Clean Security of Supply in Europe:
Models for Market-Aligned Contracting and Procurement

PREPARED BY

Dr. Andrew W. Thompson

Dr. Kathleen Spees

PREPARED FOR

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Brattle

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Section I: Problems with Power Investments

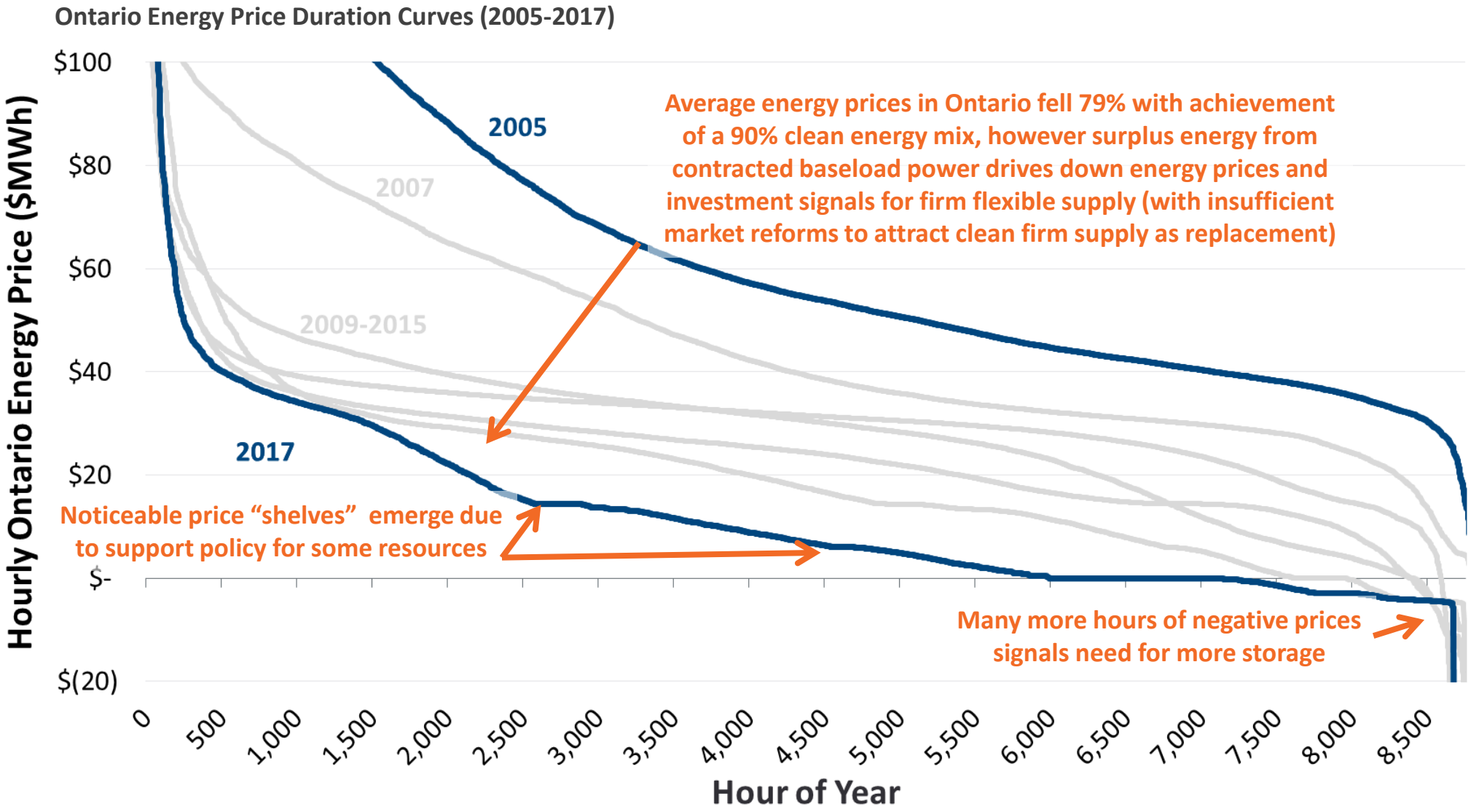
Problem Statement

The conundrum of power investments is that we need clean energy, and secure supply, which to date have been pursued in disconnected and expensive ways.

- Long-term contracts if poorly designed can undermine short-term market signals and competition
- Non-dispatchable clean energy procurements often do not contribute sufficiently to changing reliability needs
- Current security of supply mechanisms tend to procure reliability at least cost, with limited scope for also supporting clean energy policy goals
- Hard to incorporate market discipline and price transparency with long-term contracts
- Hedging costs via contracting requires dedicated expertise which may limit access for smaller customers
- Many ongoing efforts to improve contract structures for clean energy procurements and security of supply mechanisms, but minimal coordination between the two

How to ensure security of supply for changing system needs while enabling the clean energy transition?

