RAP® Energy solutions for a changing world

The Flexibility Challenge in Global Power Sector Transformation: Monopoly vs. Liberalized Markets

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Summary

Question:

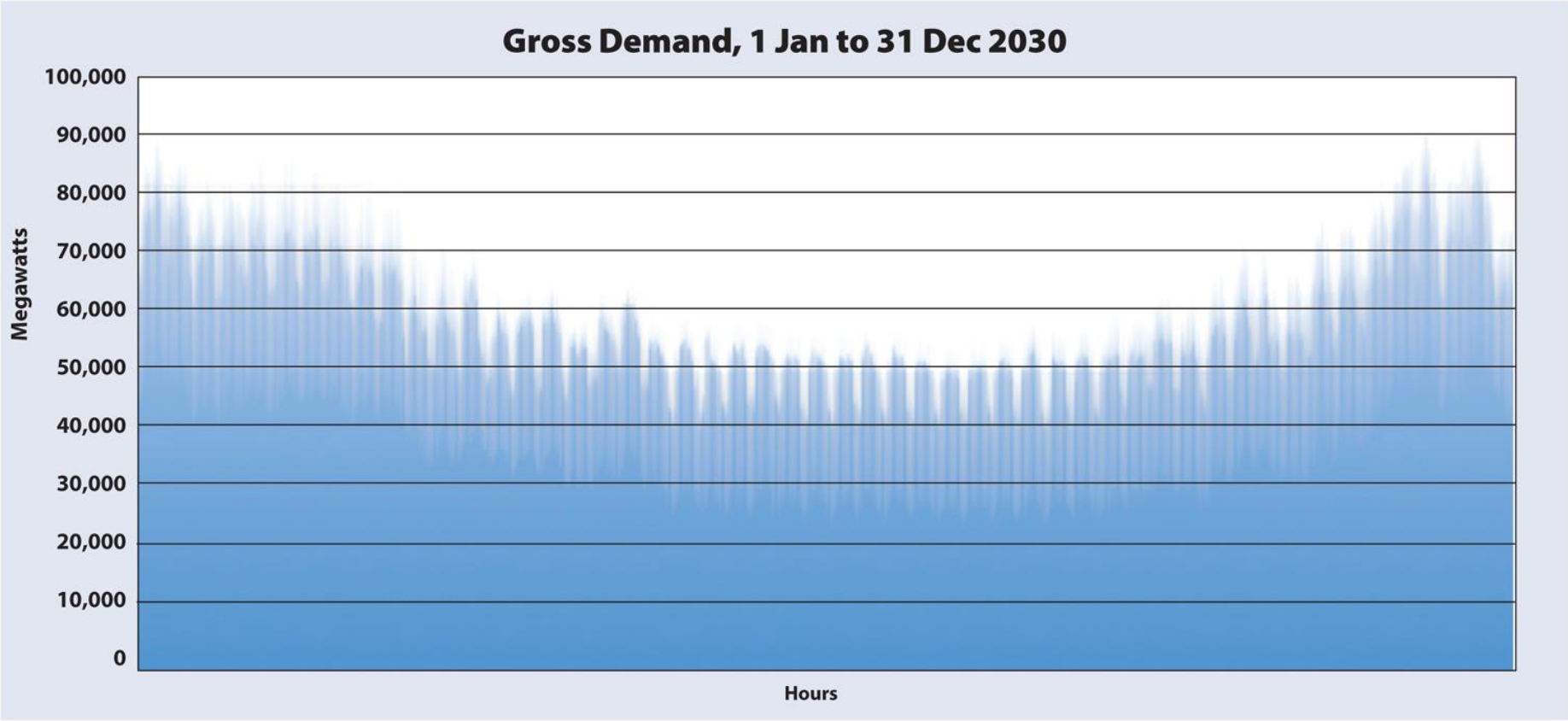
Monopolistic or liberalized market designs as enablers for decarbonization and flexibility?

Answer:

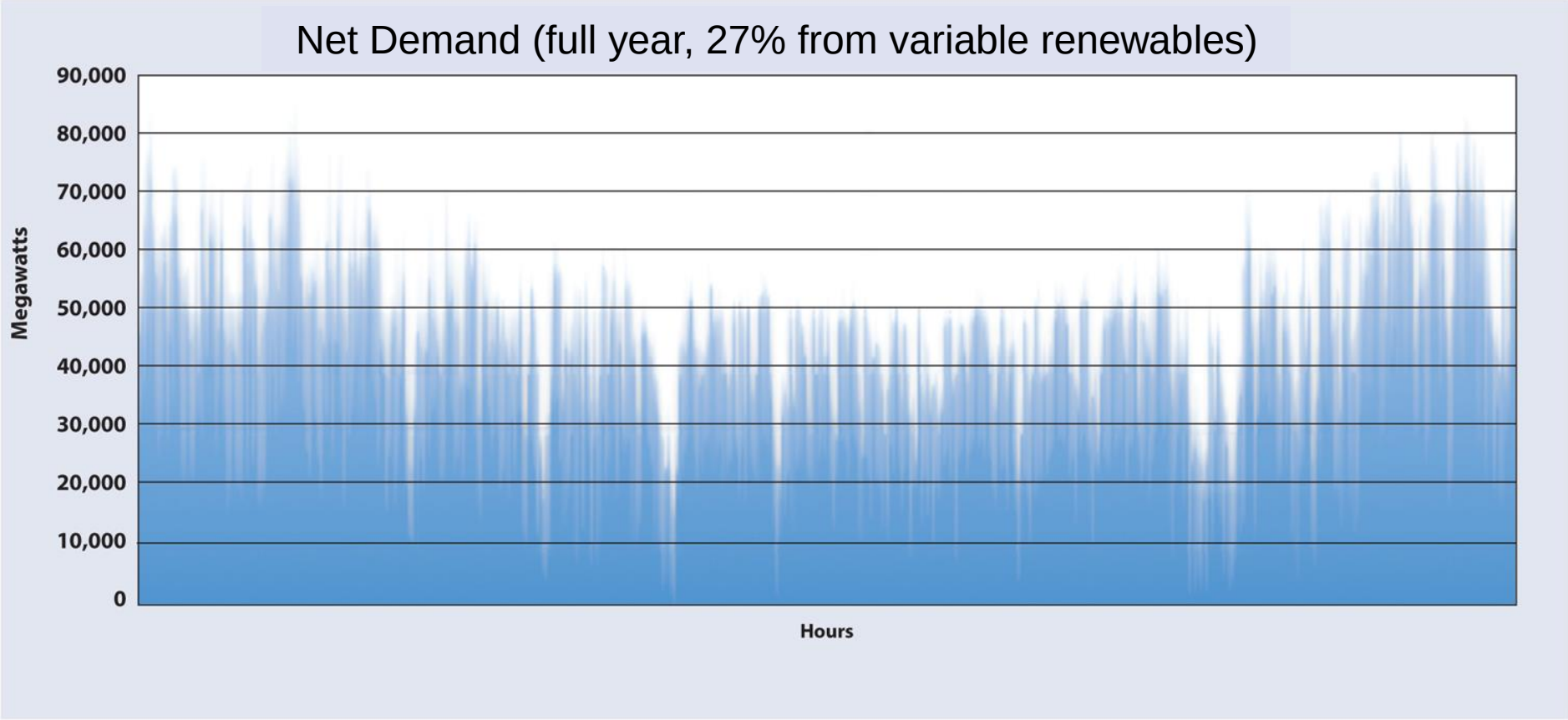
Yes.

Requirements for regulated & liberalized power systems to increase flexibility of power systems & minimize power system costs?

