



US Association for Energy Economics

Energy Economics in a Carbon-Constrained World
Markets, Barriers, and Pathways

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A decorative horizontal bar at the bottom of the slide consists of several overlapping colored segments: blue, green, dark blue, light green, dark blue, green, and blue.

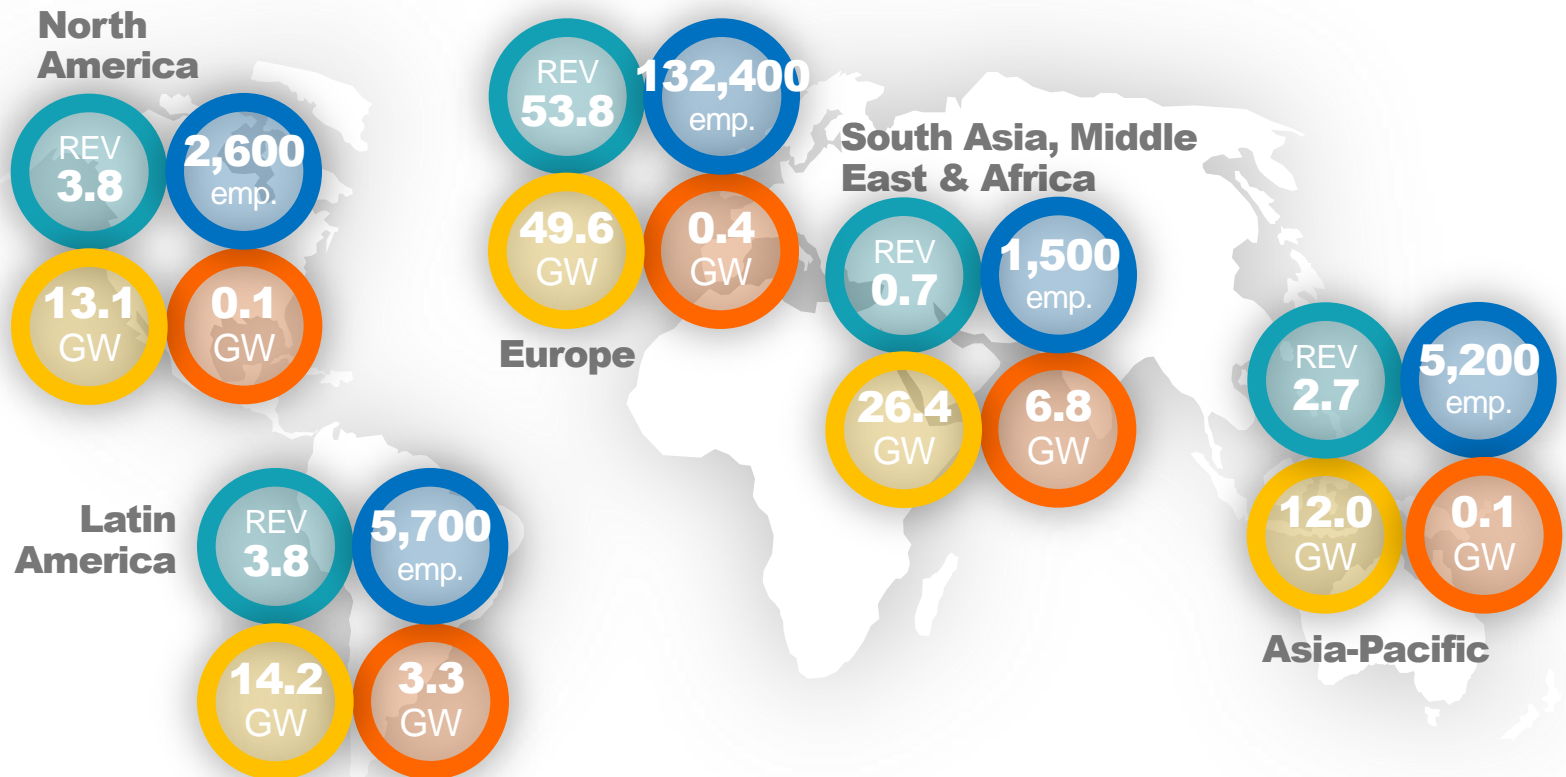
From its European heartland, ENGIE has grown to become the world's largest Independent Power Producer