Disconnected approaches to clean resource contracting and security of supply can result in additional changes to short-term energy prices



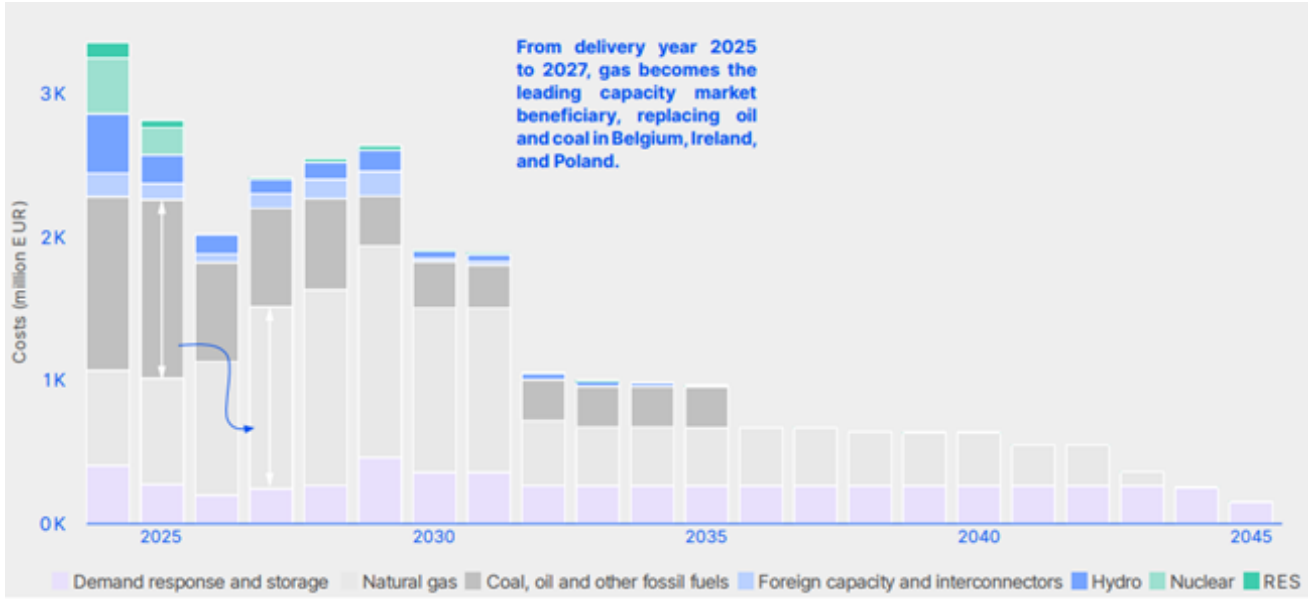
Current capacity mechanisms largely support fossil supply

Capacity mechanisms in Europe to date tend to attract and retain fossil-fuels (least cost for reliability) and do not always result in least cost for reliability + clean energy transition.

ACER expressed concern about potential challenges with capacity markets working at cross purposes with the clean energy transition in the 2025 Security of EU Electricity Supply Report, stating:

- *"Fossil fuels are at the core of EU capacity mechanisms, with a recent shift from oil and coal towards gas. The contracts awarded to gas units have seen their value doubled from 2024 to 2027 delivery years. However, providing long-term financial support for gas units locks them in the market. This could result in electricity prices staying exposed to tensions linked to geopolitical challenges or to the volatility of globalized LNG market."*
- *"Fossil fuels plants – coal, oil, and gas – currently benefit the most from capacity mechanisms. This impacts CO2 emissions, especially in the case of market-wide capacity mechanisms that provide non-targeted support"*

Aggregated Costs of Long-term Capacity Contracts in France, Ireland, and Poland (2024, million EUR)



Source: ACER, 2025 Security of EU Electricity Supply Report, November 2025.

Section II: Security of Supply

Many approaches to security of supply in Europe

Security of Supply measures are at varying stages of development in Europe with no standard approach to date.

