INVESTMENT ADEQUACY IN ONTARIO

How Market-Based Mechanisms Can Unlock Competition and Innovation

PRESENTED AT

Ivey Energy Policy and Management Centre
3rd Annual Workshop on the Economics of Electricity Policy and Markets

PRESENTED BY

Kathleen Spees

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THE Brattle GROUP

Hypothesis

Market-Based Approaches Will Better Enable Ontario's Electricity Sector to Address Transformational Challenges:

1: Getting COSTS under Control	2: DECARBONISING the Ontario Economy	3: Unleashing the Potential of NEW TECHNOLOGIES

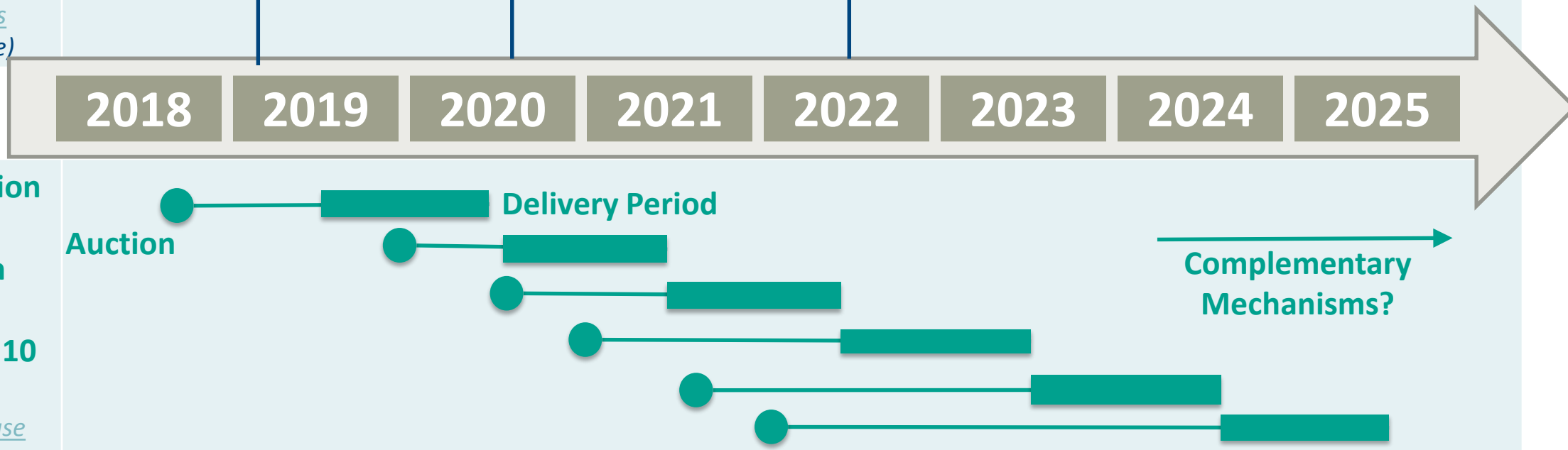
Ontario Background: The Transition to Markets and Progress in the Market Renewal Program

Energy Market Reforms

$660-930 Million NPV Net Benefits in 10 years

IESO Draft Benefits Case (2019 Update)

Note: Timelines are approximate (from IESO materials dated mid-2019)



