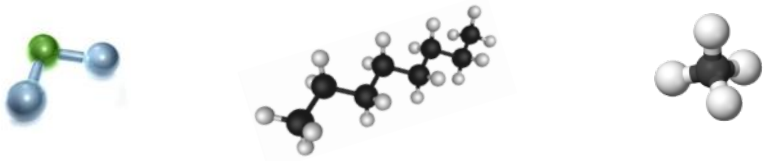
2016
ELECTRICITIES OF NC
ANNUAL
CONFERENCE
Aug. 11-13, Concord, NC

The Future of Energy

Exploring the Slow Pace of Fast Change



Garry Golden, Forward Elements Inc

Start

End

Foresight 101

Drivers of Change

IoT Consumerization +
Distributed Resources

Next Steps

The *Slow Pace* of Fast Change

Distributed

? Networks

?

?

Design for
Behavior Change

Alternative Futures

Baseline Future

Maintenance,
Preservation
& Renewal

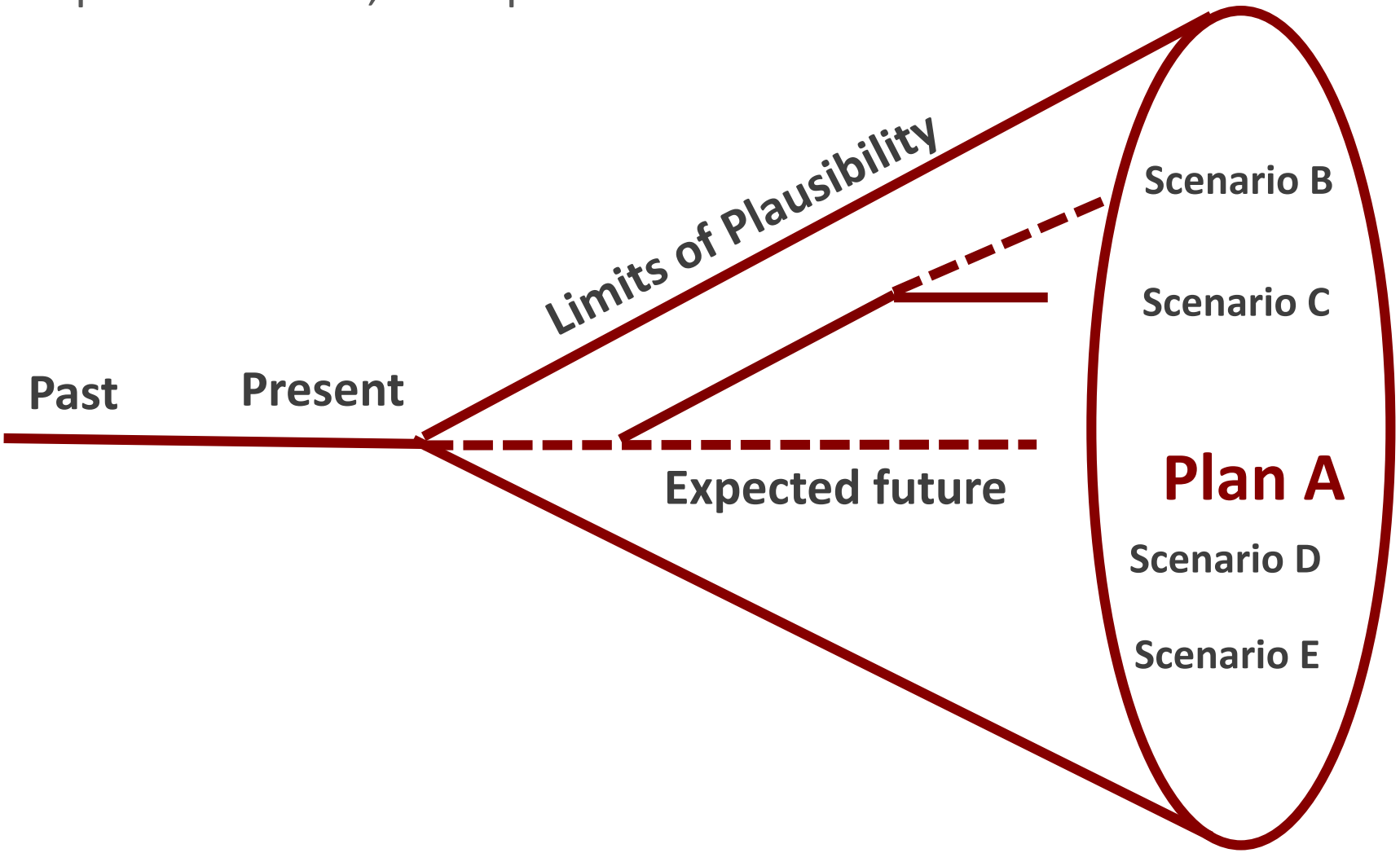
20th Century Dynamics

21st Century Dynamics

Tapping My Inner “Futurist”?

Foresight 101: Cone of Plausibility

Multiple Outcomes, Multiple Time Horizons



You will have regulatory
certainty for years to come.

IF YOU HIT THIS SIGN
YOU WILL HIT THAT BRIDGE

WAIT FOR IT

.....Wait for it.....

motifake.com

Every day I make an effort to move toward what I do not understand.

- Cellist, Yo-Yo Ma

Four Futures Thinking

?

Continued Growth

Peabody ENERGY

Microsoft

Disciplined - Constrained

IBM

Pfizer

Transformed

BlackBerry

NOKIA

Decline - Collapse

* Jim Dator, University of Hawaii

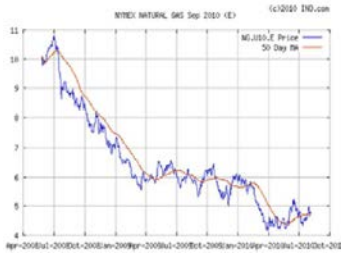
Imagine Life in 2030…

Your Utility	Your Utility	Your Utility	Your Utility
Continued Growth	**Disciplined - Constrained**	**Transformed**	**Decline - Collapse**

* Jim Dator, University of Hawaii

Three Mechanisms of Change

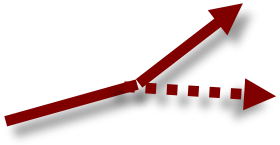
Trends
(Continuities)