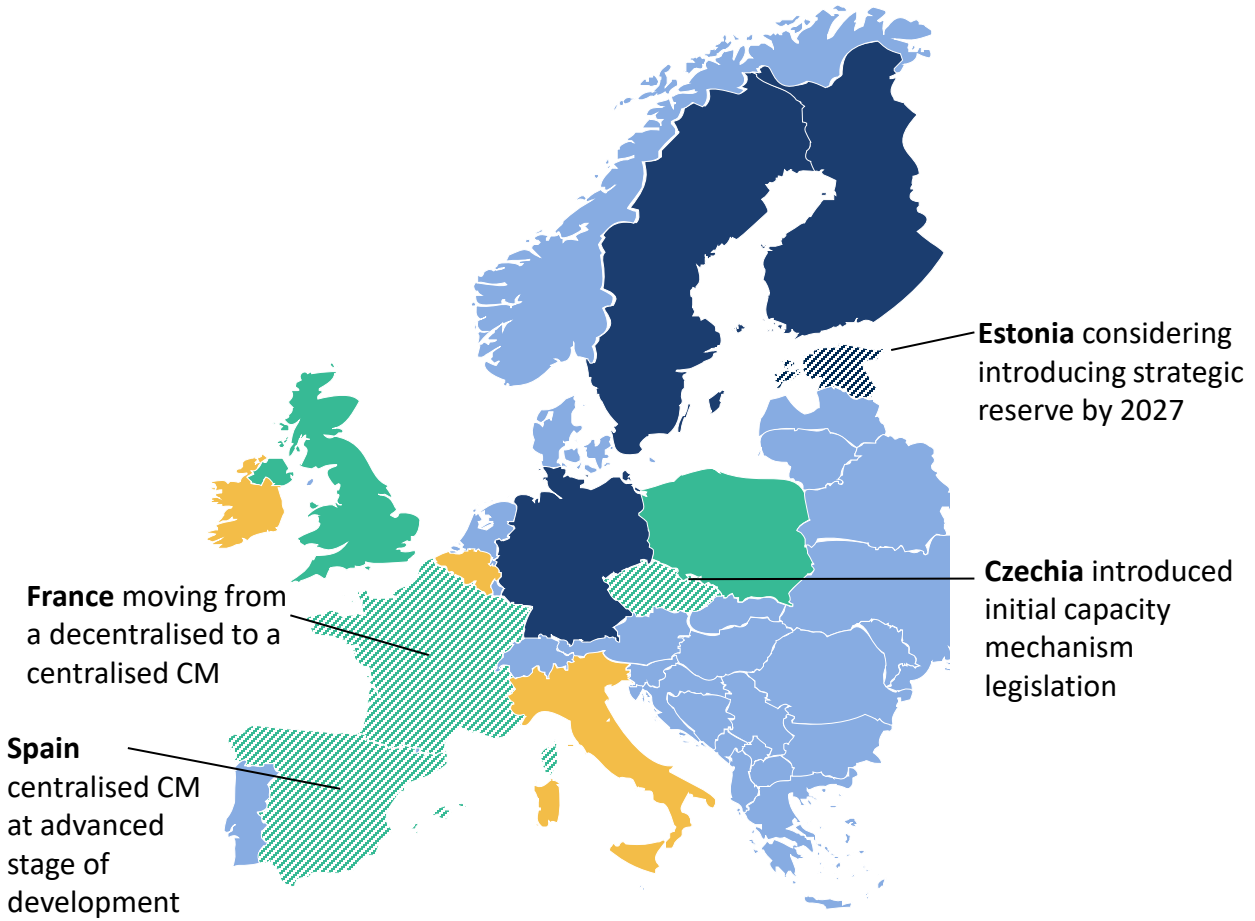
Three primary approaches to security of supply in markets have developed in Europe:

Strategic Reserves: pays generation to be held in reserve outside of the energy market. Targeted to limited supply so results in less distortion to short-term energy and balancing markets in theory. Often do not incentivise investments in new resources or technology and tend to favour existing fossil-fuels.

Capacity Mechanisms (CMs): procures a product for capacity (€/kW) often on a forward-looking basis. Provides an additional revenue stream which improve economics of new resources. Can result in distortionary effects on short-term energy and balancing market signals and high consumer costs if poorly designed.