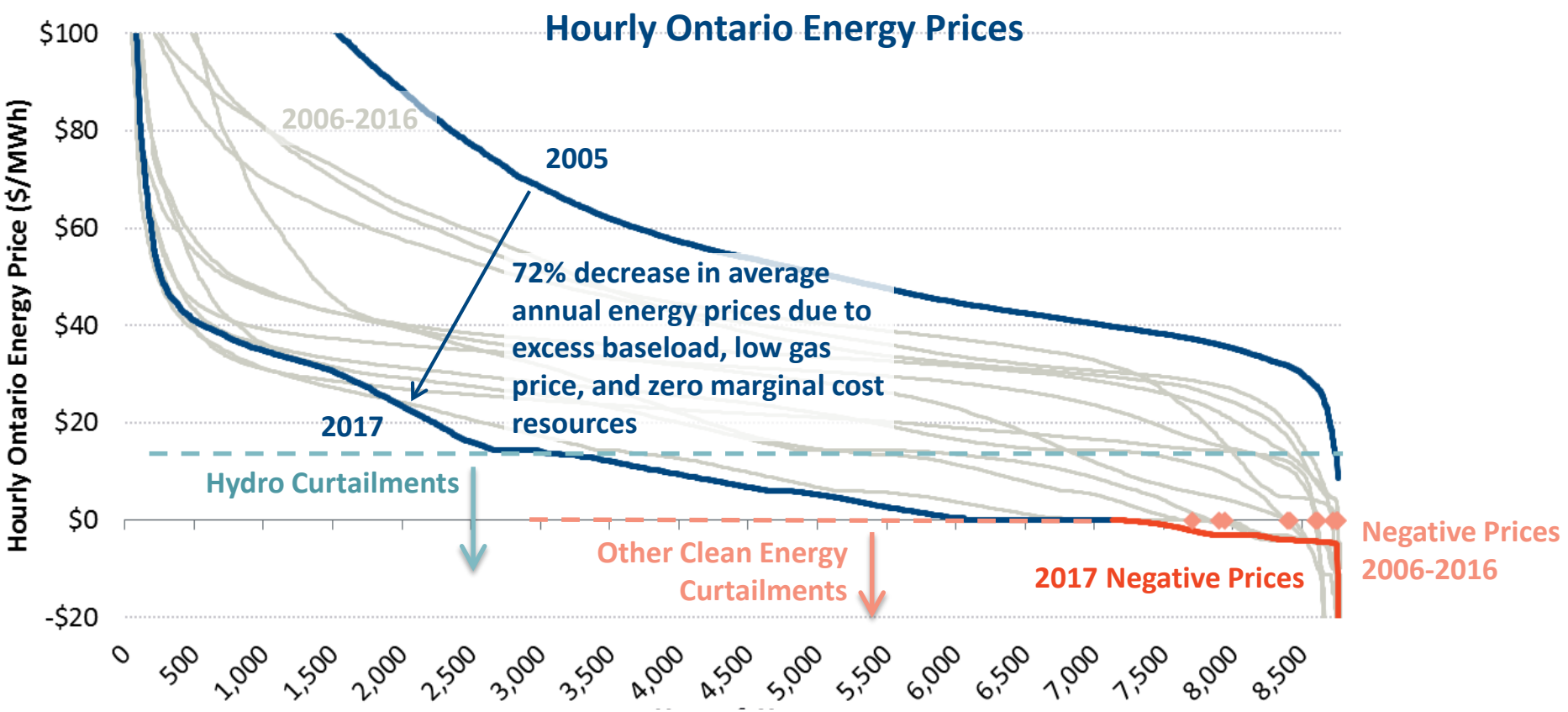
Capacity Auction

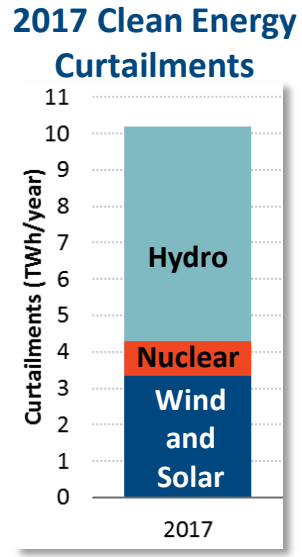
$2,530 Million NPV in Gross Benefits Over 10 Years

Brattle Benefits Case Study (2017)

Ontario Background: How the Energy Market "Bottomed Out" in the 90% Clean Energy Market

Effective energy price formation to signal shortage, surplus, and flexibility needs are more important than ever (including alignment with rates, contracts, and hydro taxes)