Plausible Future

Forecasts

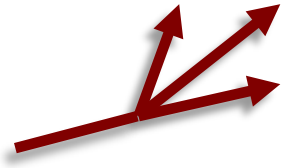
Events
(Discontinuities)



Possible Futures

Scenarios

Choices
(Discontinuities)



Preferred Future

Visions

End

Foresight 101

Drivers of Change

IoT Consumerization +
Distributed Resources

Our Next Steps

Anticipate Implications of…

The Slow Pace of Fast Change

Learning Thermostat

IoT + *Consumerization* of Energy Solutions

Distributed Resources

Internet of Things (IoT)

The Consumerization of Energy Solutions via *Connected Devices*

ecobee

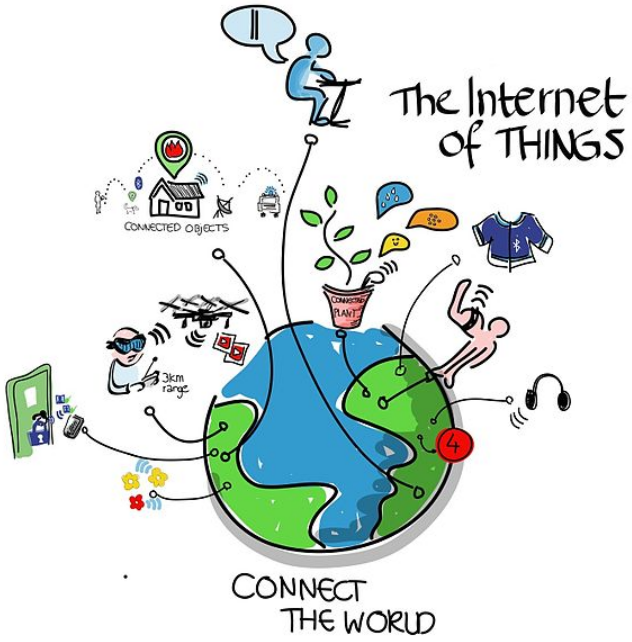
nest

Learning Thermostat

How might energy experiences evolve around products and players that Learn & Lead!

Slow Pace of Fast Change = Healthy Sense of Skepticism

Era of Connected Device driven Energy Solutions



Uncertainties to Explore

- ❑ Full (cost) + impact on energy-gas use
- ❑ Regulatory framework
- ❑ Who creates value? (Benefit over cost)
  Who captures it? (Business Model)
- ❑ Adoption-uptake models
- ❑ How might we integrate data?
  How do we deal with privacy concerns?
- ❑ What new players are capable of pushing utilities off the *value chain*?

CC 2.0 Wilgengebroed on Flickr

Key Elements Driving Consumerization?

Entrepreneurial Spirit for Energy Solutions

KICKSTARTER

SunPort™ – Demand Solar. Anywhere. Instantly.

Join the movement to crowdsource demand for solar energy, just by plugging in.

Pre-order Here

Created by

Paul Droege

1,676 backers pledged $120,599 to help bring this project to life.

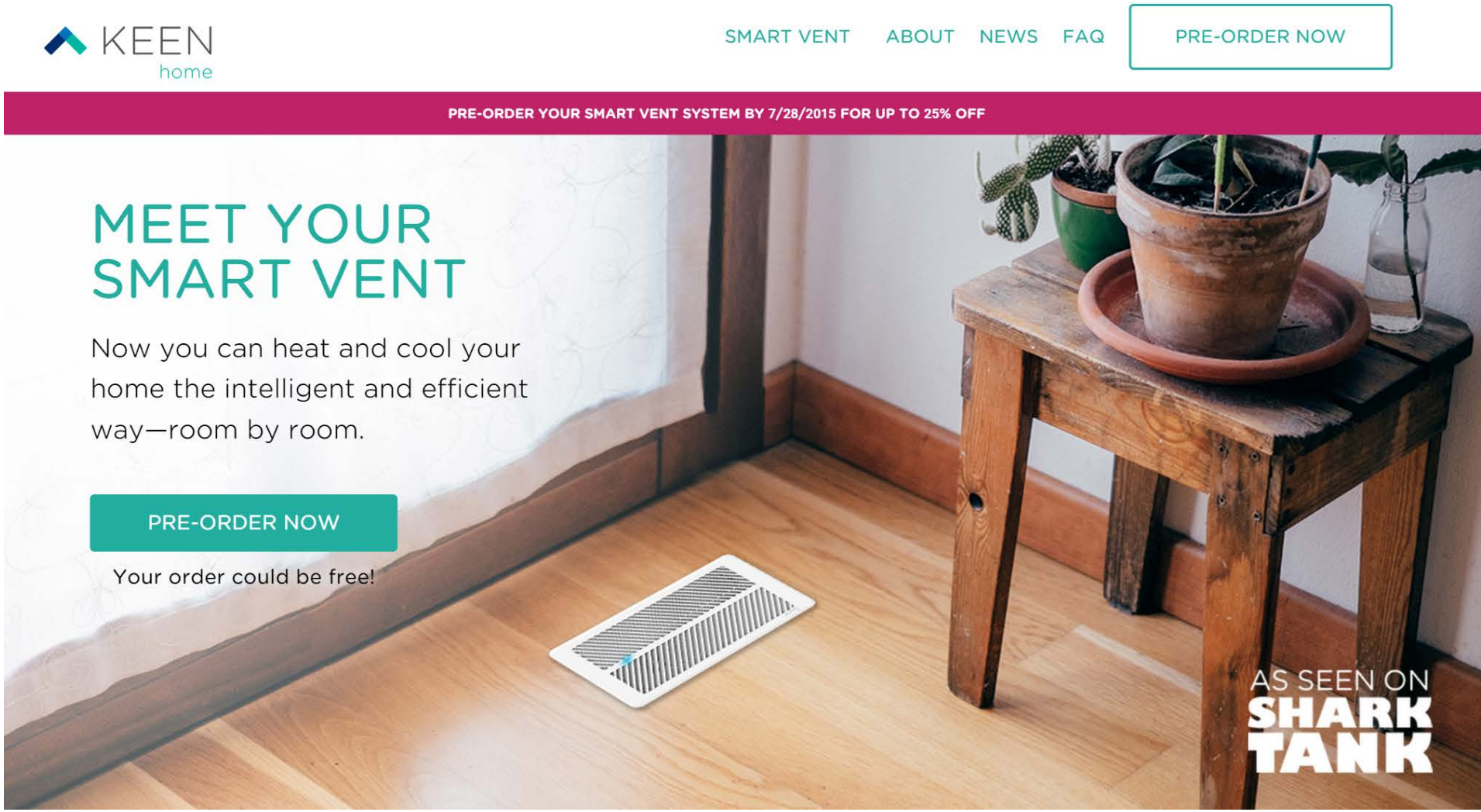
Key Element Driving Consumerization:

Lower Barriers to Entry for Innovation + Adoption

- How do we interface with energy entrepreneurs and branded solutions?
- How do we guide our communities in making decisions on solutions?
- How do we learn from our community members who are early adopters?