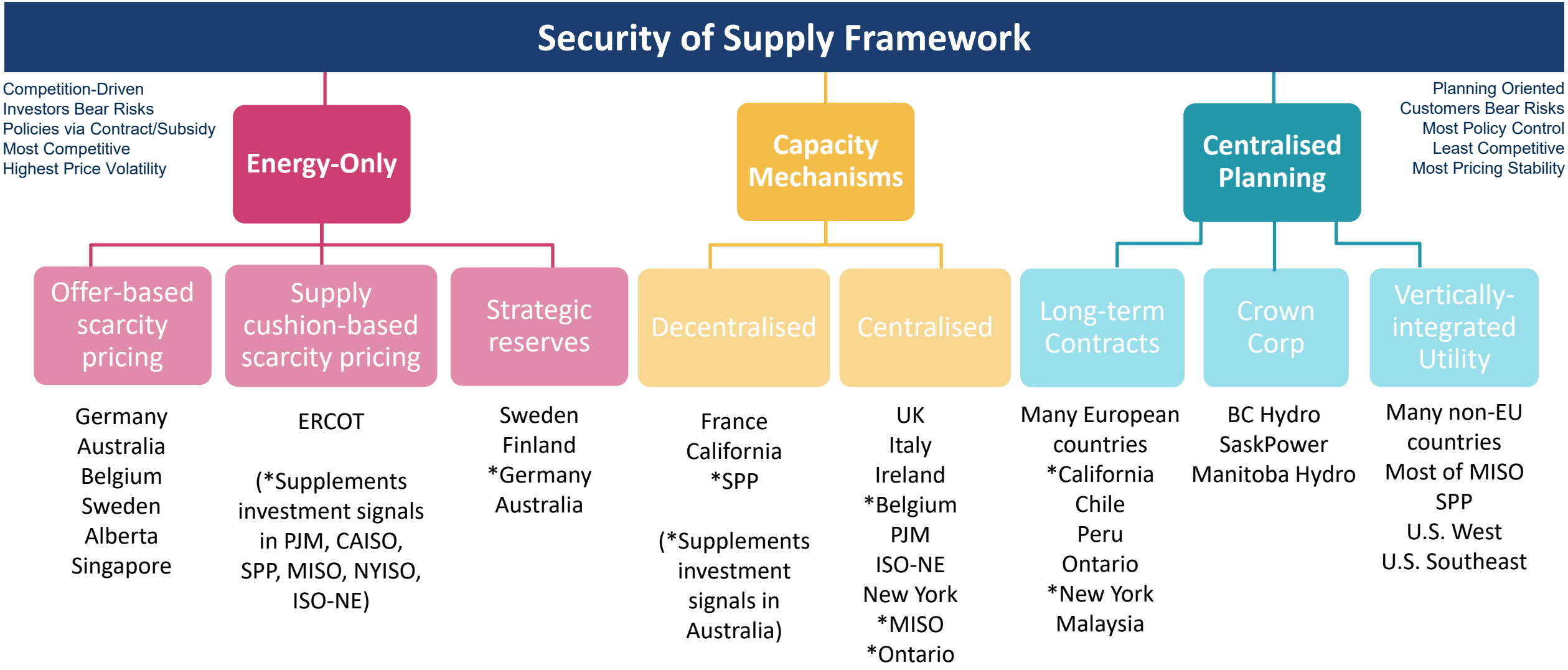
Reliability Options: similar to CMs but with a payback mechanism to consumers when short-term energy prices are high. Ensures greater consumer protections during extreme prices but capped supplier revenue at strike price may discourage new investment at necessary pace if set too low.

Security of Supply Measures in Europe (2025)



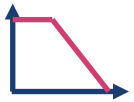
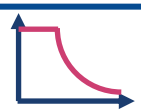
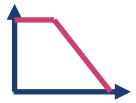
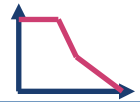
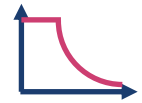
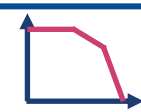
Source: Adapted from ACER, 2025 Security of EU Electricity Supply Report, November 2025.

Security of supply has traditionally been a spectrum of options



*Most jurisdictions rely on more than one market-based or planning-based approach to attract new investments (e.g. primarily market-based, with a small share of policy contracts; or regulated planning as influenced by market-price-driven economic incentives and short-term purchases.)

Capacity mechanisms require a number of design decisions

	Forward Period	Seasonality	Delivery Period	Capacity Auctions	Price lock-in	Derating Factor	Demand Curve
CAISO	2 months (annual) 45 days (monthly)	J F M A M J J A S O N D	Monthly x 24 slice of day	None (Bilateral Market)	Varies	Thermal: historic performance Wind/solar: exceedance	none
Ontario	4 Months	Summer | Winter	Seasonal (2 Seasons)	Centralized auction for residual need only	6-months	Thermal: forced outage Wind/solar: historic performance	
MISO	1.5 Months	Sum | Fall | Win | Spring	Seasonal (4 Seasons)	Mandatory Auction (Net of Self-Supply)	4-months	Approximated average probabilistic during critical hours	
NYISO	0-6 Months	A M J J A S O N D J F M	Monthly & 6-Month Strip	Voluntary & Mandatory Auctions	Up to 6-months	Marginal probabilistic	
PJM	3 Years	Annual	Annual	Mandatory Auction (opt-out possible)	1-year	Marginal probabilistic	
ISO-NE	Prior: 3 Years Plan: Non-Forward	Annual	Annual Plan: Seasonal	Mandatory Auction	1-year	Marginal probabilistic	
UK	T-1: 1 year T-4: 4 Years	Annual	Annual	Mandatory Auction	Existing: 1-year New: 15-years	Average probabilistic	

Sources and Notes: Kathleen Spees, Are Resource Adequacy Markets Adequate?, Energy Bar Association 2025 Annual Meeting & Conference.