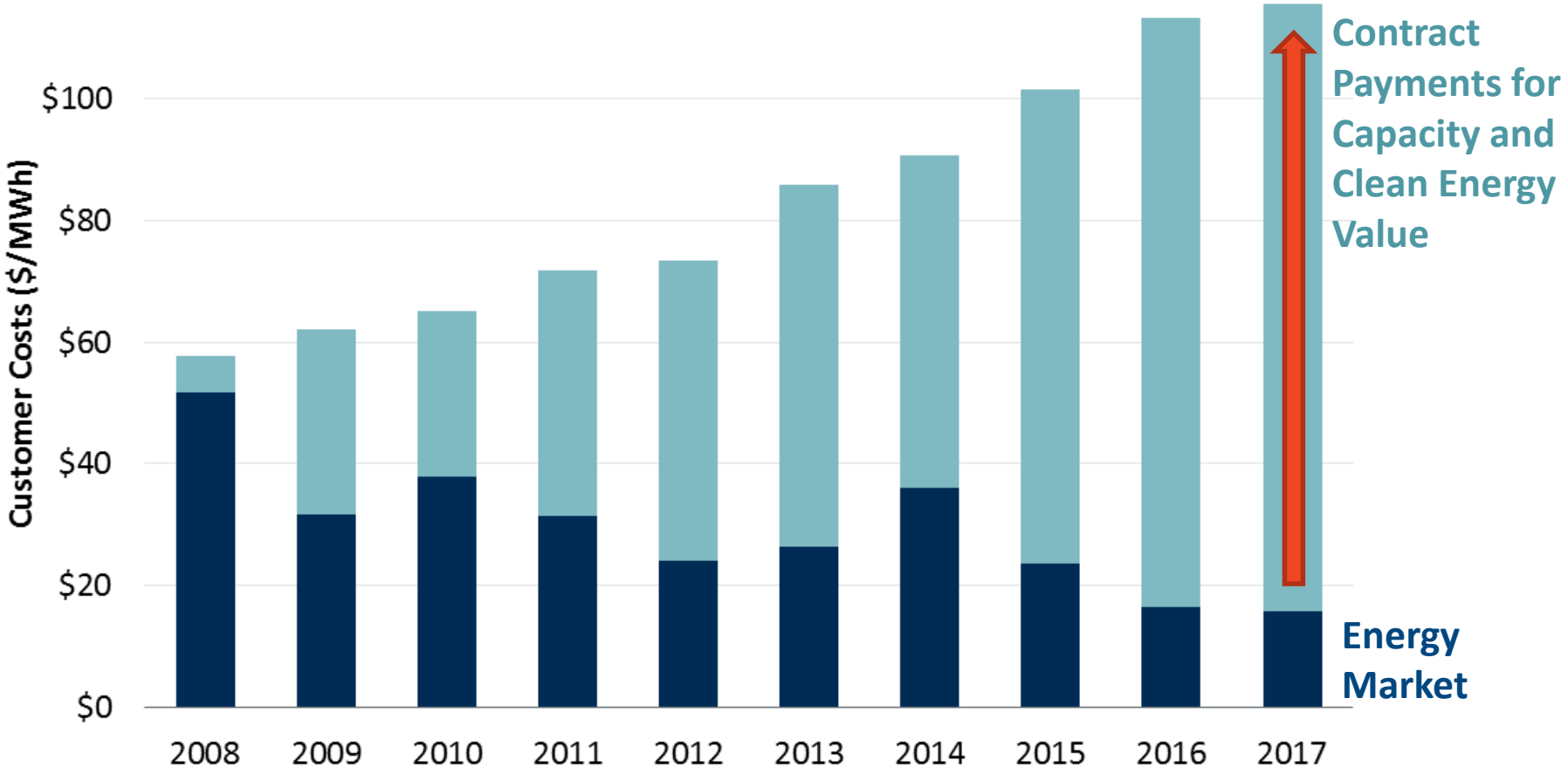


Sources: Hourly Ontario Energy Prices taken from IESO Data Directory. Curtailments taken from IESO year-end data and OPG's annual & financial reports. Water rental charge and property tax calculated from Ontario Ministry of Finance, assuming $43/MWh contract price and over 700 GWh/year generation.