Blurring of Digital-Physical Boundaries

Battery-powered vents to control temperature in individual rooms



Signal: Bigger Players Dipping Toes into the Water

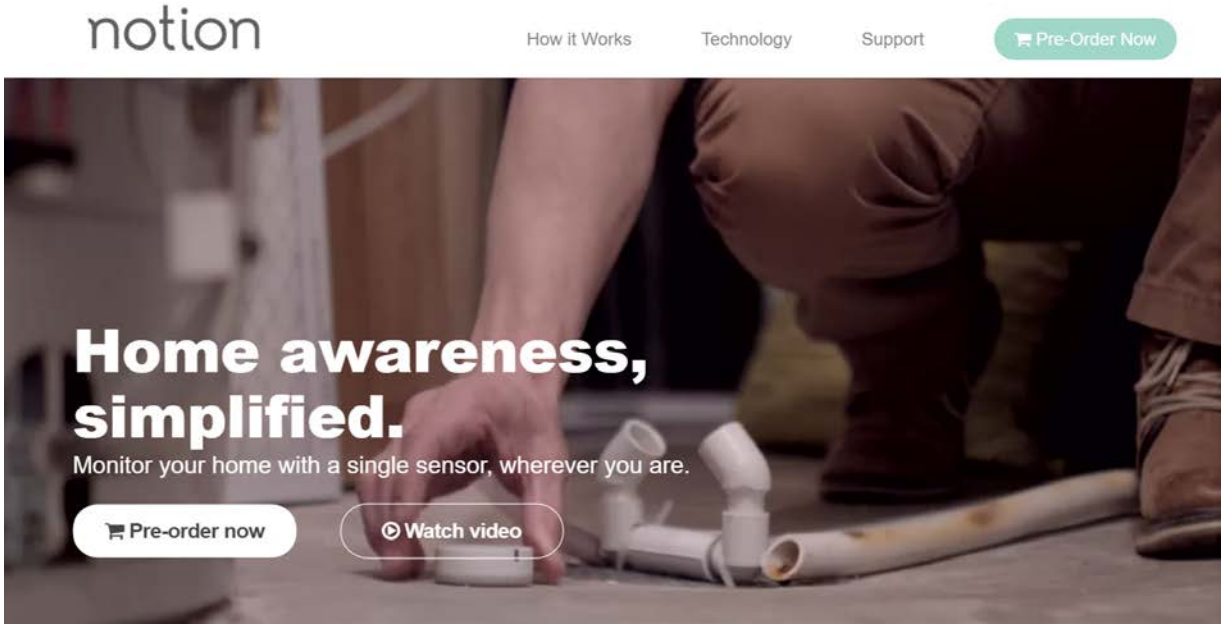
Smart-home heating startup Ecovent lands $6.9M investment, touts $1M in pre-orders

ecovent

EMERSON
Climate Technologies

Key Element Driving Consumerization:

How might Connected Devices transform Expectations?



Integration of Products:

Security, Plumbing, Indoor Air Quality

Strategic Assumption: Elevated Expectations Ahead

Eventually 'Connected Homes' solutions will not seem silly (or expensive)

How might we deliver innovative managed services for 'connected devices' solutions?

- ❑ *Partnerships*
- ❑ *Pilots*
- ❑ *Crowdfunding promotion?*
- ❑ *Niche Demands (e.g. aging populations)*

HEAT METER

HEATWORKS

ecovent

notion

Be home, even when you're not.

Consumerization Phase implications for Energy sector?

Legacy Phase…

Build out Access to Infrastructure

Consumerization Phase…

Managed Services & Behavior Change Solutions

Consumerization Solutions will be Outcomes-based

Turning Connected Data into Insights, Actions + Outcomes

Design for Behavior Change

Why Software is Eating the World…

THE WALL STREET JOURNAL.

By MARC ANDREESSEN

August 20, 2011

Social Norms for the Anonymous-Access Web

1993

"On the Internet, nobody knows you're a dog."

Social Norms & the Social Web

2008

Everyone knows I'm working on some personal growth issues
BARRON'S
DOG TRAINING BIBLE
Andrea Arden
BARRON'S
Assumption:
The web is becoming a platform for managing outcomes & personal behavior change.