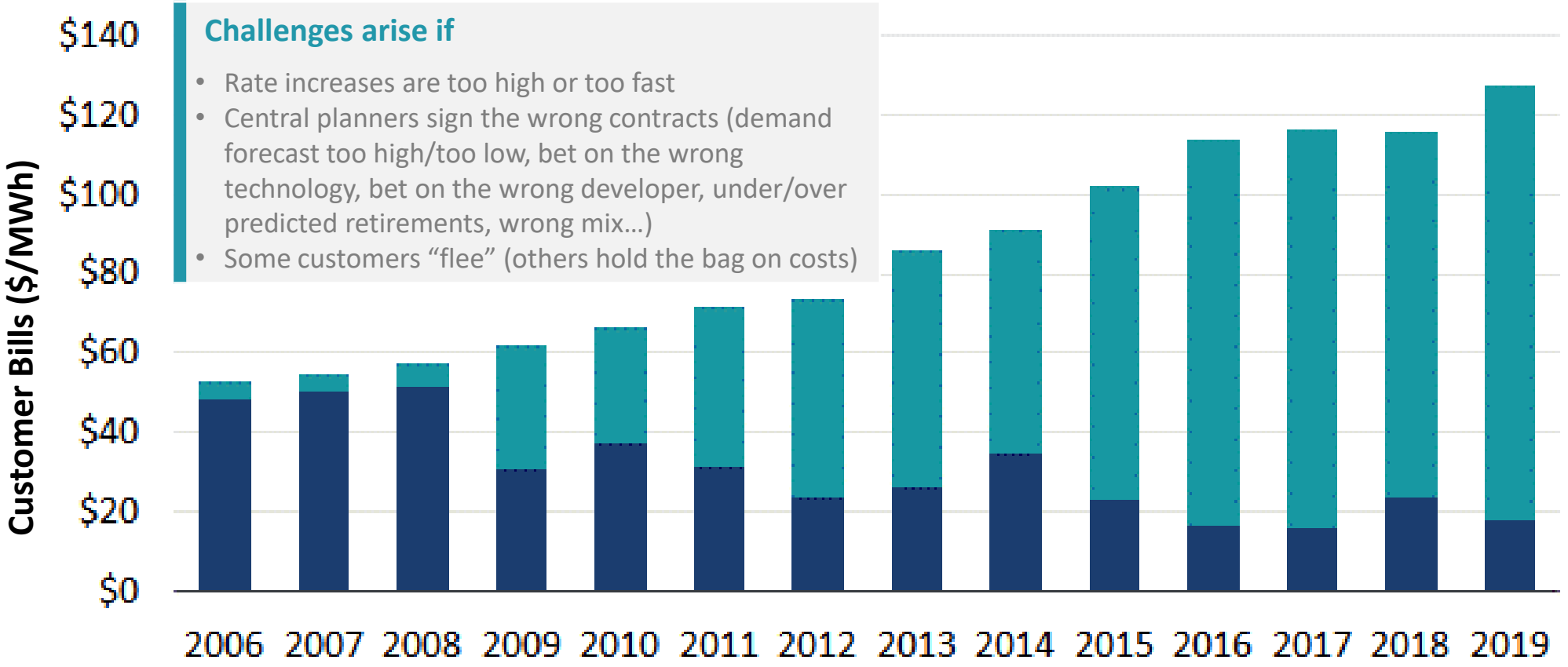
Section III: Clean Procurement

Low energy prices do not always translate to low customer costs

Long-term contract-based investment model that is not sufficiently market aligned can mean customers pay investment costs as pass-through