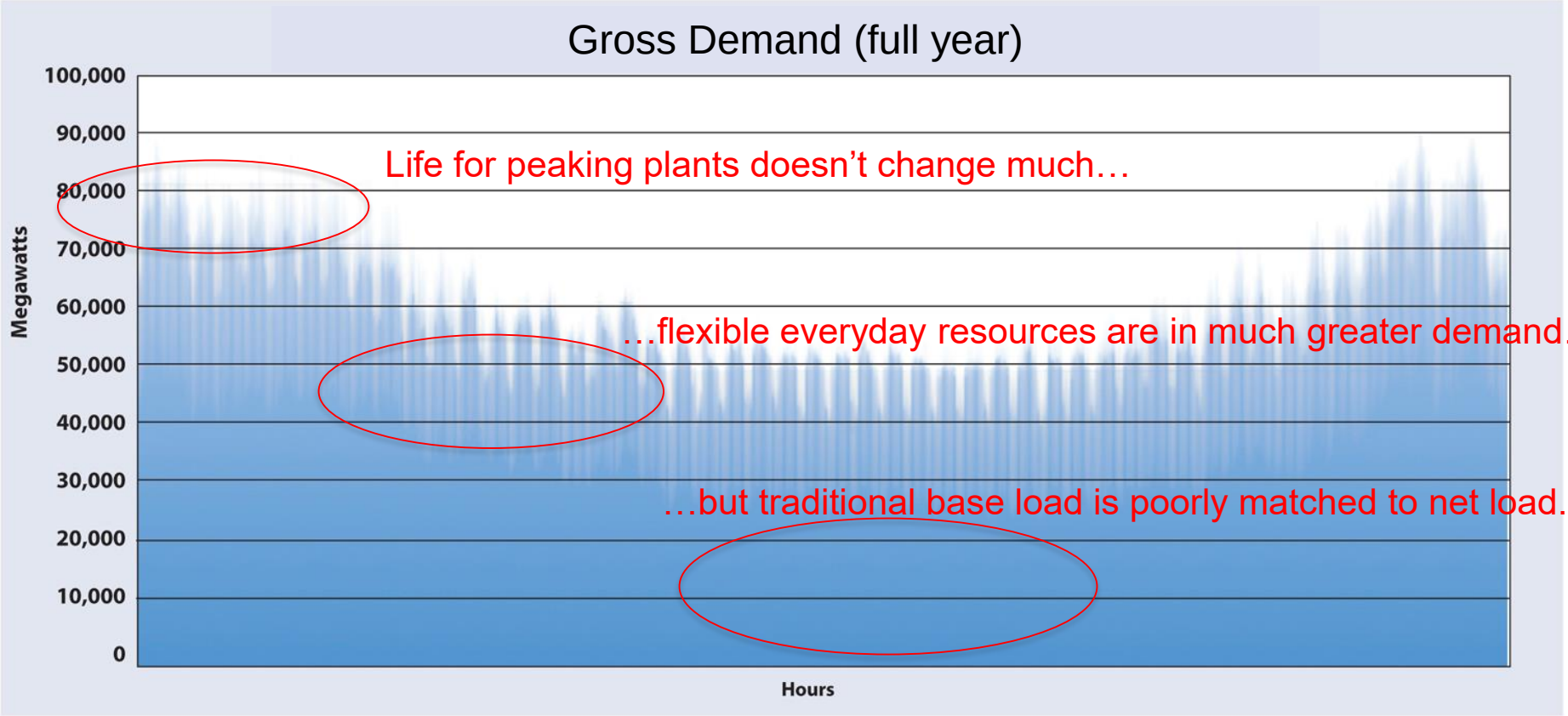
Nominal 25GW system



35% RES (of which 77% VRES)