Transformational Challenges

Challenge 1: Getting **COSTS** Under Control

Centralized planning and contracting combined with unforeseen/rapid changes to policy and fundamentals have driven cost escalation



Key Cost Drivers

- **Excess supply**, locked in for 30 years
- **Imbalanced mix** (excess baseload)
- **Limited competition** in procurements (lack of competition across techs, regions, term & vintage)
- **Dispatch inefficiencies** introduced by contract, market & other incentives

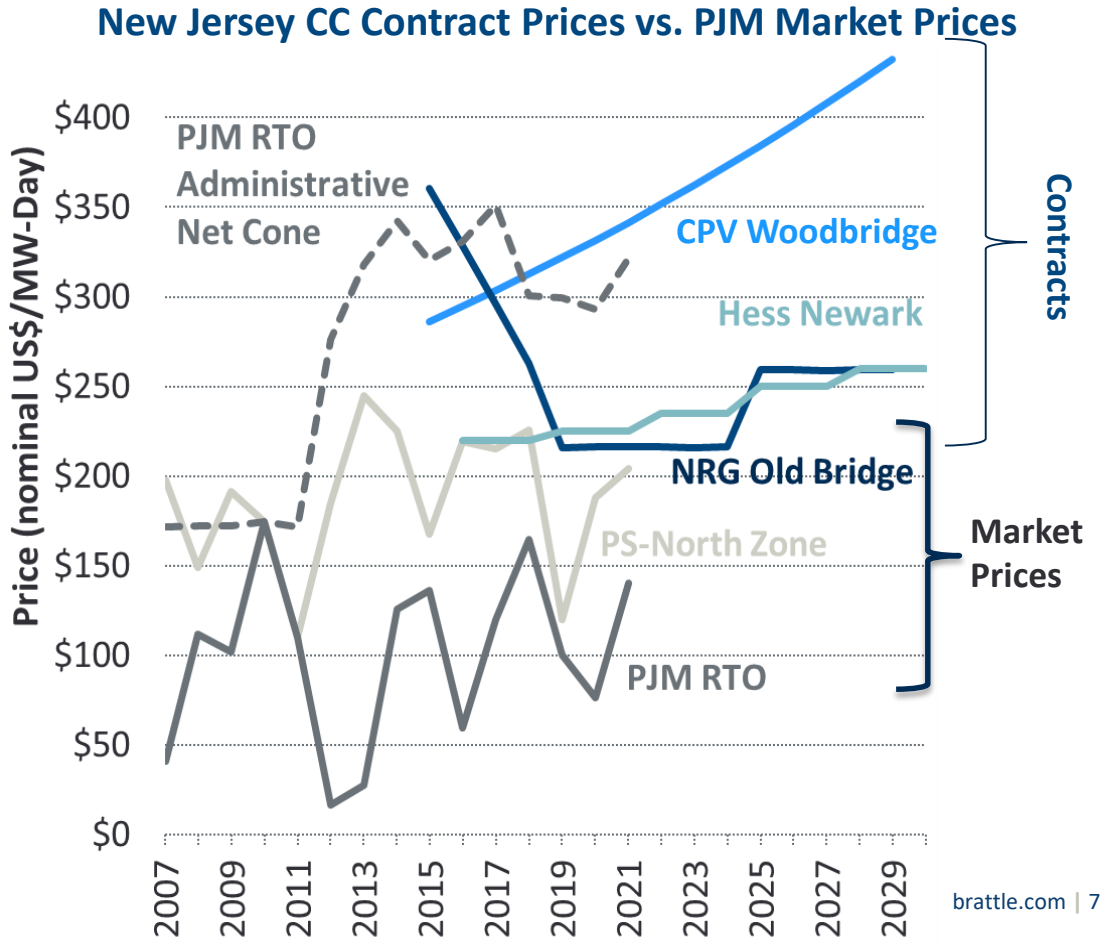
Source: IESO Global Adjustment Data.

Challenge 1: Markets Drive Down **COSTS** by Harnessing Competition and Rewarding Innovation

Example: New Jersey competitive RFP for long-term contracts signed at prices 15-60% above competitive capacity auction prices

How Did the Market Drive Lower Costs?