Energy Service + Experience Design

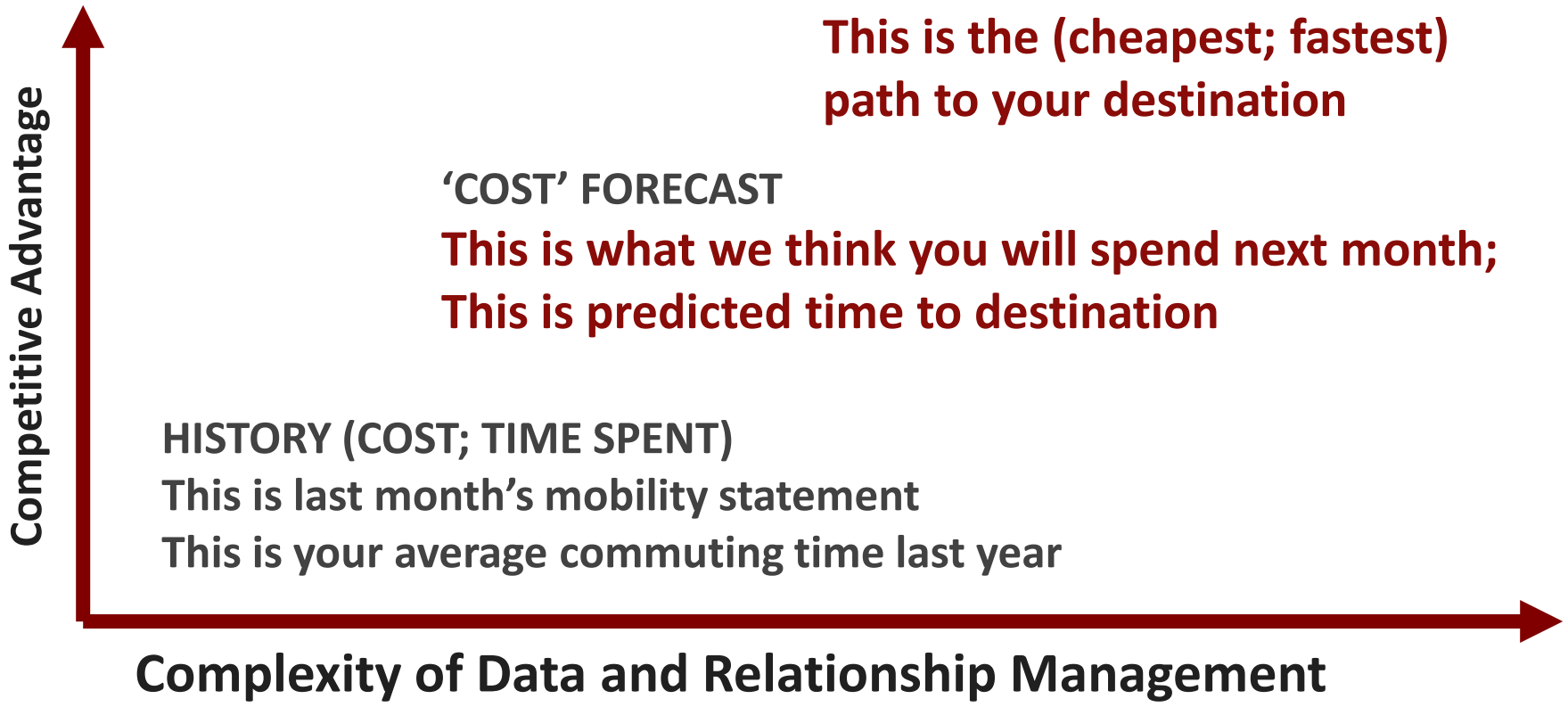
How do we think of Behavior Change to Guide Outcomes?

Social Norms + Slow Embrace of Prescriptive Analytics

Guided Financial Experiences

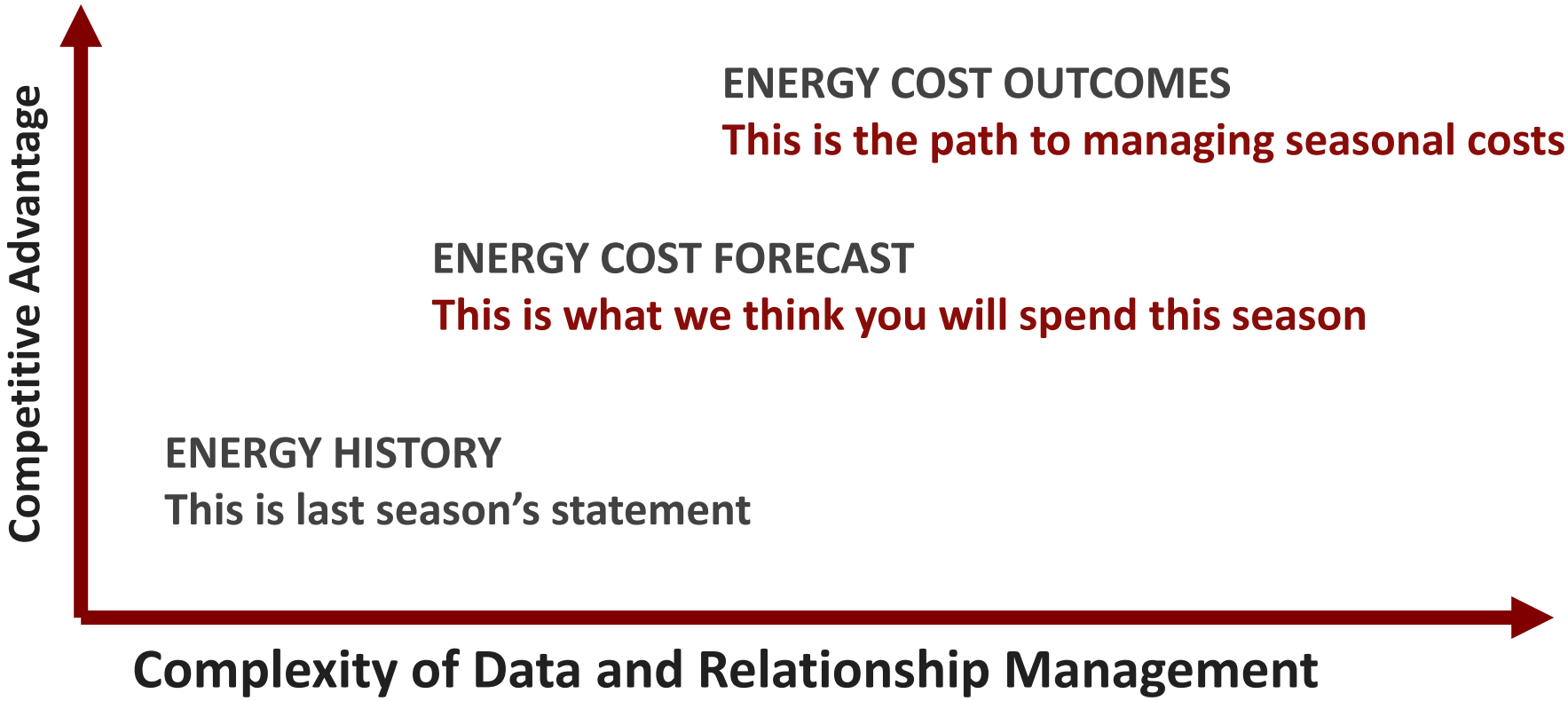
Social Norms + Slow Embrace of Prescriptive Analytics

Guided Transportation Experiences



Social Norms + Slow Embrace of Prescriptive Analytics

Guided Utilities Experiences ?