The flexible challenge…from a generation perspective

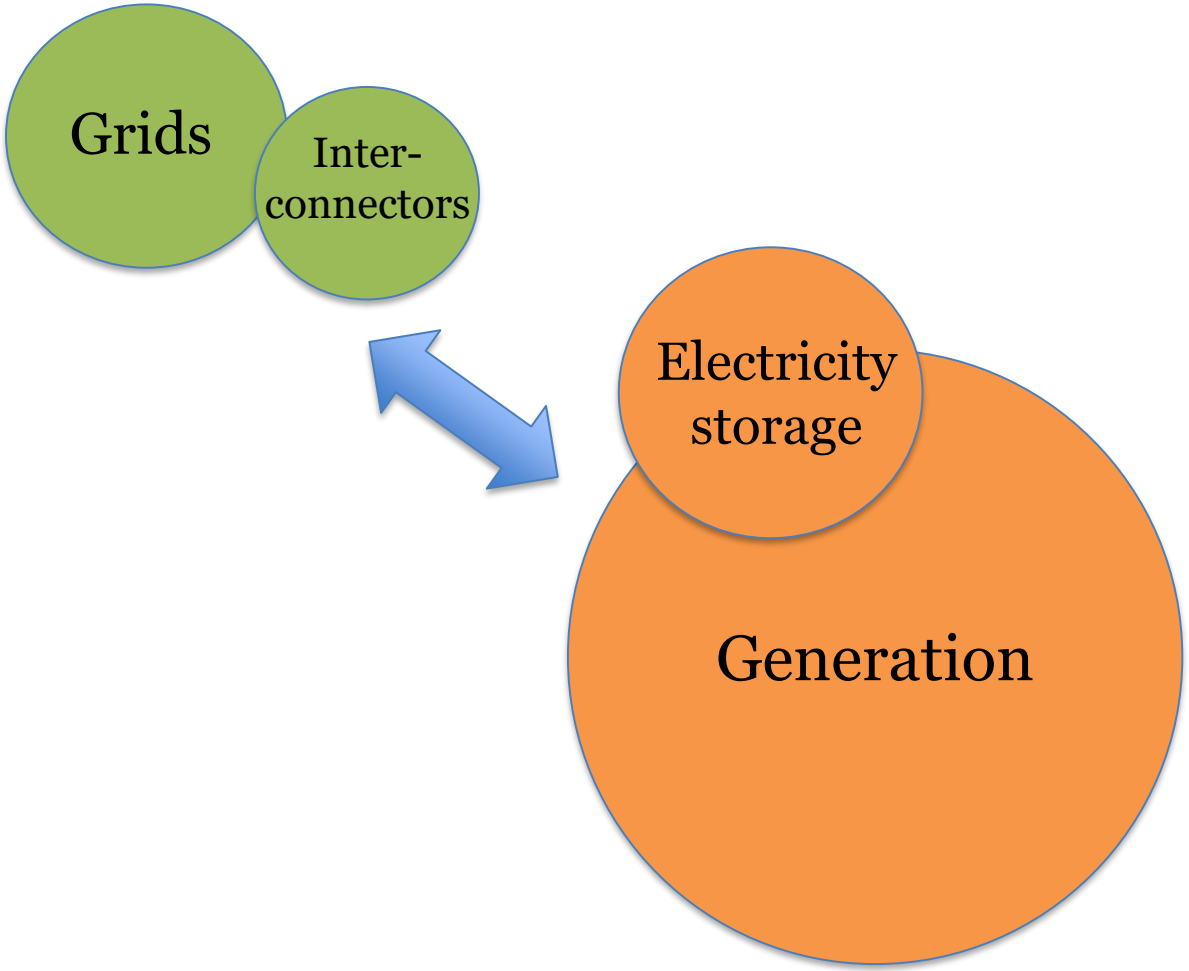


Many ways to skin this cat…with very different price tags

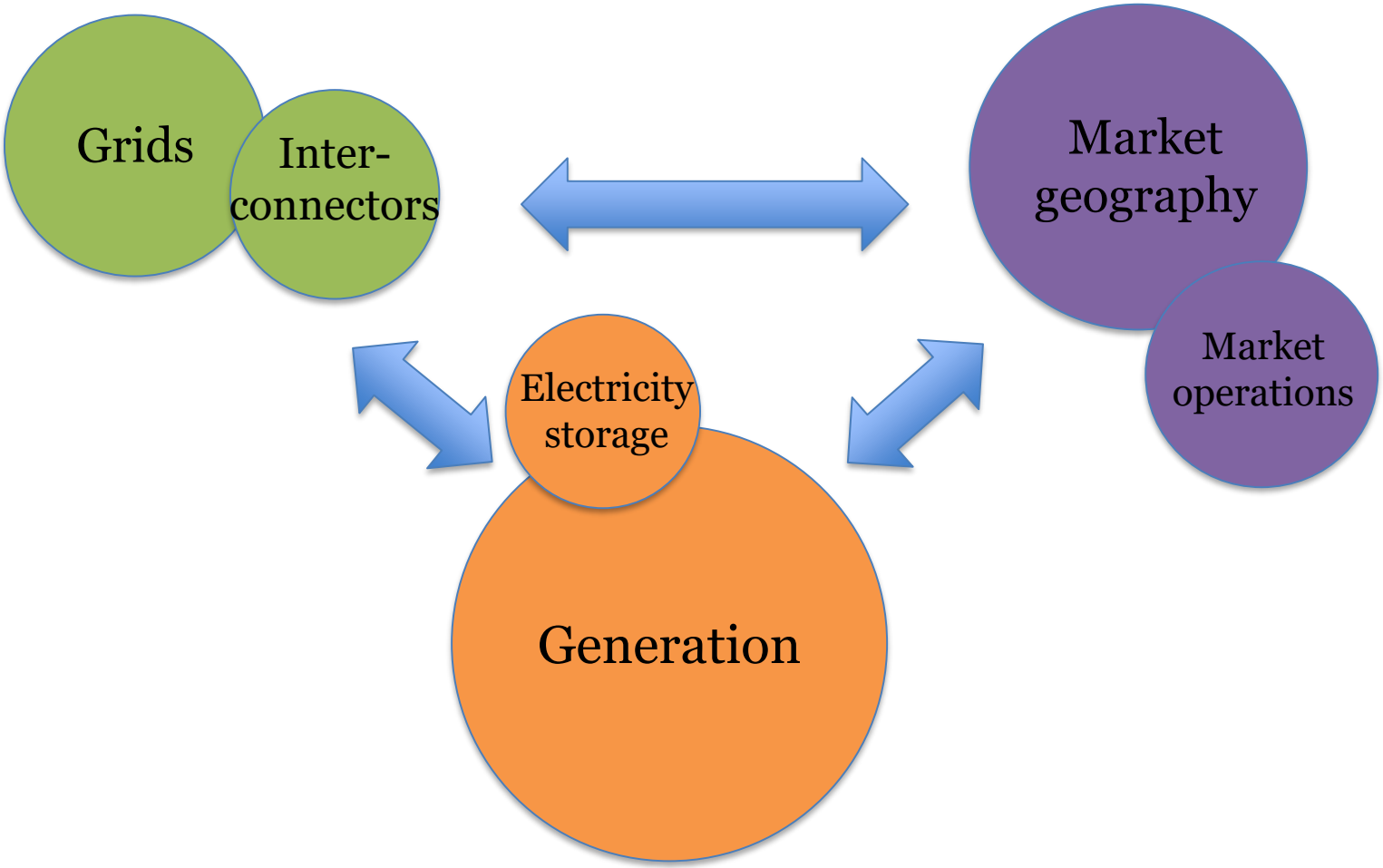
Transmission & additional generation capacity requirements[1]

Pathways	DSM	Transmission	Back-up and balancing
80% RES 10% CCS 10% nuclear	0%	166	255
	20%	127	160
60% RES 20% CCS 20% nuclear	0%	103	205
	20%	87	140
40% RES 30% CCS 30% nuclear	0%	56	150
	20%	55	110

Traditional (monopoly) flexibility levers



Complementary sources of flexibility



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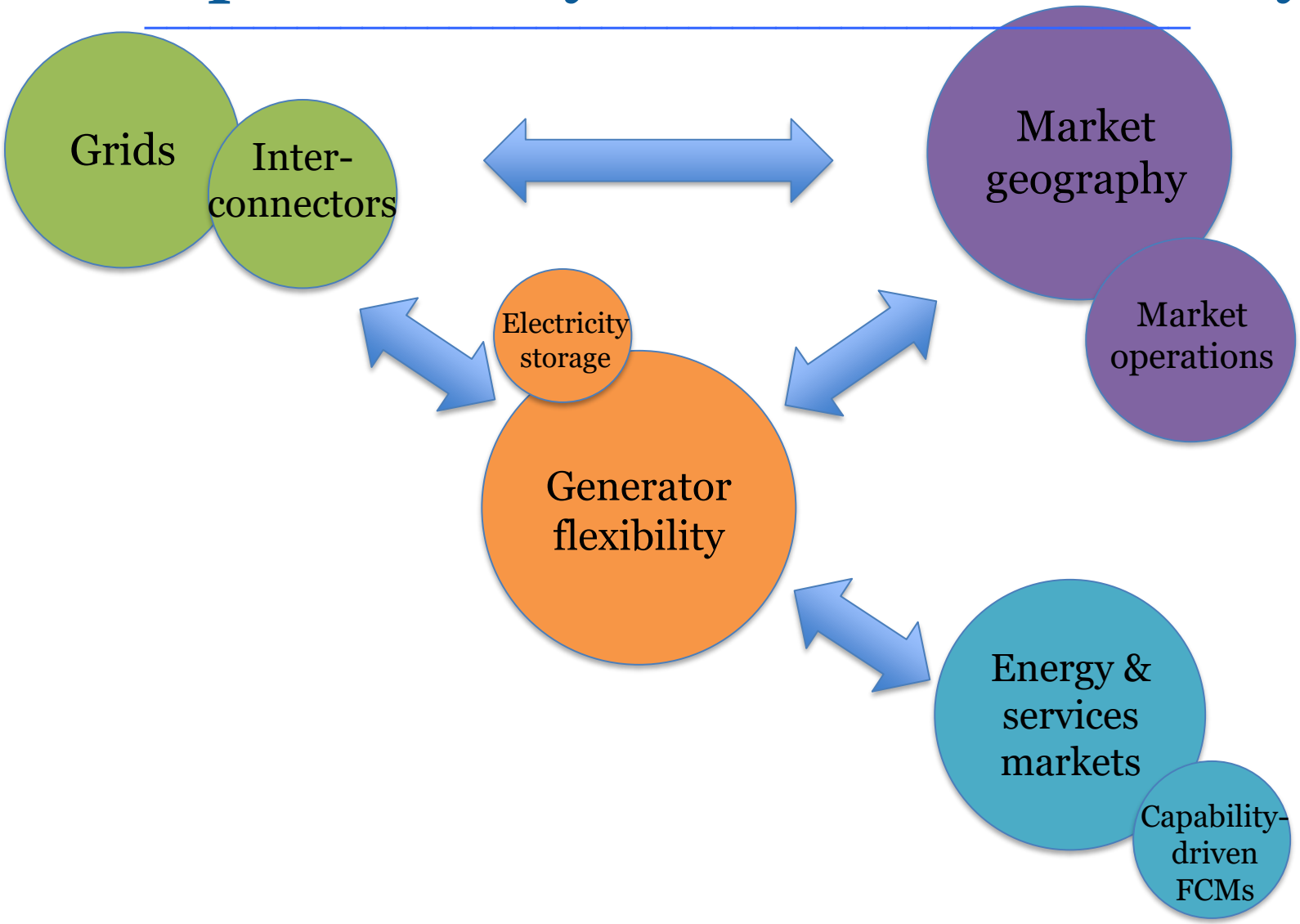
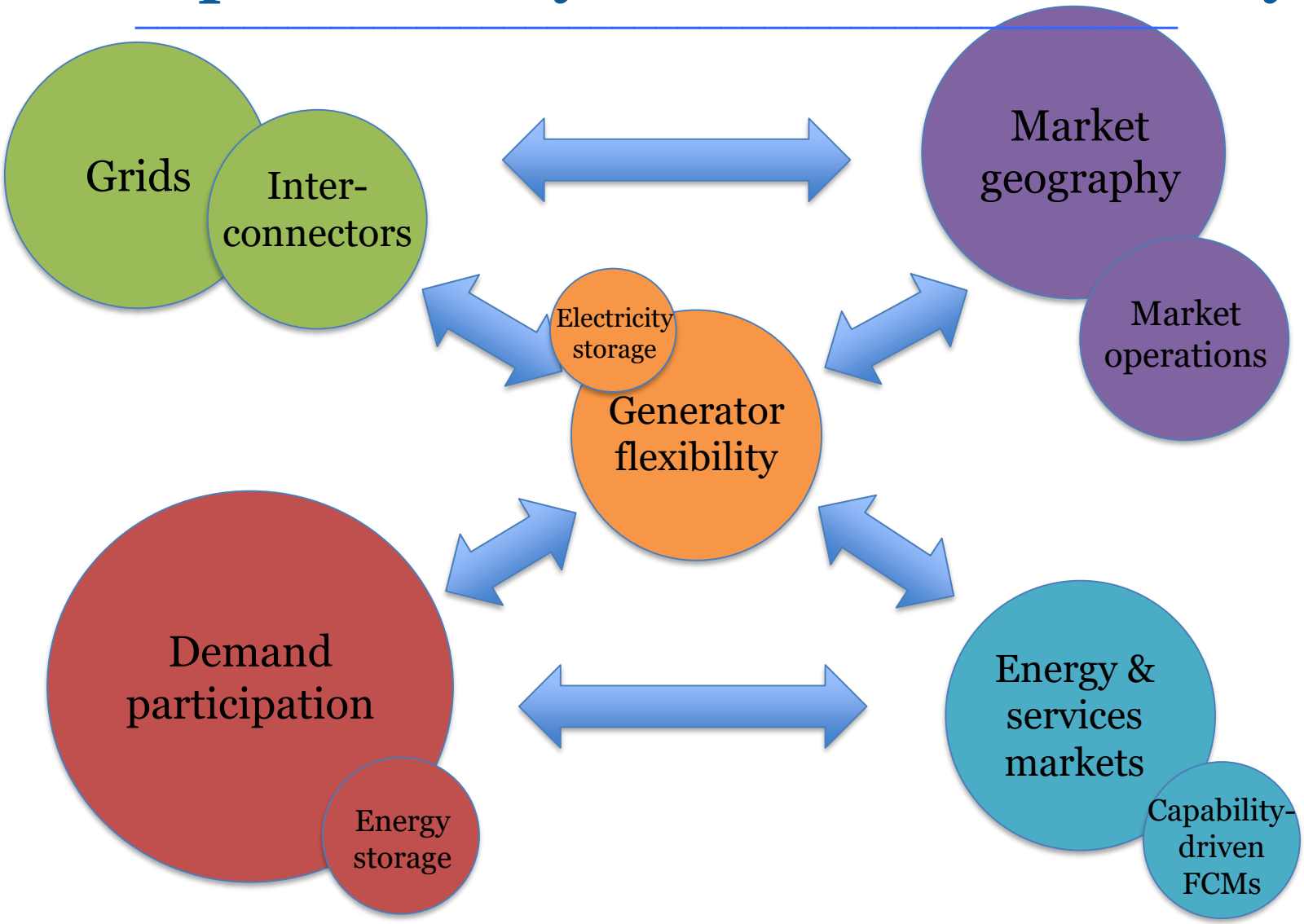