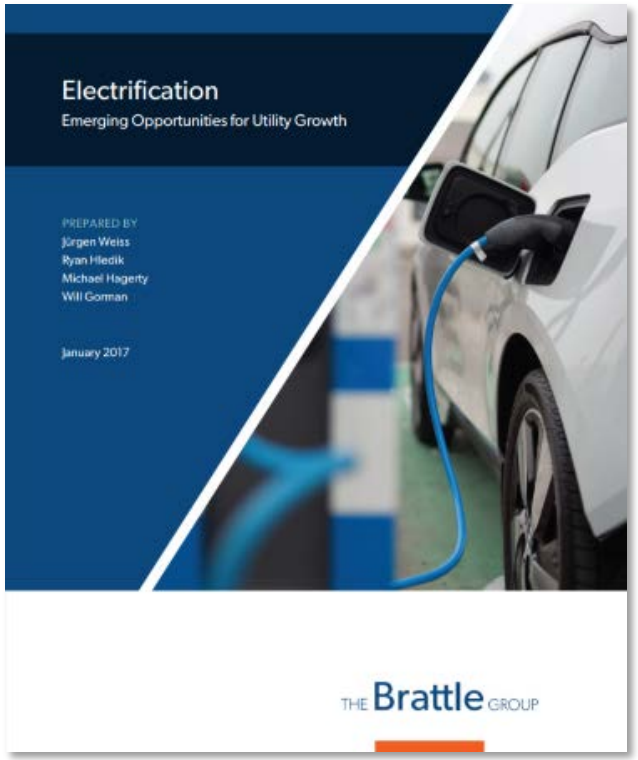
- **More competition** across vintages, technologies, locations, and firms
- **Shorter 1-year term** offered (though private market enables financing via multi-year hedges)
- **Uniform price auction** incentivizes sellers to truthfully reveal minimum costs
- **Centralized auction** offers transparency, liquidity, and (some) regulatory stability
- **Uniform product** definition and qualification standards enable resource neutrality