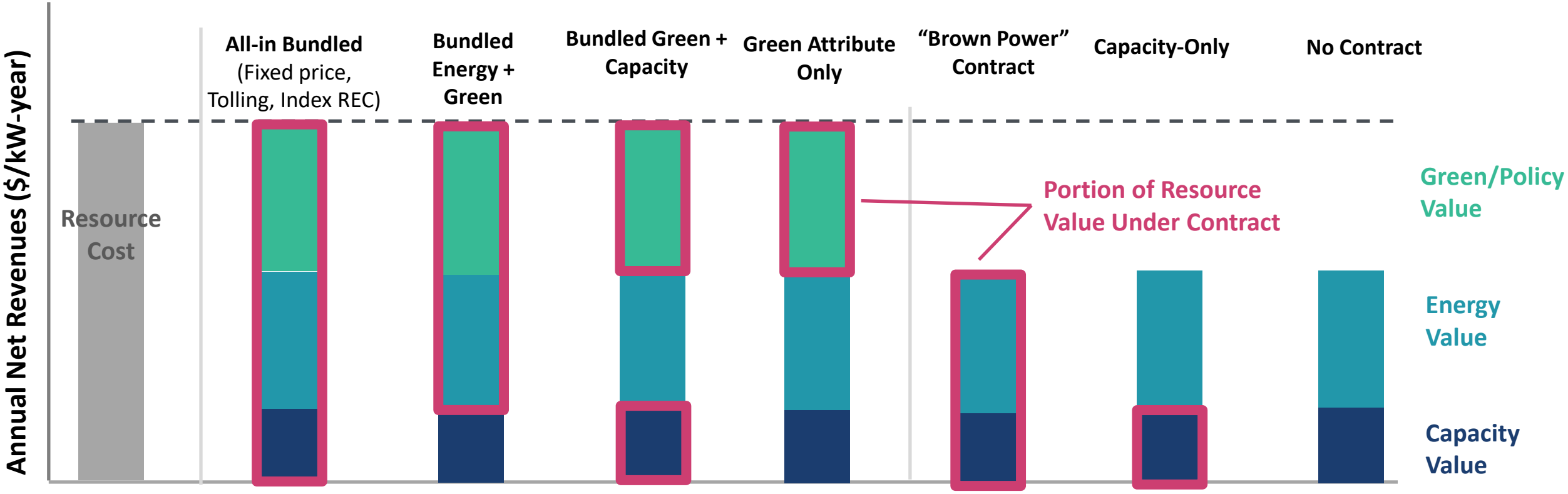
Challenges arise if

- Rate increases are too high or too fast
- Central planners sign the wrong contracts (demand forecast too high/too low, bet on the wrong technology, bet on the wrong developer, under/over predicted retirements, wrong mix…)
- Some customers "flee" (others hold the bag on costs)



Source: Ontario Independent Electricity System Operator, Global Adjustment Components and Costs.

Contracts have different allocations of risks between buyers and sellers



Green Power Contracts
Include a subsidy above expected market prices, which is needed to attract "preferred" resource types. Can place more risk on customers (left) or sellers (right).

Brown Power Contracts
Hedge against market volatility, but do not include any subsidy above expected market prices.

Design process for clean contract incentives

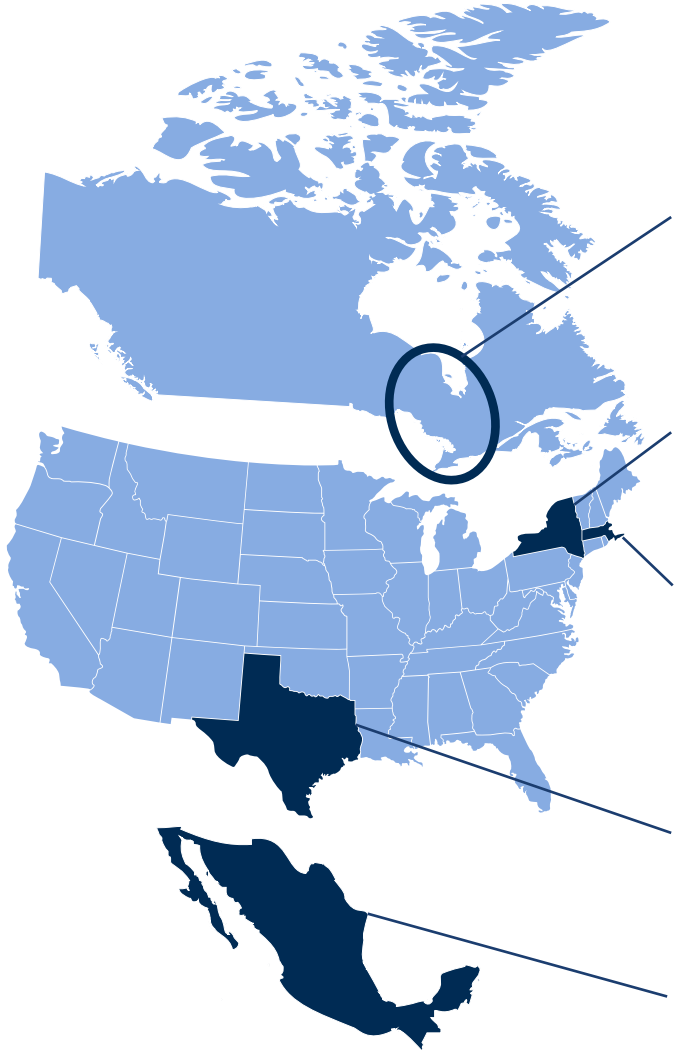
Design principles for long-term contracting and incentives for clean and secure supply:

- Design process to meet policy goals very similar to other market design processes focused on reliability or security (but rather than starting with reliability needs, begin with policy goals)
- Initial focus (step 1) is to clarify policy goals in clear units of measure, and then translate goals into a clear product definition (step 2), as this creates the central basis for many other aspects of efficient investment & operational incentives
- If all resources (contracted and not contracted) can access the same monetisable value in the operating timeframe for green, reliability, and other values, then markets & contracts can be mutually informative and reinforcing

DESIGN PROCESS	
1	Set policy objectives/targets to be achieved
2	Translate objectives into primary product definition (units of measure toward meeting objective)
3	Identify regulatory entity responsible for meeting objective, and mechanism to enforce compliance (defines buy side of the market/contracts)
4	Measure how different resources contribute to (or detract from) meeting policy objectives (defines the sell side of the market)
5	Create a spot market (or contract-based operating incentives) that incentivise buyers & sellers to pursue the policy objective
6	Identify investment market or contract procurement model that will attract resource development, retrofits & retention
7	Assign costs (if cost allocation is not inherent)
8	Enable self-supply and lower-cost solutions

Section IV: Models for Clean Security of Supply

Integrated models for clean and secure supply: a spectrum of options



Ontario: centralised planning model with 90% clean supply mix and government playing central role

New York: mix of markets and targeted centralised procurements for clean supply with strong policy goals

New England Forward Clean Energy Market (FCEM): novel approach to incorporate clean energy goals into markets

Texas: energy-only market with scarcity pricing and substantial uptake of clean resources despite no policy support

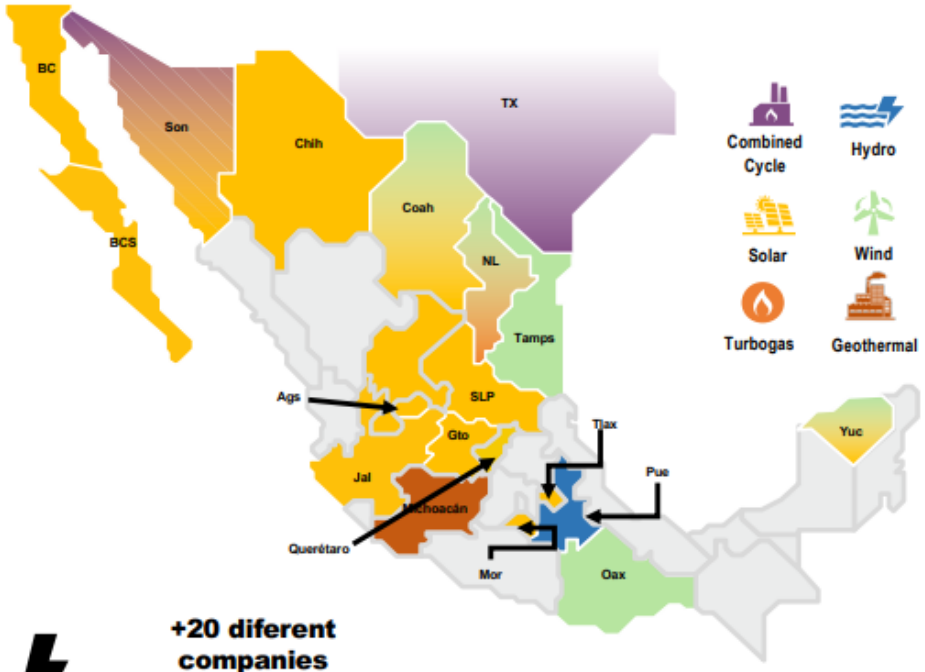
Mexico: Long-term auction design that resulted in world-record low costs for clean supply

Great Britain: mix of markets and long-term procurements for clean supply

Australia: energy-only market with clean energy certificate market and rapid uptake of clean supply

Competitive format attracted many investors and achieved successively lower prices for new investment in capacity

Locations of winning technology types and clearing prices in Mexico's long-term auction scheme (2015-2017)