Complementary sources of flexibility



How to ensure reliability and system adequacy?
at the lowest reasonable cost to consumers?

What are we trying to ensure?

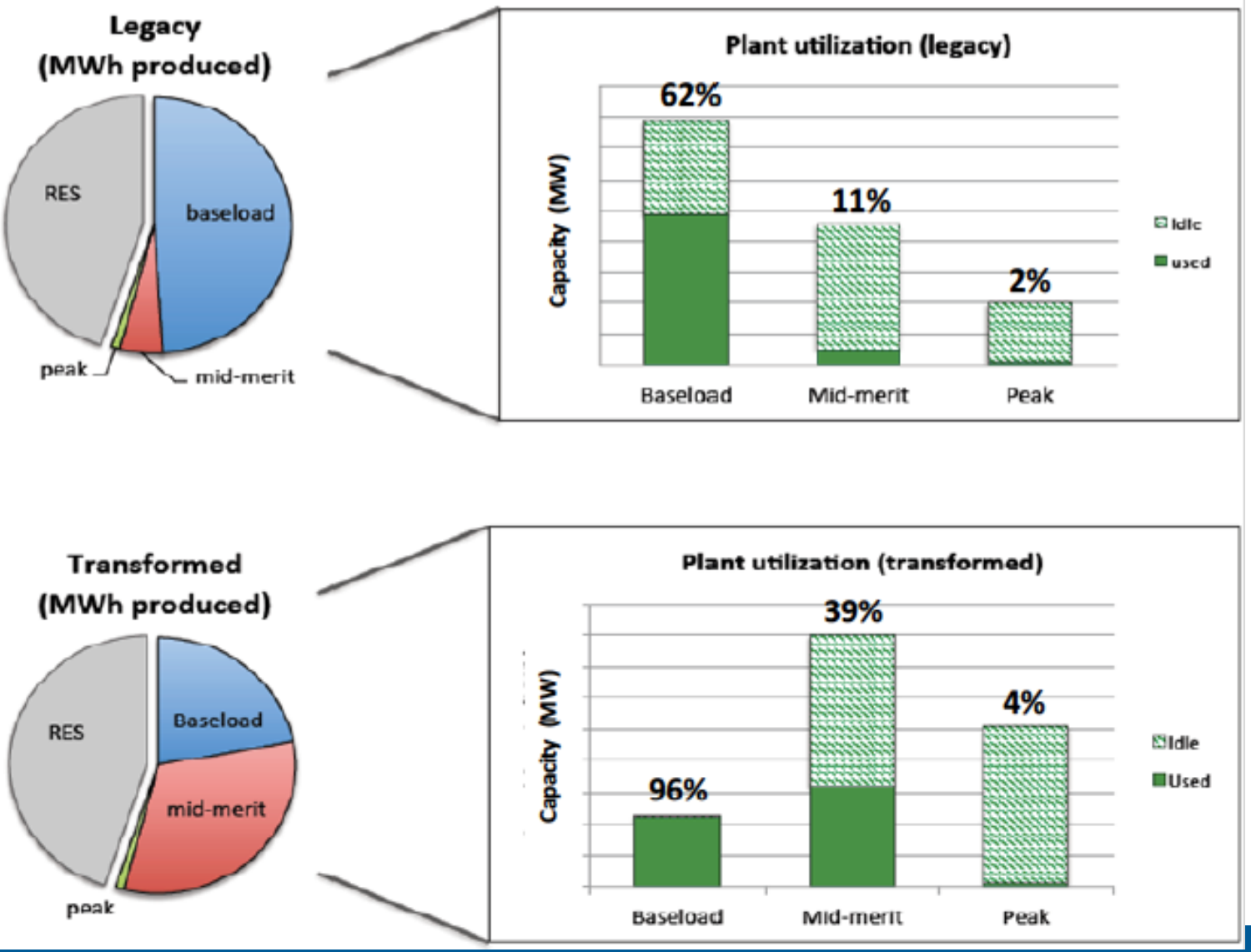
Define "reliable" and "adequate" objectively on the basis of consumer costs and benefits

Assess adequacy regularly, independently and transparently – against clearly defined standards (see point 1)

Consider ALL dimensions of reliability and adequacy – including energy efficiency, demand response and the capacity contributions of unconventional resources

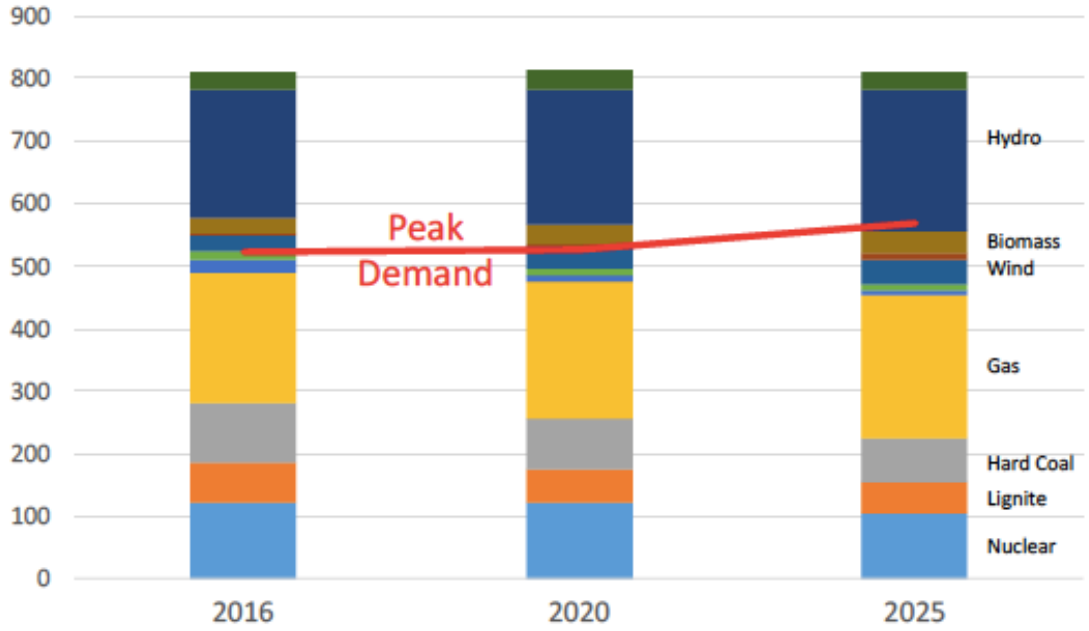
N.B. Buy-side mitigation in capacity markets

“How much?” depends on “what kind?”