IoT Consumerization

Question #1:
What outcomes matter?

- ❑ Comfort
- ❑ Informed Decision making
- ❑ Reliability (Uptime)
- ❑ Increased Savings
- ❑ ROI for Distributed Systems
- ❑ Fixed Costs
- ❑ Lower Carbon Footprint
- ❑ Worry-Free (Bill Management)

IoT Consumerization

Question #2:

How might we (or other players) scale and deliver prescriptive analytics of energy management experiences?

neurio

ambient™
information at a glance.

Can you tell me why my bill was so high?

Apps, Dashboards,
Ambient Objects,
Natural Language Assistants?

Do Not Dismiss on Techno-Novelty

Aligning Utility Tools with Expectations of Convenience

Phase of Rolling Eyes at Chat*bots*

Microsoft is betting that bots 'are the new apps'

MICROSOFT / 31 MARCH 16 / by MATTHEW REYNOLDS

Facebook launches a bot platform for Messenger

Google follows Facebook into chatbots

Published: May 19, 2016 8:43 a.m. ET

Cisco Partners with Gupshup to Boost Bot Ecosystem

Hype vs Hope of Chatbots

Specialized digital assistants and bots expected to generate over $600 billion in revenue by 2020

Can you tell me why my bill was so high?

How long will this heatwave last?

Please pay my utility bill next Friday

Connected Home Hubs

Might Amazon (et al) become a Friend, Foe or Frenemy?

INTRODUCING
amazon echo

Always ready, connected, and fast. **Just ask.**

AMAZON TEAMS WITH TADO TO PROVIDE ALEXA SUPPORT FOR ITS SMART AIR CONDITIONING UNITS

By **Rick Stella** — June 23, 2016 2:38 PM

Ecobee and Alexa heat things up with new Amazon Echo partnership

Amazon's answer to at-home voice control just got another new partner, the Ecobee3 Wi-Fi Smart Thermostat.

Opportunities + Risks

Consumerization Era for NC Utilities

How do we understand..

- ❑ ***..the roadmap***
- ❑ ***… the role of disruptors***
- ❑ ***… the business model***
- ❑ ***… the security issues***
- ❑ ***… how to deliver the unexpected innovations?***

Disruptive Trends to Watch:

The Slow Pace of Fast Change

Learning Thermostat

IoT + Consumerization of Energy Solutions

Distributed Resources

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

Moody's: Cheap Batteries Could be 'Credit Negative' for Utilities and Power Generators

Is there a pro-integration regulatory tipping point ahead?

FUTURE ELECTRIC
Utility Regulation

Reforming the Energy Vision

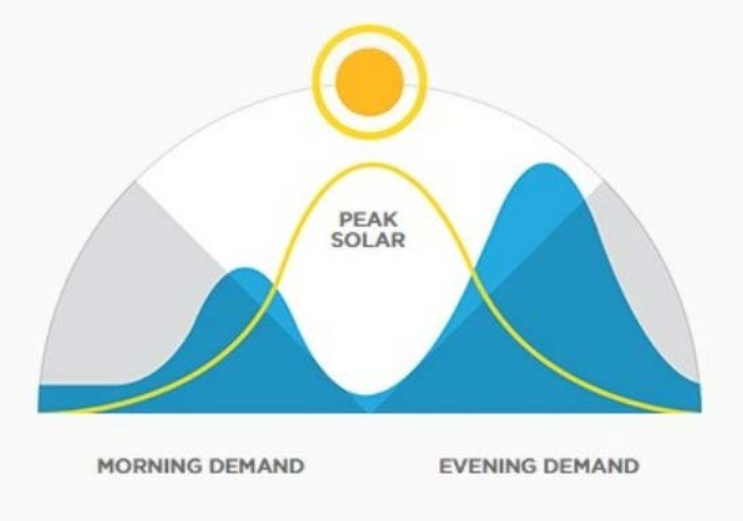
aps

Signals of Change

Policy + Consumer-driven Dynamics of Rooftop Solar

Signals of Change

Distributed (Centrally Controllable) B*ehind-the-Meter* Storage



sonnen

Signals of Change

Utilities Coordinate Aggregated System level Solutions

"Community Storage" is an emerging term for programs that aggregate distributed energy storage resources that are located throughout a community, such as water heaters, electric vehicles, and interconnected storage batteries, to improve the operational efficiency of electric energy services to consumers.

Signals of Change

New types of Exchanges, Networks and Marketplaces

neo network

Life Is On | Schneider Electric

MAP OF RENEWABLE PROJECTS

Renewable projects are happening around the world. Here's a glimpse of a few in your backyard.

Solar Hydro

Wind Other

Signals of Change

Testing Viability of Peer-to-Peer Energy Trading (via Blockchain)

TRANSACTIVEGRID

Transact locally with neighbors

TransActive Grid enables residents with smart meters to transact with neighbors using existing grid infrastructure.

It includes a hardware layer of smart meters and a software layer using the blockchain and smart contracts. These are self-enforcing contracts that can provide an auditable, non-repudiable and cryptographically secure history of automated transactions. The current prototype uses the Ethereum blockchain.

Solutions for North Carolina Energy Prosumers?

Low by MW, but Growing, Visible and Personal

Over the past 5 year, net energy – that is energy fed into the grid by consumers – has grown on average at 500 percent per annum while net utility generation grew at 1.2percent