+20 diferent companies
Companies from more than 11 countries, including Mexico

8.9 billion USD of investment in the coming years

Increase of **7.6 GW** to the current generation capacity in Mexico

Resume of resulting prices

		1ra	2da	3ra
USD/MWh+CEL*				
	Solar	44.97	31.22	21.34
	Wind	55.33	33.27	18.48
kUSD/MW-yr**				
	Geothermal	—	43.70	—
	Combined Cycle	—	51.90	—
	Turbogas	—	—	36.60
USD/CEL				
	Hydro	—	6.94	—
Number of offers	Offers	18	56	16
	Winner Offers	9	17	8

Elaboración propia. *Promedio ponderado de ofertas de paquetes que únicamente ofrecieron Energía y CELs. ** El dato de geotérmica corresponde a "3ª subasta de Largo Plazo", PWC, 2016. Tipo de cambio (MX/USD) utilizado por SLP: 1ra 17.3192, 2da 20.17, 3ra 19.185

USD/MWh for energy plus green attributes

USD/kW-yr Capacity

USD/MWh green attributes

Sources and Notes: CEL = certificado de energía limpia. Comision Reguladora de Energia, The Electricity Market in Mexico, A Recent Market & Regulatory Design for an Era of Low-Cost Renewables and Empowered Consumers, 5th GO15 & ICER Workshop Meeting, October 11, 2018.

Section V: A Better Path Forward

There is a spectrum of options for market-aligned contracting and procurement models for clean security of supply. Different approaches may be taken but all of these models have key features of better aligning investment needs to serve GHG reductions, as well as maintaining the role of competition and operating incentives to serve complex grid needs.

Competition-driven ⟷ Planning oriented

	Energy-Only		Capacity Mechanism		Multi-product Market	Centralised Planning
	+ Strong Carbon/Clean Credit Pricing	+ Clean Supply Requirements	+ Clean Supply Requirements	+ GHG Rate Reductions	Forward Clean Energy + Capacity Mechanism	Clean Policy-driven Planning
Security of Supply	Energy scarcity pricing		Energy + centralised capacity market		Centralised multi-product markets for procuring clean energy + (clean) capacity 1-year for existing capacity and ~15-year contracts for new capacity	Integrated planning, with all source procurements and market-aligned contract structures
Clean Policy	Strong carbon pricing or a tradable clean-energy-credit market	Decentralised model where each TSO must procure portion of national clean energy target through clean-energy certificates or PPAs	Long-term contracts for given amount of clean supply set by government	Targeted procurements of clean resources + GHG rate reductions set on generators		Clean policy determines resource types procured
How to Ensure Success?	Carbon or clean energy credit price must be high enough to reflect social value of clean supply	Need entity for accountability and given enforcement powers of clean energy targets	Transparent and consistent methods for derating factors in capacity market paired with "least-regrets" system planning to set procurement volumes for clean resources through long-term contracts		Co-optimised procurement of distinct products for clean energy, clean capacity, and GHG reductions on a forward basis; enable participation from greater range of customer types, not just TSOs	Ensure contracts are exposed to short-term energy market to ensure pricing discipline

Contact information

Dr. Andrew W. Thompson

ENERGY ASSOCIATE | MADRID

Andrew.Thompson@brattle.com

Dr. Thompson is an energy economist with a background in electrical engineering and expertise in wholesale electricity market design, regulatory economics, and policy analysis of network industries, particularly in the energy sector. Dr. Thompson has supported clients and diverse stakeholder groups – including electricity system operators, energy regulators, governments, clean energy advocacy groups, market participants, institutional investors, and utilities – in several international jurisdictions. He earned a Ph.D. in Economics from the Université Paris-Saclay (France), an MS in Energy Economics from the Pontificia Universidad Comillas (Spain), an MSc. in Engineering and Policy Analysis from TU Delft (The Netherlands), and a BSc. in Electrical and Computer Engineering from Rowan University (USA).

Dr. Kathleen Spees

PRINCIPAL | WASHINGTON DC

Kathleen.Spees@brattle.com

Dr. Spees is a Principal at The Brattle Group with expertise in wholesale electricity markets design and carbon policies. Her expertise focuses on wholesale electricity market design, environmental policy, economic analysis, and modeling. For market operators she supports implementation and development of wholesale markets including energy, ancillary services, capacity, FTRs, clean energy attribute markets, and integration of emerging technologies. She supports stakeholders to develop GHG reduction policy alternatives, conduct power sector and economy-wide modeling of GHG abatement pathways, and assess benefits/costs in the context of policy reforms for clean energy transition. Dr. Spees earned her PhD in Engineering and Public Policy within the Carnegie Mellon Electricity Industry Center and her MS in Electrical and Computer Engineering from Carnegie Mellon University. She earned her BS in Physics and Mechanical Engineering from Iowa State University.