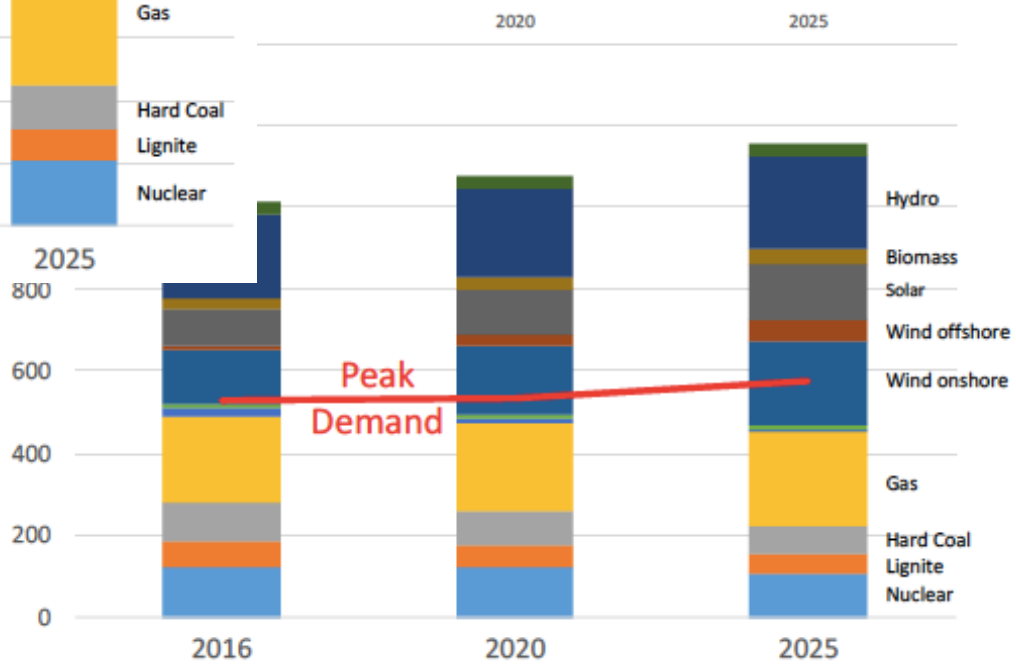
Source: Adapted from *The Power of Transformation* (IEA, 2014)

Saturation, new investment & retirement



EU28 (assumes zero capacity for PV, 20% for wind)

EU28 (full nameplate capacity for PV and wind)



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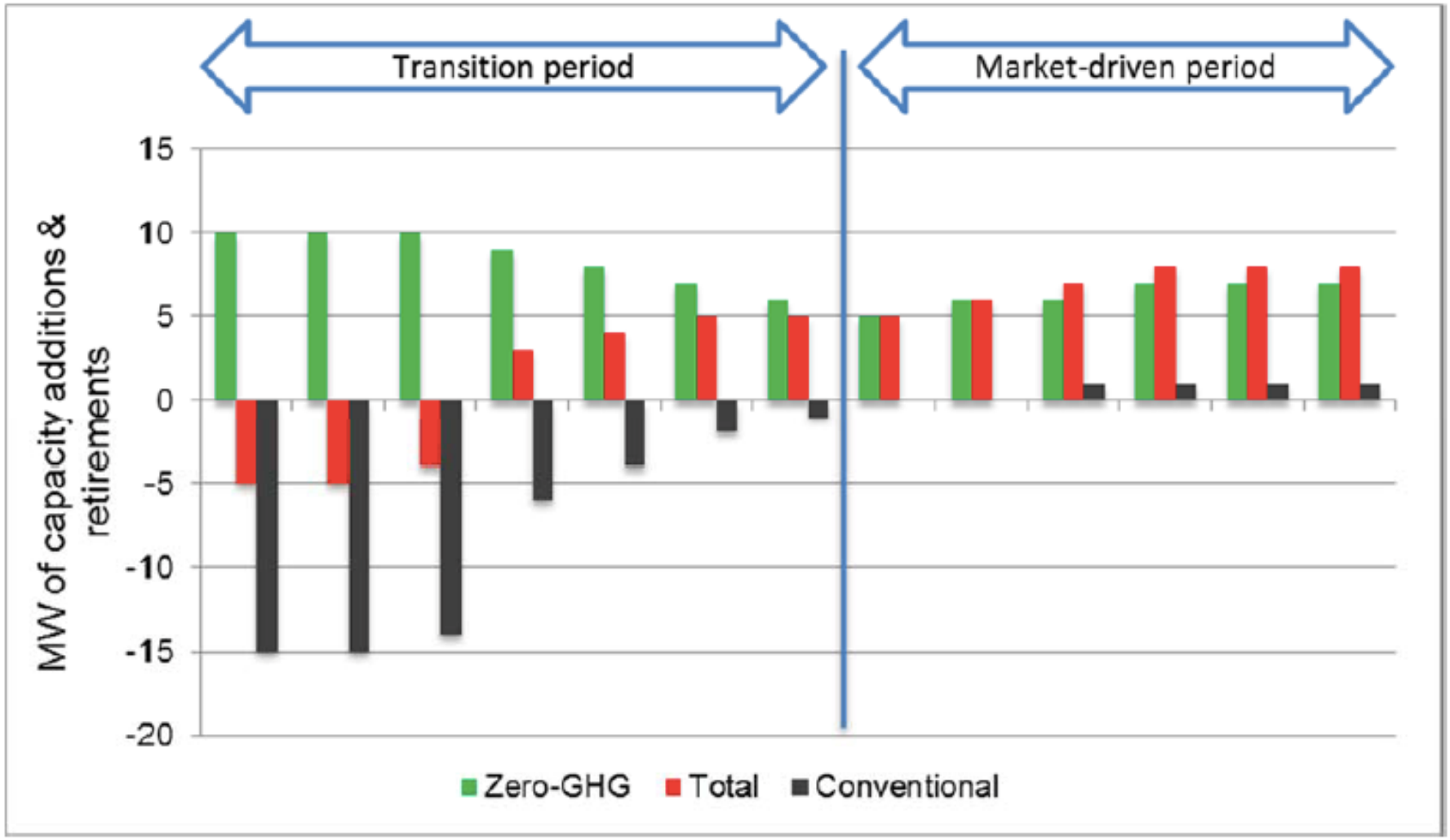
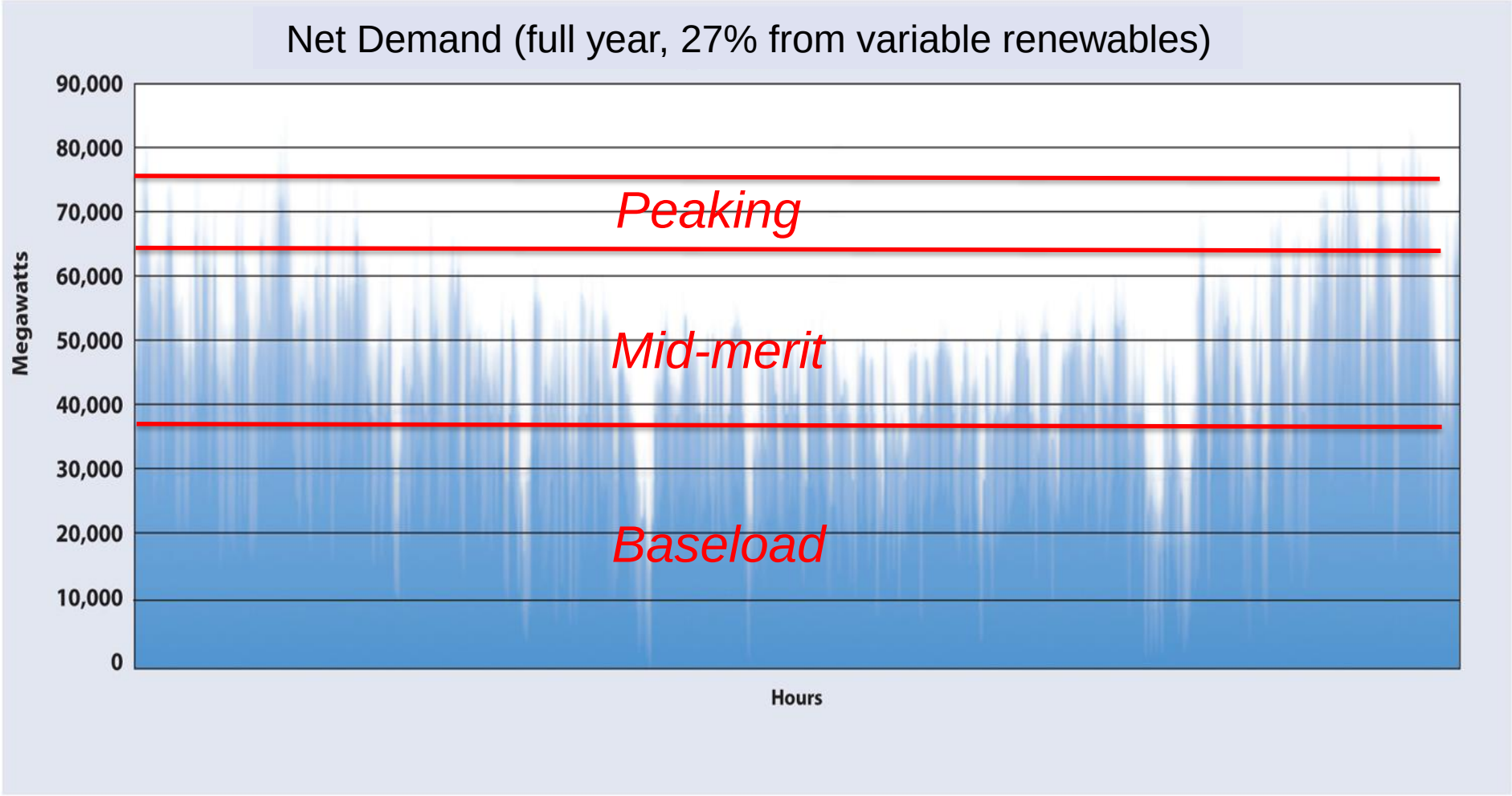
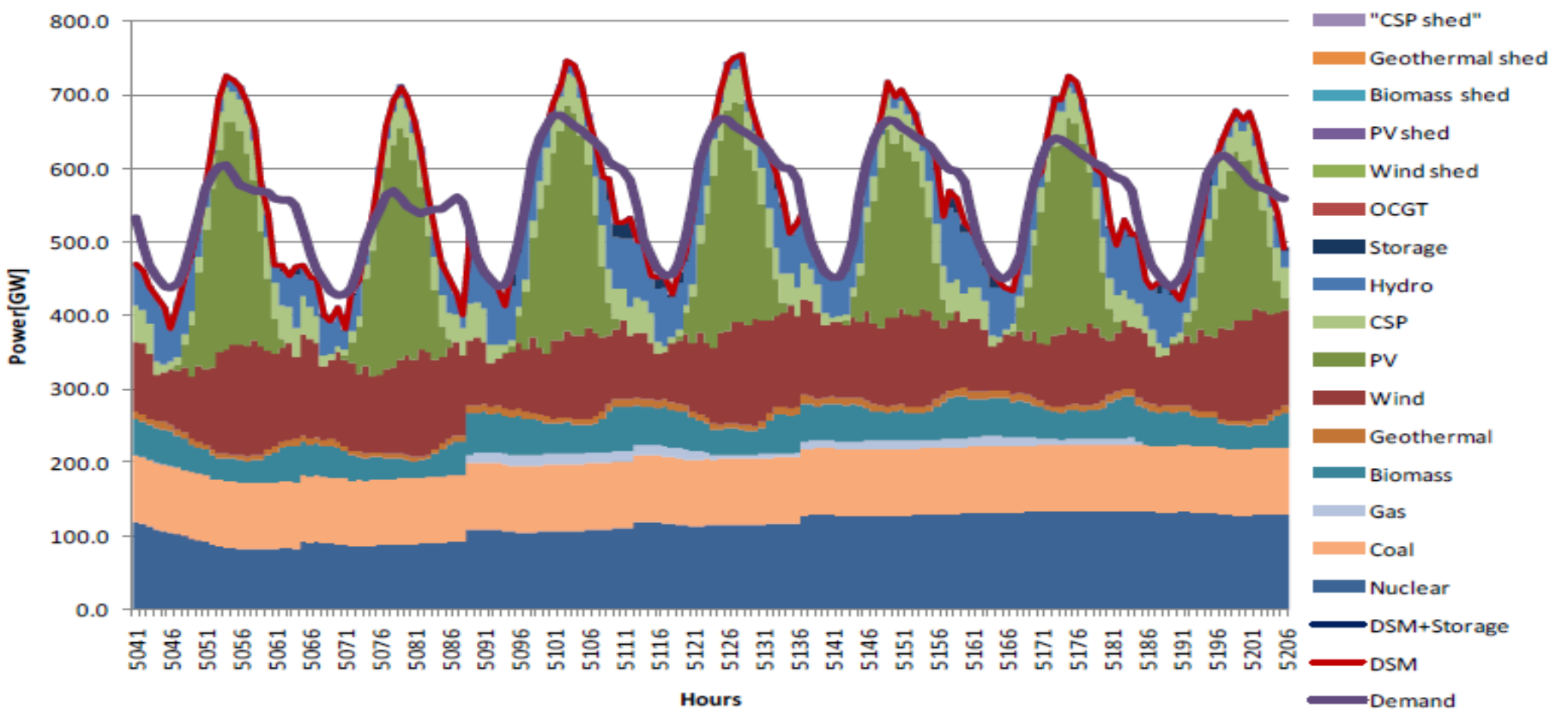


