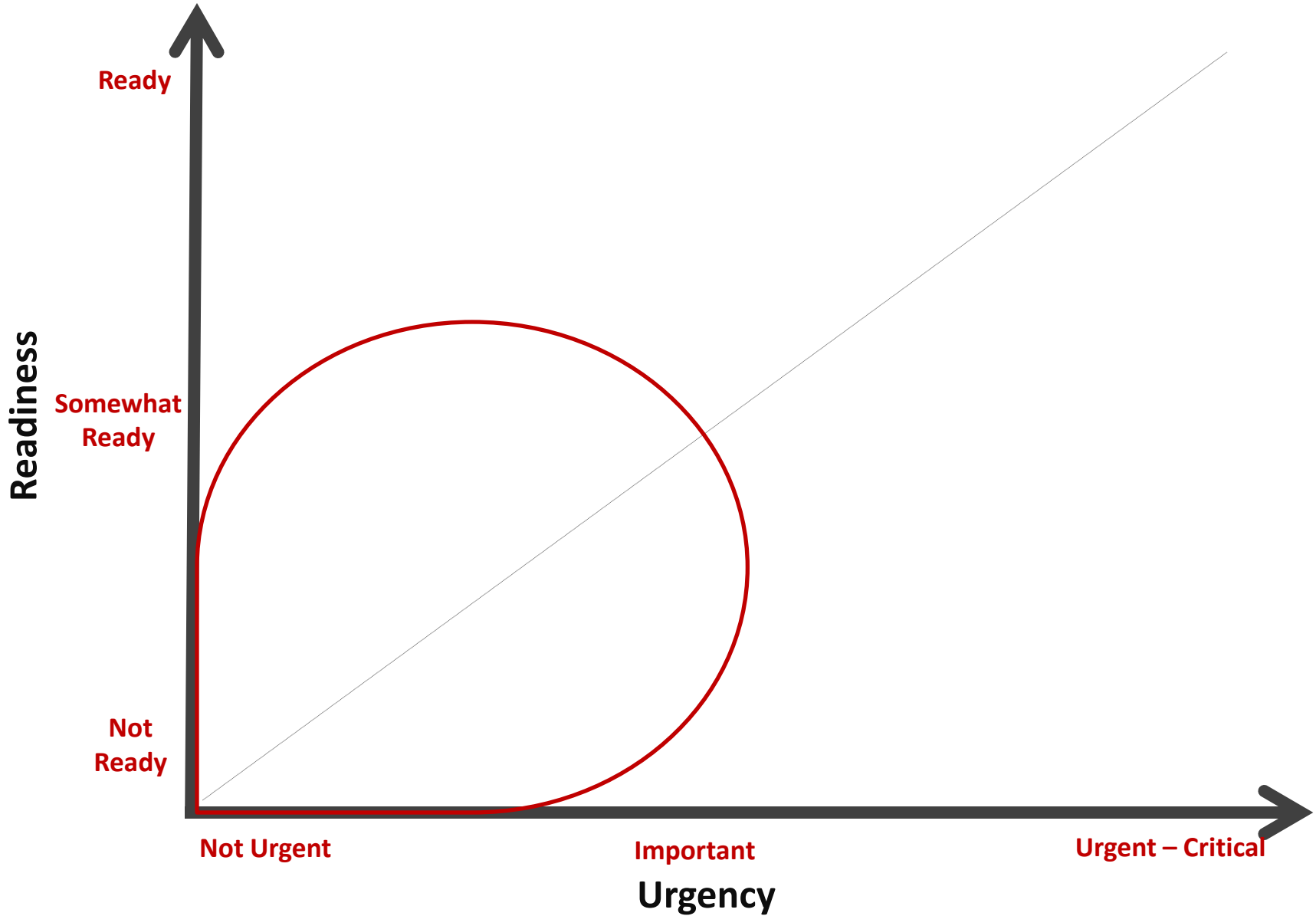
Global Implications

- Efficiency Loss vs Gain
- Utility Influence vs Device Controls
- Global Energy Ladder
- Portable Renewable Fuels Market

Assumptions governing dynamics of change?



Trends Mapped Against Readiness & Urgency



***Questions
Comments
Challenges?***



***+ Links &
Resources***

garrygolden.com/aespwebinar