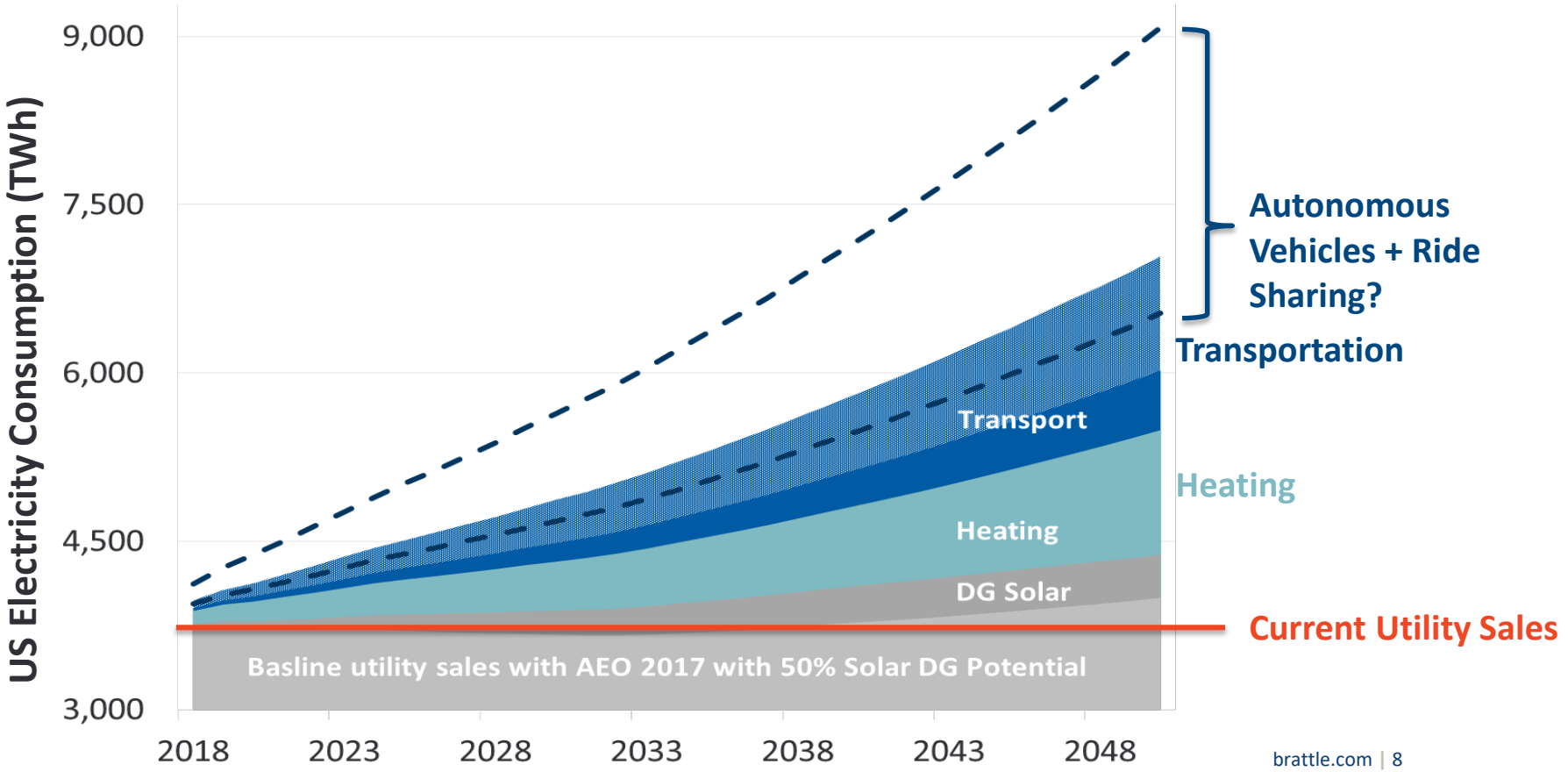


Sources: SNL Energy, PJM capacity auction parameters and results.
RTO = Regional Transmission Organization
PS-North is a sub-region of Public Service Enterprise Group transmission zone

Challenge 2: **DECARBONISING** the Ontario Economy

Electrifying the entire economy with (near) 100% clean power is currently the primary feasible path to 80% greenhouse gas reductions by 2050