Accept volatility and its consequences…



…or change the net demand curve



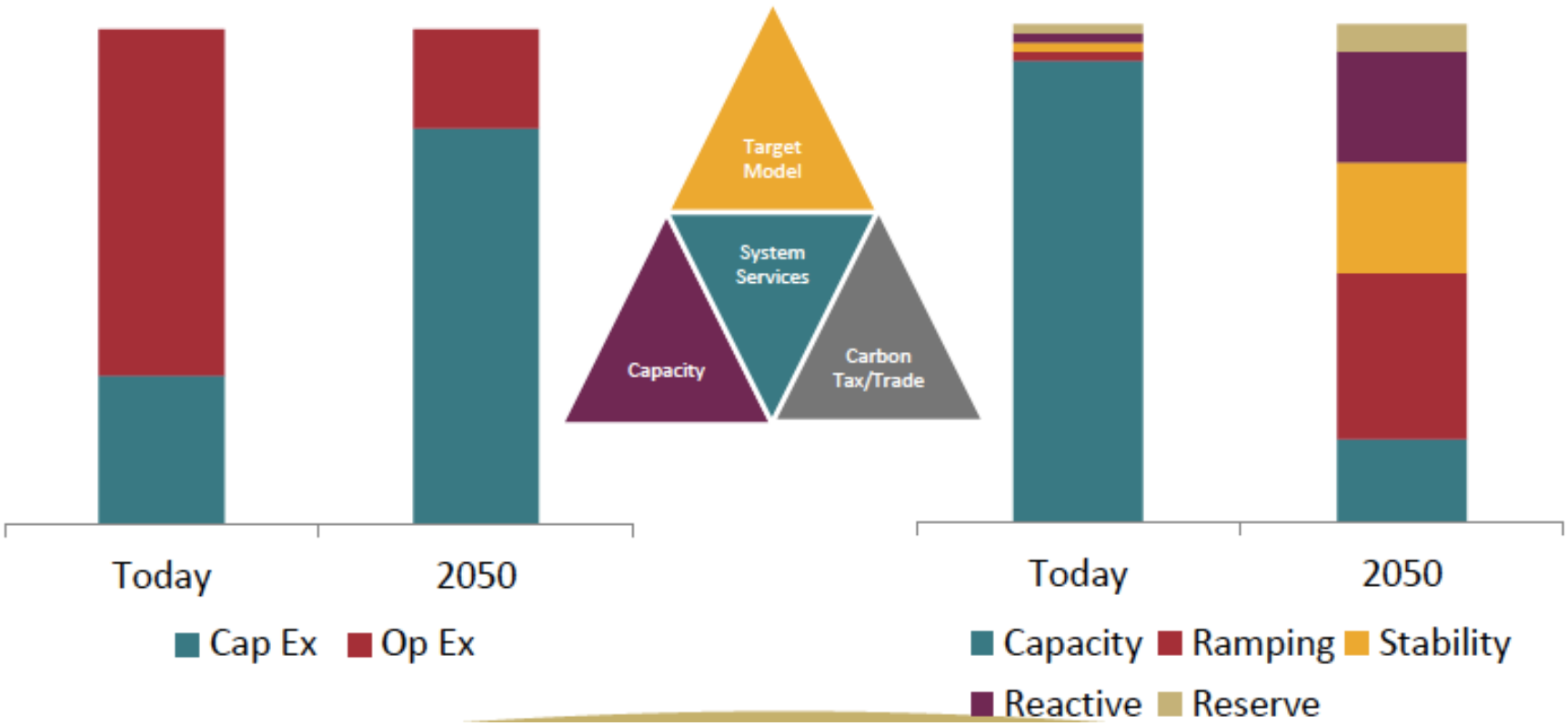
The answer: almost certainly some of both

What are key aspects of adequacy in a high-RES system?