€74.7 billion
in 2014 revenues

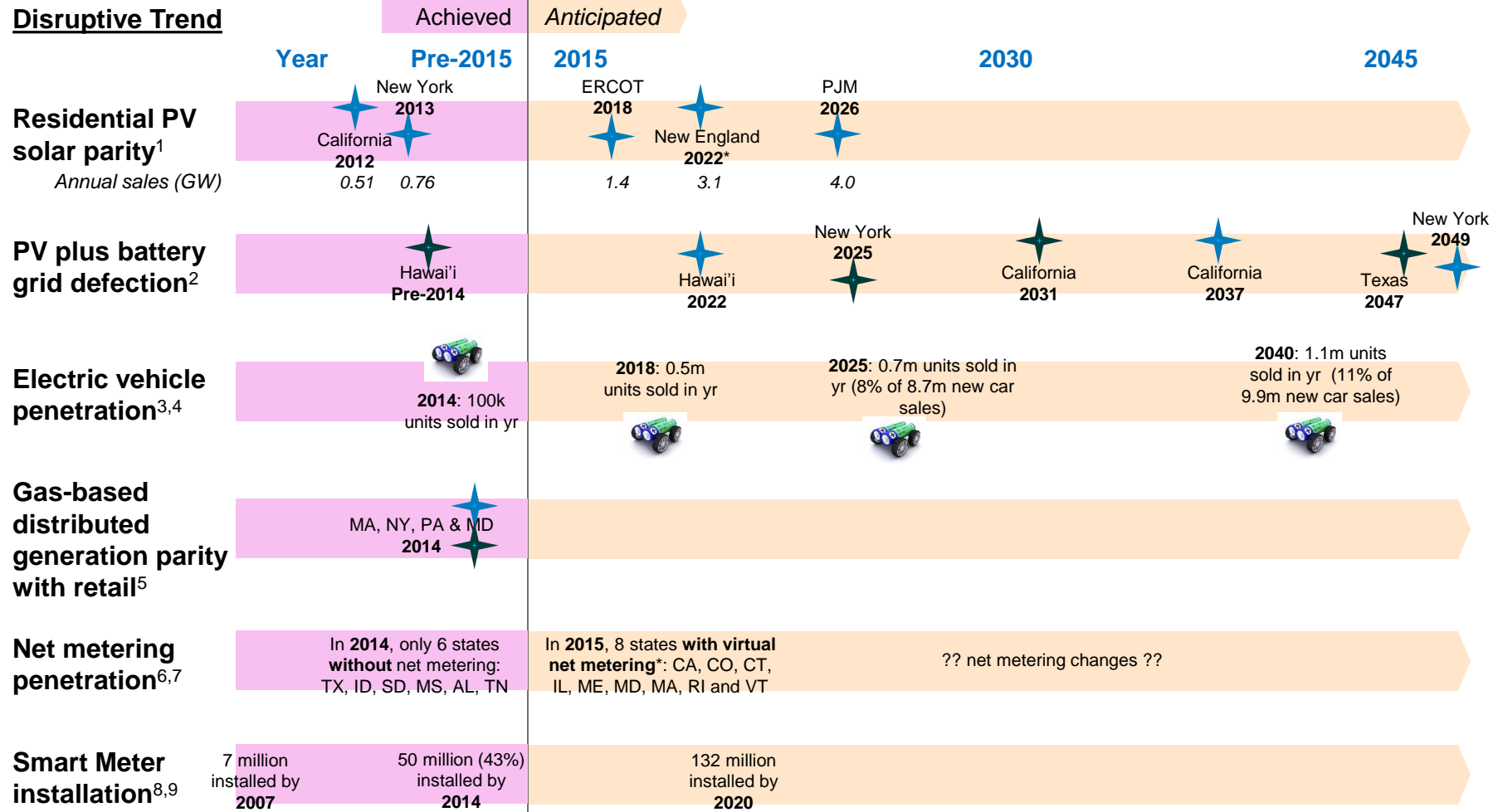
147,400
employees

115.3 gigawatts
of installed power capacity

10.5 gigawatts
under construction



The energy transition is happening



¹ Bloomberg New Energy Finance; ² EPRI; ³ UBS; ⁴ U.S. Energy Information Administration; ⁵ GDF SUEZ; ⁶ Renewable Energy World.com; ⁷ Seia.org; ⁸ IIE; ⁹ Telefonica