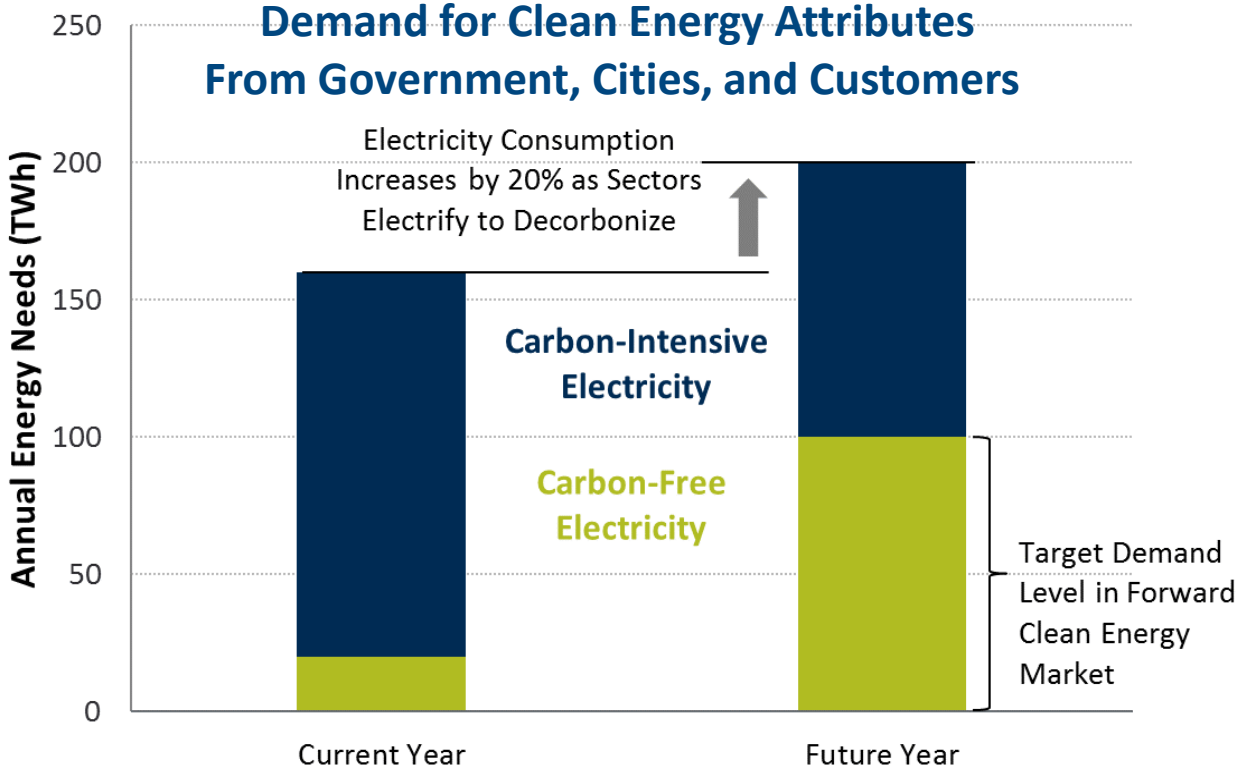




Source: The Brattle Group, *Electrification* (2017).

Challenge 2: Markets Can Meet Policymakers' and Customers' **DECARBONISATION** Goals

Example: Forward Clean Energy Market (FCEM) is a design proposal to enable companies, cities & governments buy unbundled clean energy attributes. Designed to align with energy & capacity markets



Sources and Notes:

See the full design proposal in *How States, Cities, and Customers Can Harness Competitive Markets to Meet Ambitious Carbon Goals Through a Forward Market For Clean Energy Attributes* April 2019.

Challenge 3: Unleashing the Potential of NEW TECHNOLOGIES

Rapid cost reductions, technology advancements, and customer adoption rates amplify the need for a nimble marketplace that rewards innovators (and avoids locking in the costs of current technologies)

Google Home

hue PHILIPS

nest

NISSAN leaf

ohmconnect

amazon alexa

Challenge 3: Markets Can Reward NEW TECHNOLOGIES that Can Meet System Needs Faster, Better, or Cheaper

Compared to traditional planning and procurement, technology-neutral markets to serve well-defined system needs can better enable innovative solutions

Technology Types

System Needs	Coal	CC	CT	Nuclear	RoR Hydro	Hydro w/ Storage	Wind	Solar	Battery Storage	DR	EE	Imports
Day-Ahead Energy	✓	✓	○	✓	✓	✓	✓	✓	○	○	○	✓
Real-Time Energy (5 Min)	✓	✓	○	○	✓	✓	✓	✓	○	○	○	○
Regulation	✓	✓	○	X	✓	✓	○	○	✓	○	X	○
Spinning Reserves	✓	✓	✓	X	○	✓	X	X	✓	○	X	○
Non-Spinning Reserves	X	✓	✓	X	X	✓	X	X	✓	○	X	○
Load following / Flexibility	○	✓	✓	○	○	✓	○	○	✓	○	X	○
Capacity	✓	✓	✓	✓	○	✓	○	○	○	✓	✓	✓
Clean Attributes (RECs)	X	○	○	✓	✓	✓	✓	✓	○	○	✓	✓
Reactive / Voltage Support	✓	✓	✓	✓	✓	✓	○	○	✓	X	X	○
Black Start	○	✓	✓	X	✓	✓	X	X	○	X	X	○