How to operationalize the new flexibility paradigm?

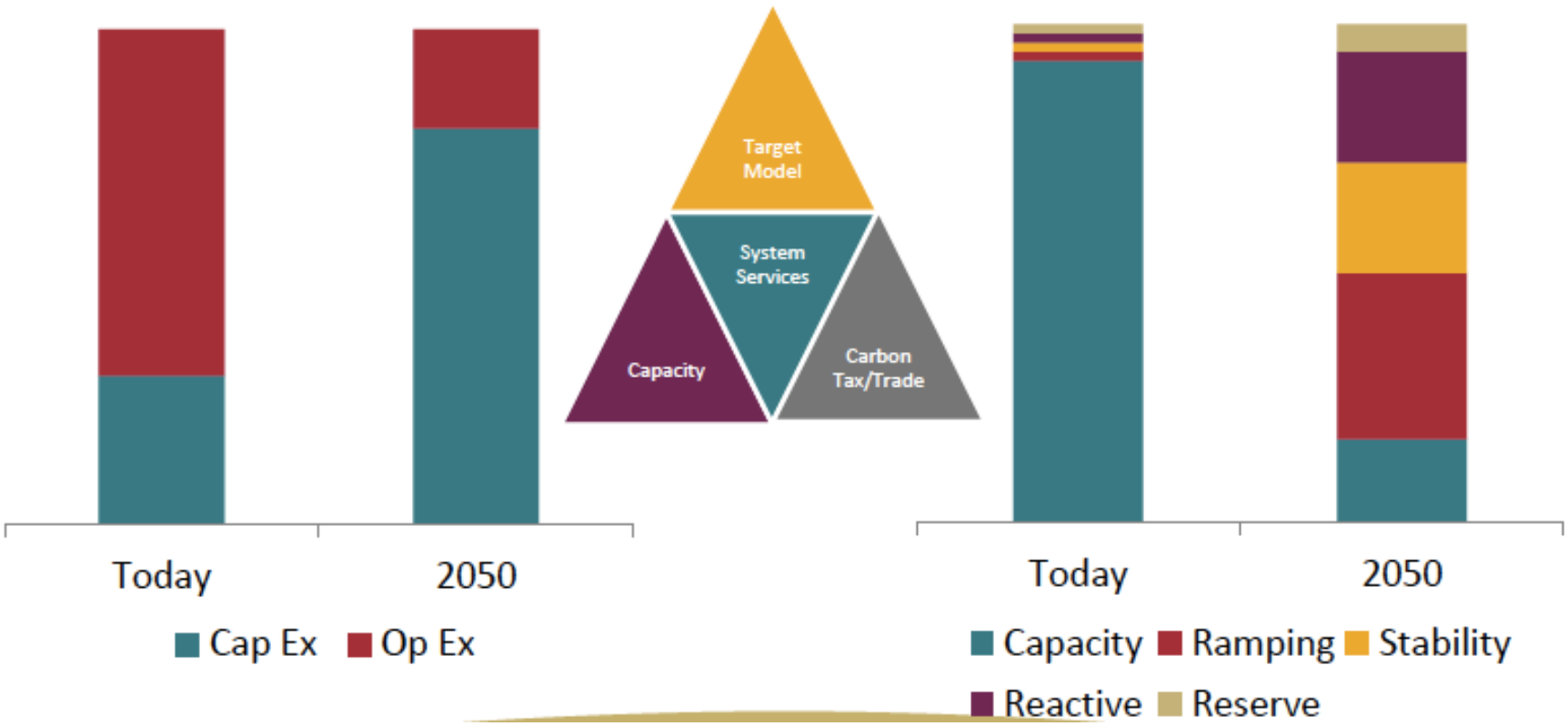
How to adjust market designs?

What are the key aspects of “adequacy”?



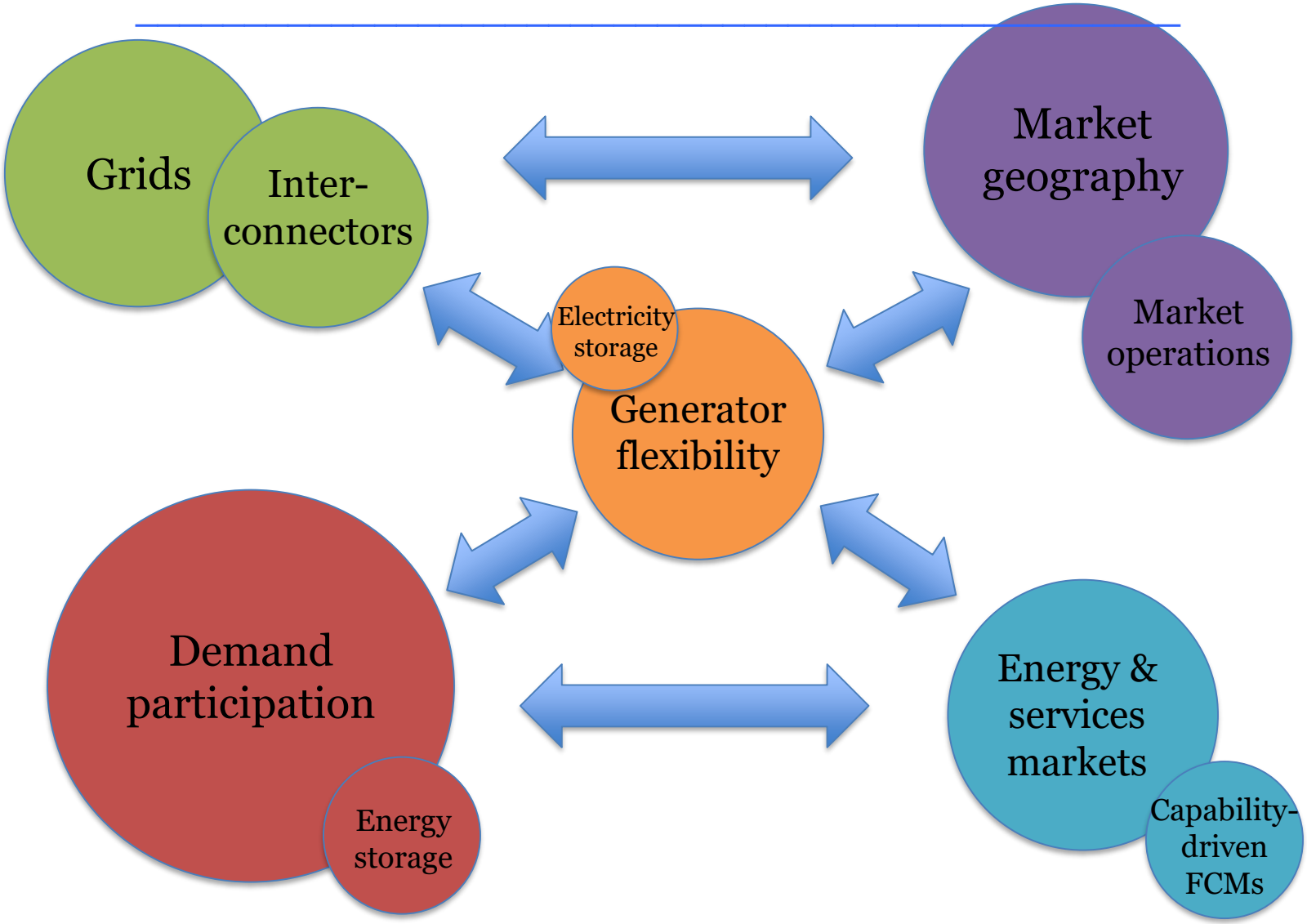
Capacity per se is no longer the best measure of adequacy – the best measure is capabilities

What are the key aspects of “adequacy”?



The problem: capacity is capacity and is relatively easy to measure – but capability/flexibility….?