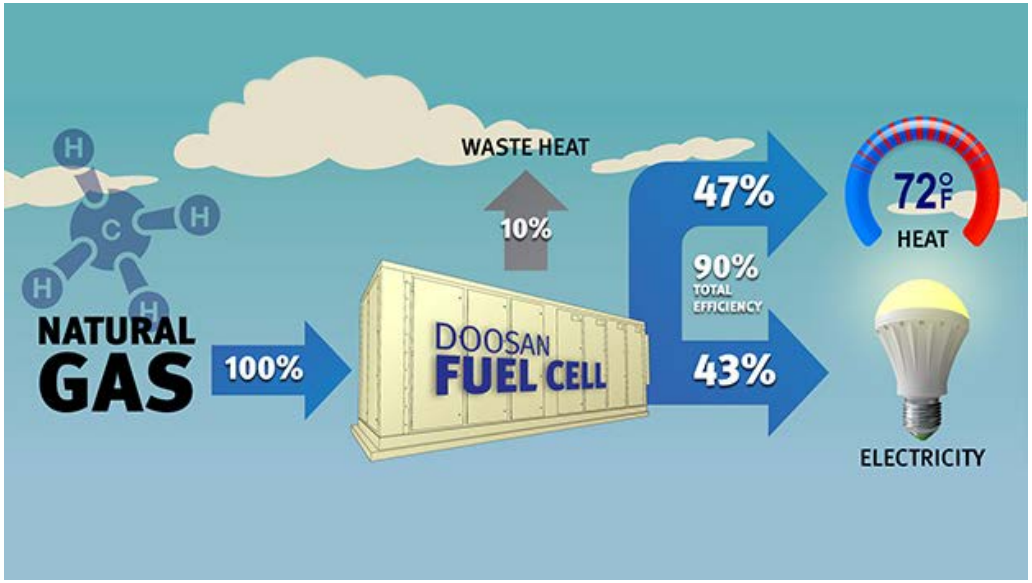
TRANSACTIVEGRID

powerpeers
share your energy

Signals of Change (Despite Lingering Scars)

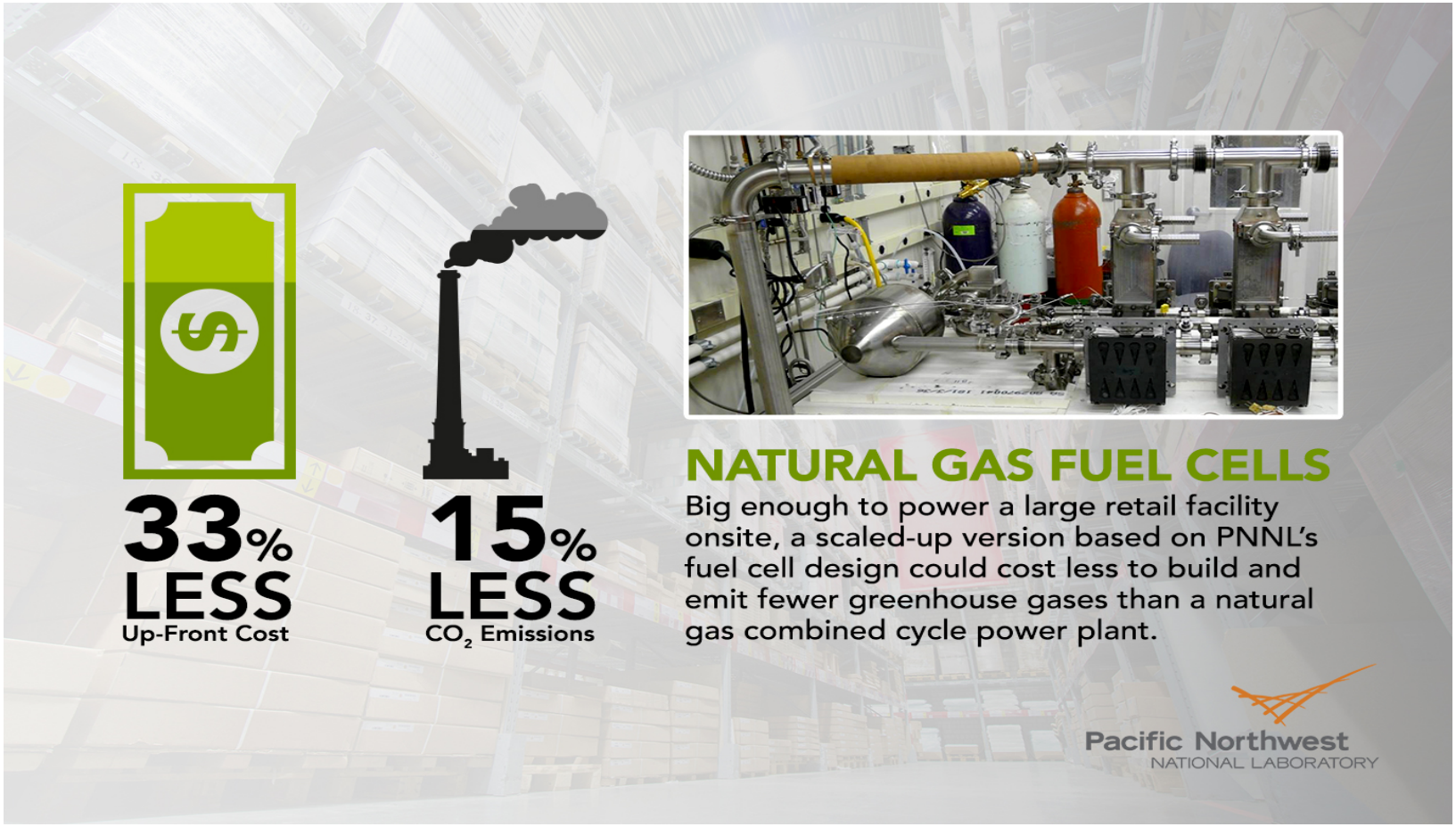
Fuel Cell based Renewable Integration and Micro Grid Foundation