* Enables multiple homeowners to participate in the same metering system and share the output from a single facility that is not physically connected to their property or meter

— Global concerns and trends are driving the business landscape

Global Warming

- **Increasing global consensus** around human contribution to Global Warming
- **COP21** in Paris offers framework for tangible cooperation to reduce warming to **+2°C**

Economic growth

- Future economic growth increasingly from **Emerging Markets & developing countries**: 5% GDP annual growth vs. 2% in advanced economies 2015-2020¹

Decentralized solutions

- Increasingly cost-competitive distributed generation technology permits a “**jump**” straight to **decentralized electrification** (without need to develop costly centralized grid infrastructure)

Digital technology

- **Mobile technology** is enabling economic growth in the absence of physical infrastructure
- Facilitated by migration of **Smartphone growth**— all of top 10 highest growth by value markets in 2015 are emerging economies²

Powerful forces are shaping the North American energy transition

Key Factors

Implications

Shale gas & oil

- **Re-orientation of gas flows** across North America, and new pricing mechanisms
- **New uses for gas**; new investment in **gas-intensive manufacturing**
- **\$1+ trillion investment** in supporting infrastructure

Disruptive technology / business models

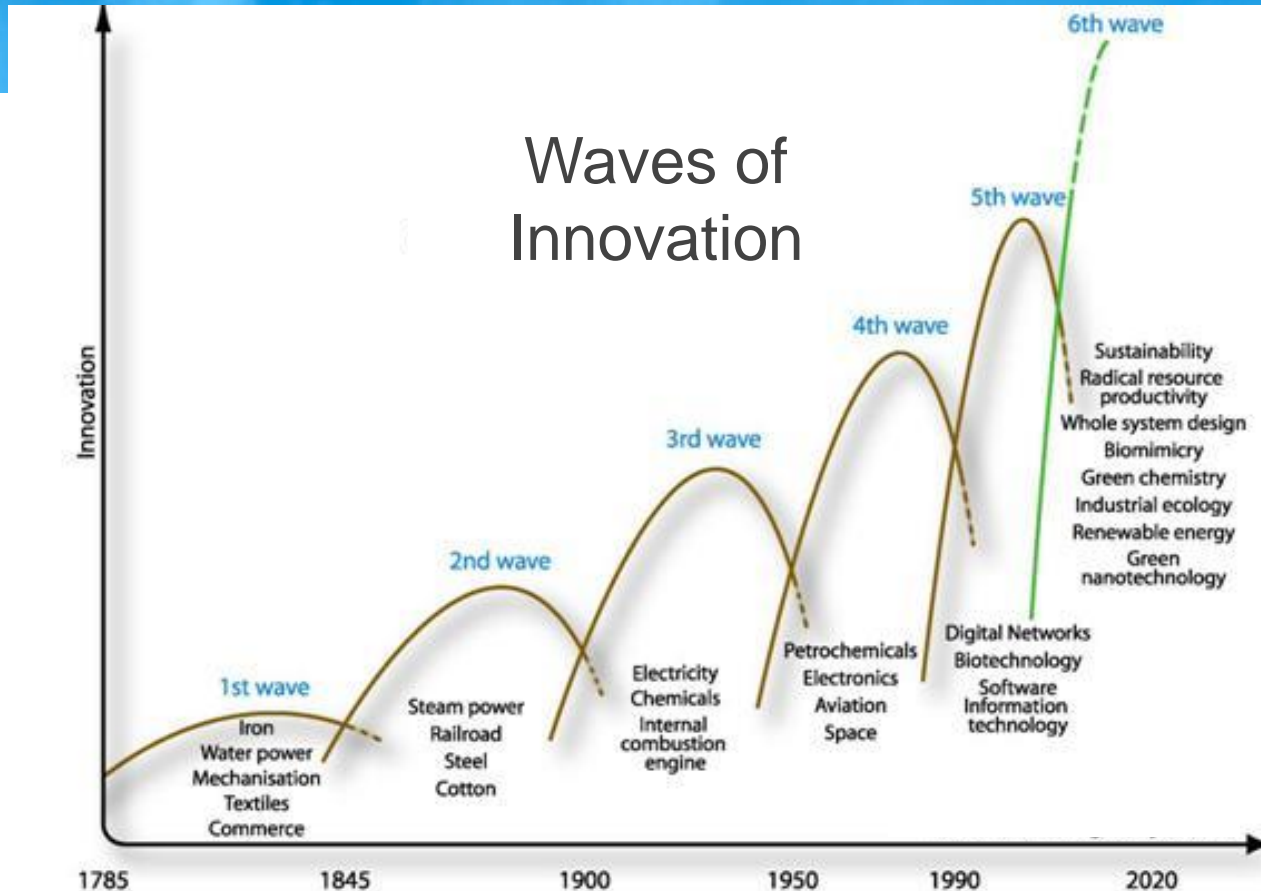
- **Distributed generation** based on natural gas; **distributed solar PV**; **batteries**
- More **integrated, 2-way grid**
- The **empowered consumer**, serving as both producer and consumer (subsequently referred to in this document as a “prosumer”)
- **Mobile engagement**, and higher consumer expectations, will drive service quality, ease of use, and personal **customization**