Technical Capability for Service

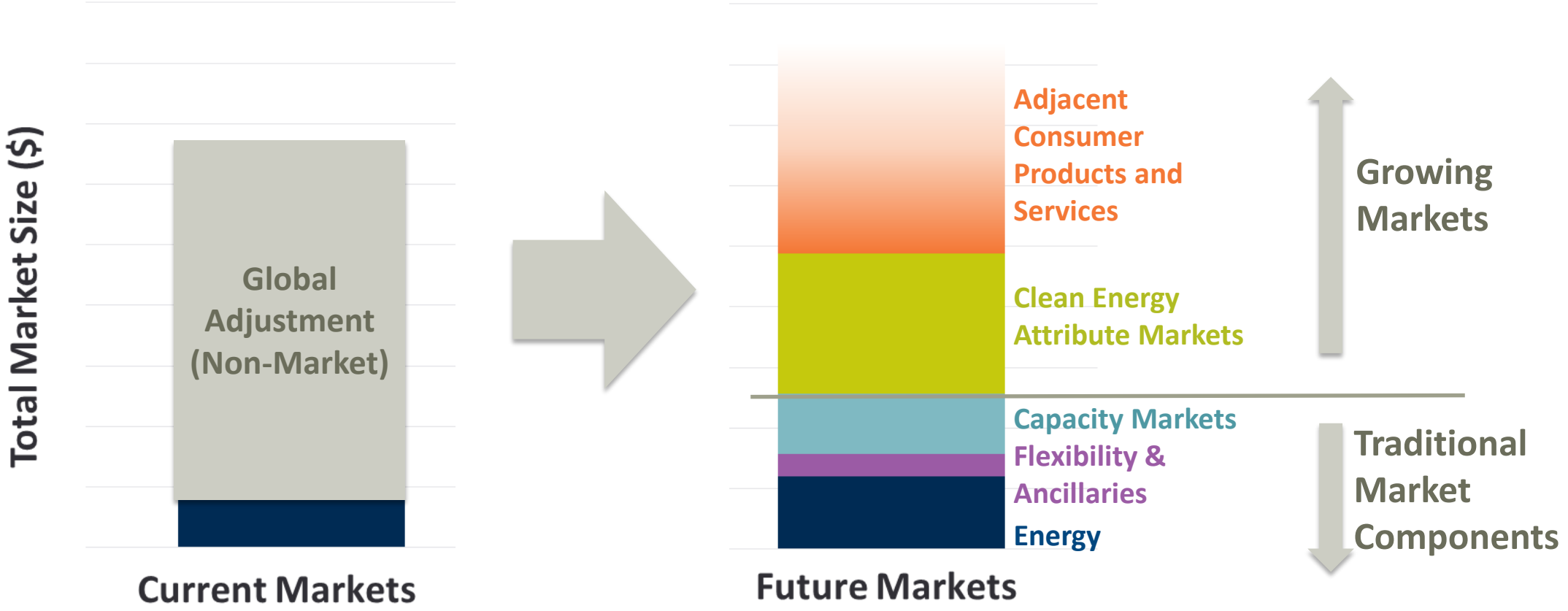
- ✓ Well Suited
- ○ Somewhat Capable
- X Not / Poorly Suited

Even non-traditional & carbon-free supply can provide essential grid services (If enabled to compete in a competitive marketplace)

A Market Vision for 2040?

Market Vision: Where Are the Markets Going?

Transitioning to markets would mean slowly replacing contracts with competitive markets, including for emerging system/customer needs



Takeways for Investment Adequacy: Thoughts on the Ontario Capacity Auction & Potential "Supplementary Mechanisms"

- Capacity auction will begin delivering benefits on day one and grow over time as the quantity increases, product definition/design are refined & more resources are enabled over the coming years
- But capacity auction is just one component of the transition to a more dynamic, market-based sector
- Other reforms and new products may be needed to address all challenges including flexibility, clean energy, expressing customer preferences, and enabling the grid edge
- Recommend that the discussion around supplementary mechanisms maintain a focus on an overall trajectory to maximize the benefits of competition through resource-neutral approaches to serve well-defined, unbundled products

Presented By

Kathleen Spees
Principal
Washington, DC

+1.202.419.3390
Kathleen.Spees@brattle.com

Experience

Dr. Spees is an expert in wholesale electricity and environmental policy design and analysis. Her work for market operators, regulators, regulated utilities, and market participants focuses on:

- Energy, capacity, and ancillary service market design
- Carbon and environmental policy design
- Valuation of traditional and emerging technology assets
- Strategic planning in the face of industry disruption

In more than a dozen international jurisdictions, Dr. Spees's work has supported the design and enhancement of environmental policies and wholesale power markets in decarbonizing electricity systems.

Education

Ph.D., Engineering and Public Policy, Carnegie Mellon University

M.S., Electrical and Computer Engineering, Carnegie Mellon University

B.S., Physics and Mechanical Engineering, Iowa State University

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