Bloomenergy



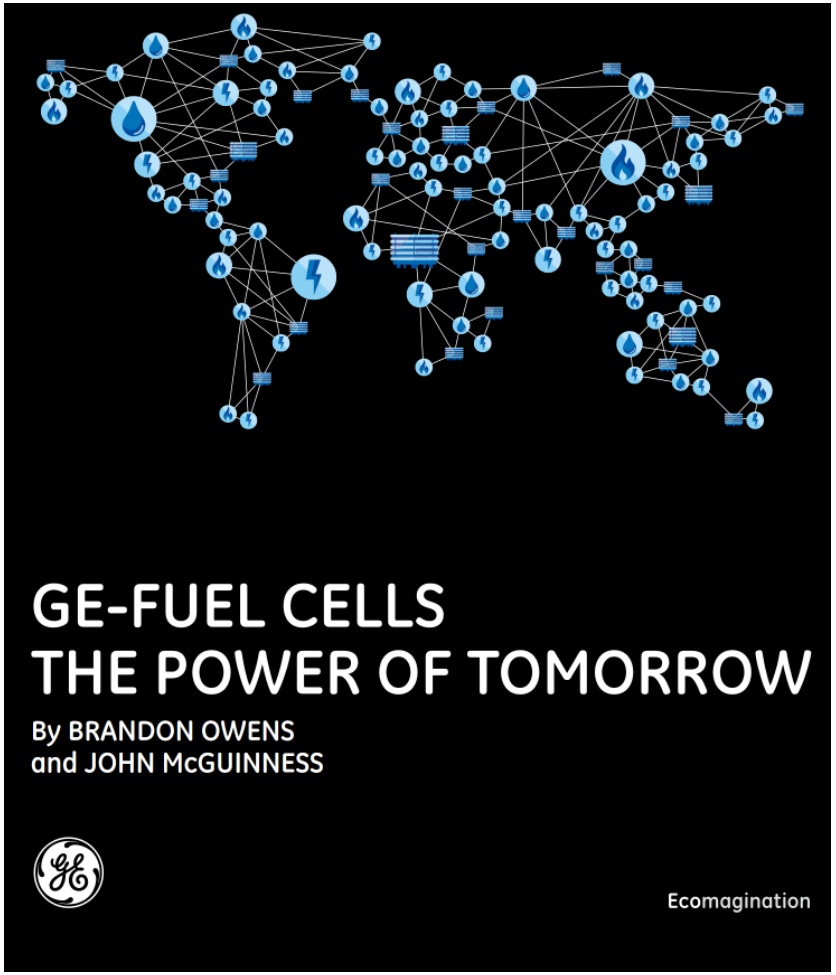
DOOSAN

Distributed Driven by: Cost/Capital, Resilience & Control



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.

GE Enters Market in 2018 (1MW – 10MW)



Distributed Scenario: Solar Fails to Scale vs Energy Appliances

Bloomberg Businessweek

Toho Gas units for an "ene-farm" household fuel cell system sit outside a smart home developed by Toyota in Toyota City, Japan, on Oct. 17, 2014. Photographer: Kiyoshi Ota/Bloomberg

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

Plausible Paths:

1) Subsidies & cost reductions = Viable Products
2) Localized MW *Power Parks = Utility Micro Grids*
3) NatGas + DG Managed Service = *Clean Energy as Service*

Scenario to Explore

What if our Communities Embrace Natgas + Distributed Generation?

Bringing Value to Our Communities
Ownership or 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 or Coopetition?

Opportunities + Risks

Distributed Resources for NC

How do we understand…

- ❑ ***… the roadmap***
- ❑ ***… the role of disruptors***
- ❑ ***… the business model***
- ❑ ***… implications on existing commitments***
- ❑ ***… the upside of resilience***
- ❑ ***… lower capital scaling***

End

Foresight 101

Drivers of Change

Next Steps

Create a Healthy Sense of Urgency

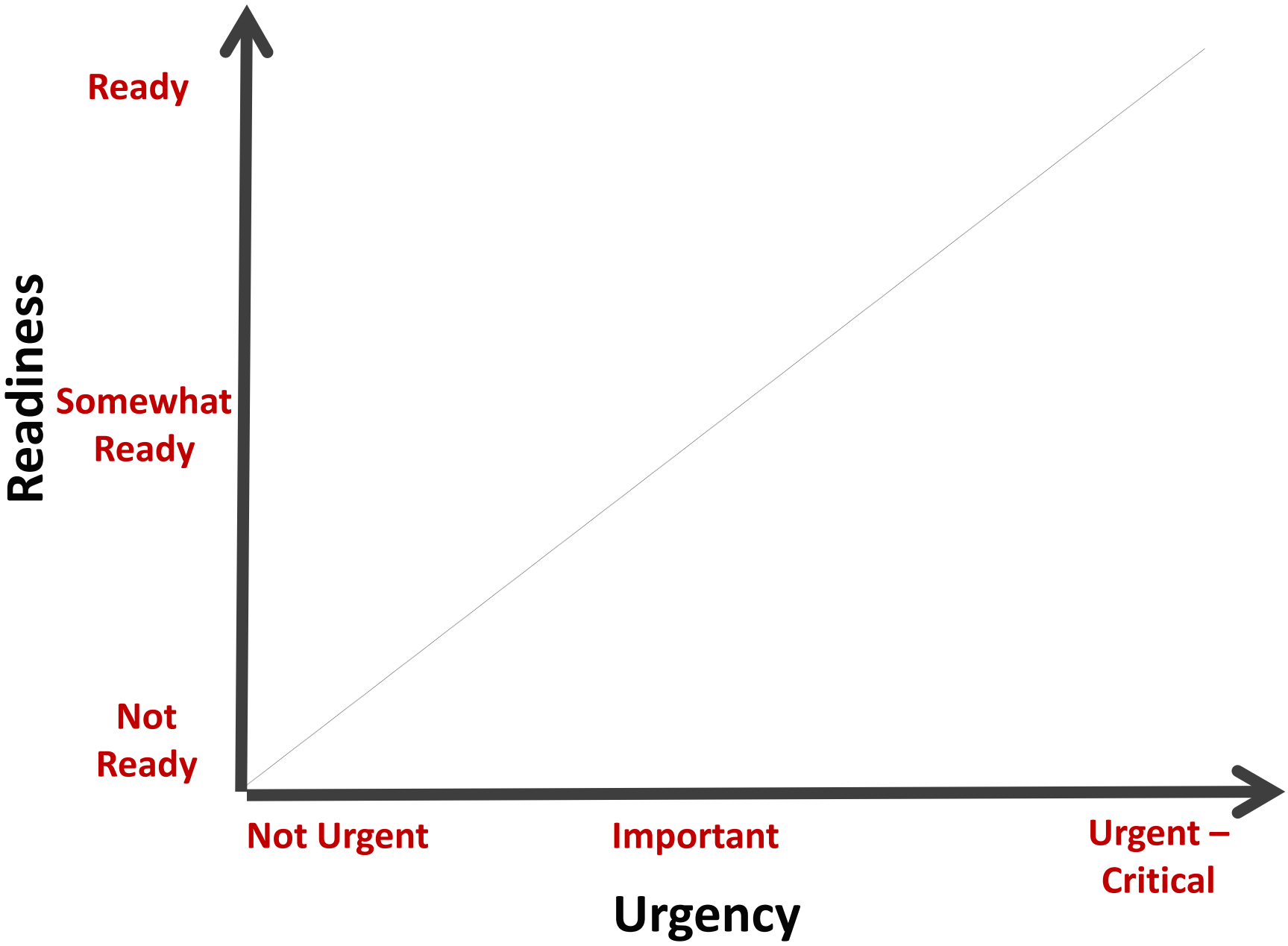
On the Plateau
'Managing the Decline'