Digitalization & consumer engagement

Energy policy

- US EPA rules & low cost gas enabling **acceleration of coal/oil plant closures** - up to **70 GW Coal retirements expected**.
- **Energy Efficiency and subsidized renewables** as a tool for compliance
- **Wholesale power markets in transition – policy adjustments are needed**

- Technology innovation waves are arriving more frequently, and are increasingly short in duration



- **Innovation is inevitable** – but it is difficult to forecast what specific technology will succeed commercially, and the timing and duration of that success (e.g., Blackberry vs. iPhone)
- **Increasing diversity of participants in the energy sector** (e.g., Tesla, Google) increases innovation – it also adds to **competitive intensity** and the need for **continuous business model evolution**

The challenge for energy suppliers: a traditionally low engagement category, plus new expectations from Millennials

Low levels of customer engagement (and loyalty):

- Interact with their provider only ~ **9 minutes per year**



Rise of the **Millennial* generation** -- a catalyst for transforming customer engagement

- **1/3** of the U.S. adult population **by 2020**, and **75%** of the U.S. workforce **by 2025**

A **new approach** is needed to engage the **new consumer generation**:

Beliefs: **81%** expect companies to align with their beliefs, and to be **green**

Trust: **83%** don't trust large companies. **But they trust their peers** – take advantage of “**social contagion**” across peer groups.

Independence: All services expected to be **on-demand and DIY**.

Personalization: Customer experience needs to be individualized. **Personalization techniques** have been shown to increase utility email open rates by an average of nearly 15% versus the norm

* Millennials are identified here as those born between 1982 and 2003

Source: Forbes; Accenture; Opower, 2014

Two overriding goals for ENGIE

1

Be a leader in the energy transition in mature markets

- United States
- Continental Europe
- Great Britain

2

Be the benchmark energy player in fast growing markets

- Central America- Mexico
- South America
- Africa
- Asia

Within North America, We Are Evolving with a New Strategic Focus

Retail Energy and Services

Opportunities in Energy Transition Context

- Predictive energy management and diagnostics
- Distributed power solutions (e.g., solar, CHP)
- Price responsive demand; peak demand reduction
- Energy efficiency programs
- Electric vehicles

ENGIE examples

Mobile commerce



Rooftop solar



Energy services



Energy consulting



Generation

- Contracted power and Combined Heat and Power
- Utility scale and community solar
- Grid services

Industrial CHP



Contracted renewables



Gas

- Off-grid, remote and transport solutions
- CNG (fuel stations, mobile pipelines)

LNG distribution





Thank you