- **Incumbent mindset**
- **Incremental Improvement**
- **Fear, Uncertainty, Doubt & Denial**

Walking up Hill
Enabling New Era

- **Entrepreneurial mindset**
- ***Prototyping Transformative Change***
- ***Failing Forward***

Survey Leadership on Emerging Trends



Establish Thought Leadership + Curator Role on Big Ideas

Engage staff, elected officials and community leaders in socializing ‘big ideas’ on the horizon of the energy sector.

- ❑ Energy Entrepreneurship
- ❑ Distributed Resources (Generation to Storage)
- ❑ Data+Privacy Infrastructure
- ❑ Business Model Challenges
- ❑ EVs (Battery + Fuel cells)
- ❑ Connected Devices + IoT (Data-Privacy-Security)
- ❑ Blockchain + Crypto DApps
  - IBM ADEPT Protocol (Ethereum)
  - Transactive Community Grid

Focus on big questions…

What do we need to learn about?
What do we need to unlearn?

Biggest Risk…
Biggest Opportunity…

How do we build bridges to future…?

Thank You!

Learn more:
garrygolden.com/EC2016

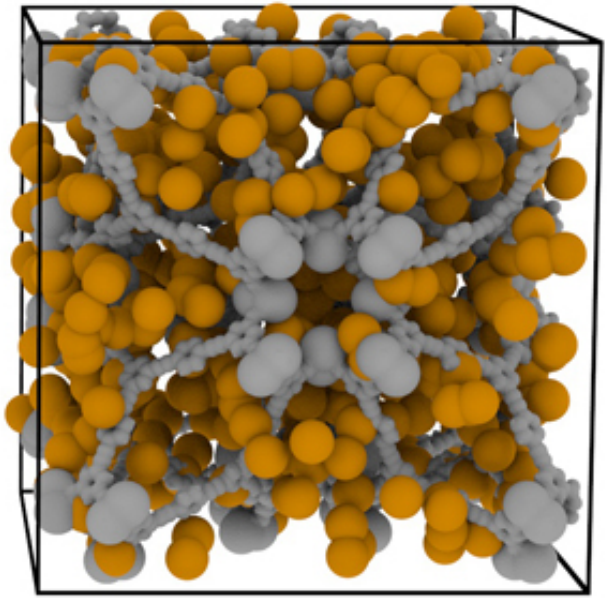
garrygolden@gmail.com
Two Rs

2016 ELECTRICITIES OF NC ANNUAL CONFERENCE
Aug. 11-13, Concord, NC

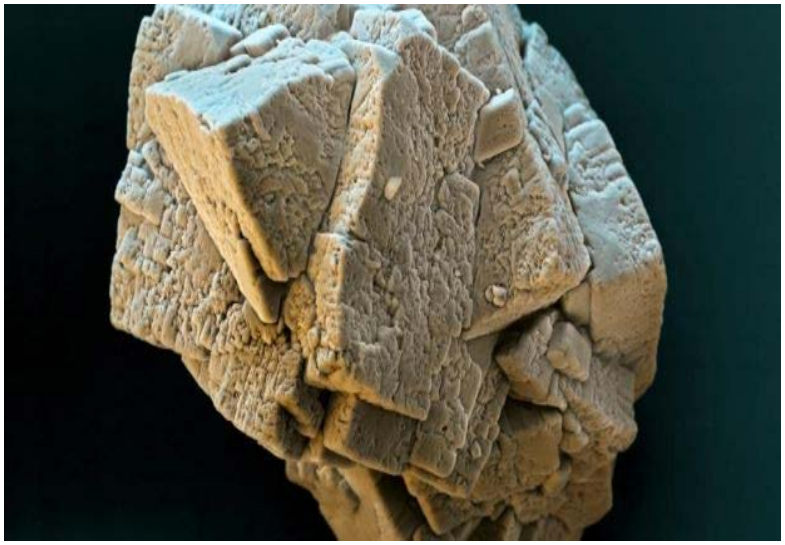
In the News

High Surface Area Crystal Sponges + Natgas

MOFs – Metal Organic Frameworks



Northwestern
Image by Christopher Wilmer/NuMat Technologies)



Science Journal

BASF
We create chemistry

NuMat
TECHNOLOGIES

MOF Technologies™
Adsorbent Nanomaterials

In 2017 Tokyo Gas will begin selling solid natural gas (MOFs) in 7-11 stores as fuel for portable micro fuel cells that recharge devices.

TOKYO GAS

ELEVEN

True

False

Could fuel-based micro-power systems be at same developmental stage as cell phones in late 1980s?

$49 (12 cartridges)
11 phone charges per cartridge

Scenario: World of low cost fuel-based electronic devices

A disruptive idea of fuel-based micro-power?

ZDNet

Apple granted portable fuel cell power system patent

Apple has been granted a patent for an external portable fuel cell electricity generation unit designed to power portable computing devices.

By Leon Spencer | March 18, 2015 -- 05:55 GMT (22:55 PDT) | Topic: Apple

Apple files patent for MacBook fuel cell that could last weeks

APPLE / 04 SEPTEMBER 15 / by JAMES TEMPERTON

One week battery life on an iPhone 6? It's possible

POSTED 1:49 PM, AUGUST 28, 2015, BY CNN WIRE

House Construction without Electrical Sockets

Unplug Refuel

5 Year Plan

Fuel-based Devices

Fuel-cell on a Chip

Walmart

#1 Fuel Distributor

2020

2022

2026

2030

Example of Tapping Your Inner Futurist

What fuel-based innovations might capture head, heart & wallets of our communities?

- ❑ Could customers *cut the cord* and reduce grid-use?
- ❑ Could we get in the business of delivering solid state or liquid fuels?
- ❑ Would our members expect traditional CH gases - or embrace hydrogen or renewable synthetic gas?