A monopoly needs to get this right

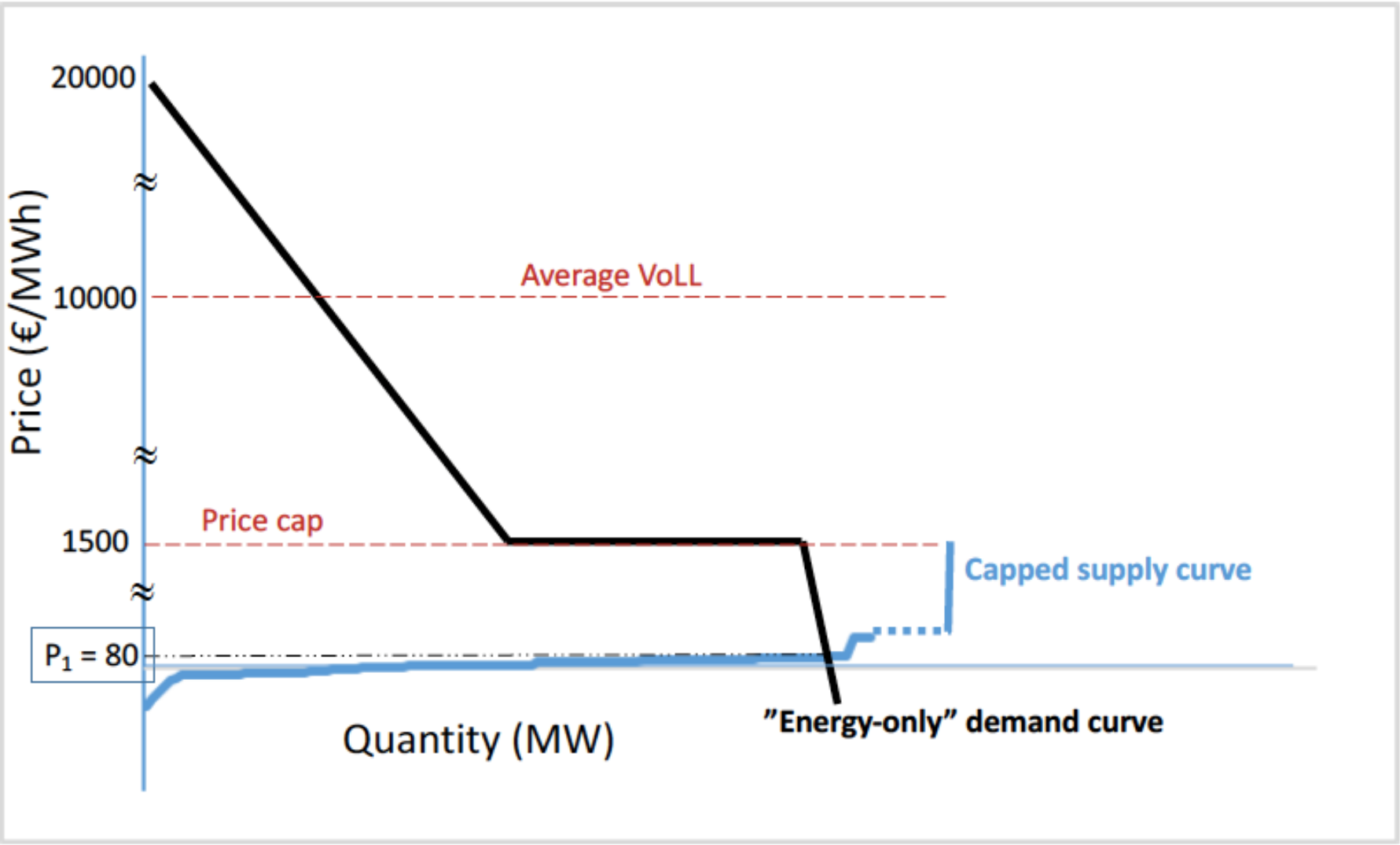


A security-constrained, economic dispatch market needs to get this right

System Resource	Full marginal cost (€/MWh)
Generation capacity ("firm" or "de-rated")	20-250
Imports	20-1000
Secondary (operating) reserves	250-5000
Emergency generation	500
Primary (regulation) reserves	500-9000
30-minute responsive back-up	1400
30-minute controllable demand response	2400
10-minute controllable demand response	2600
10-minute responsive back-up	3700
Emergency load-shedding	9000

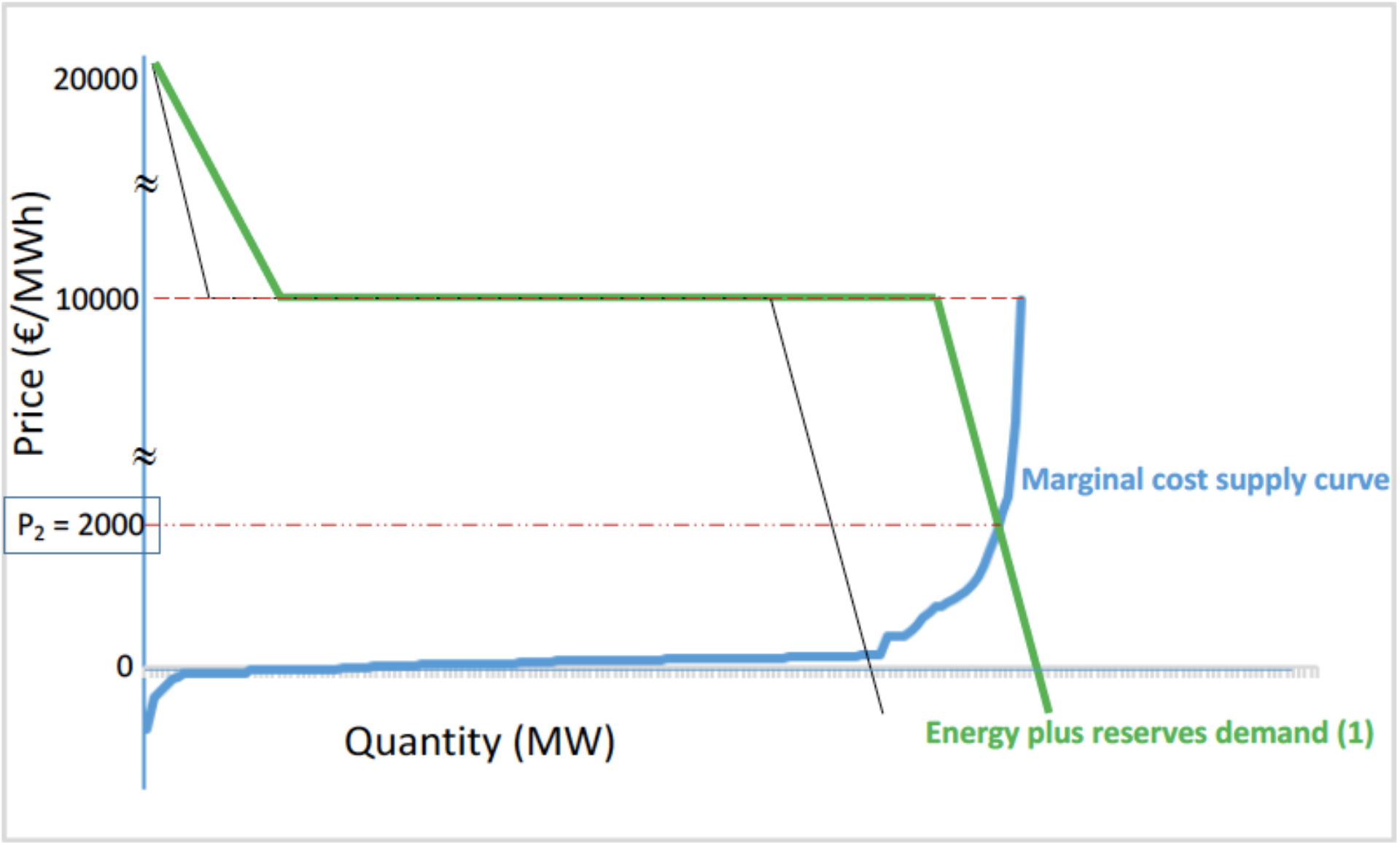
Source: Adapted from Brattle Group & Astrape Consulting (2014 report to Public Utilities Commission of Texas & 2013 report to the Federal Energy Regulatory Commission)

Energy price formation: legacy



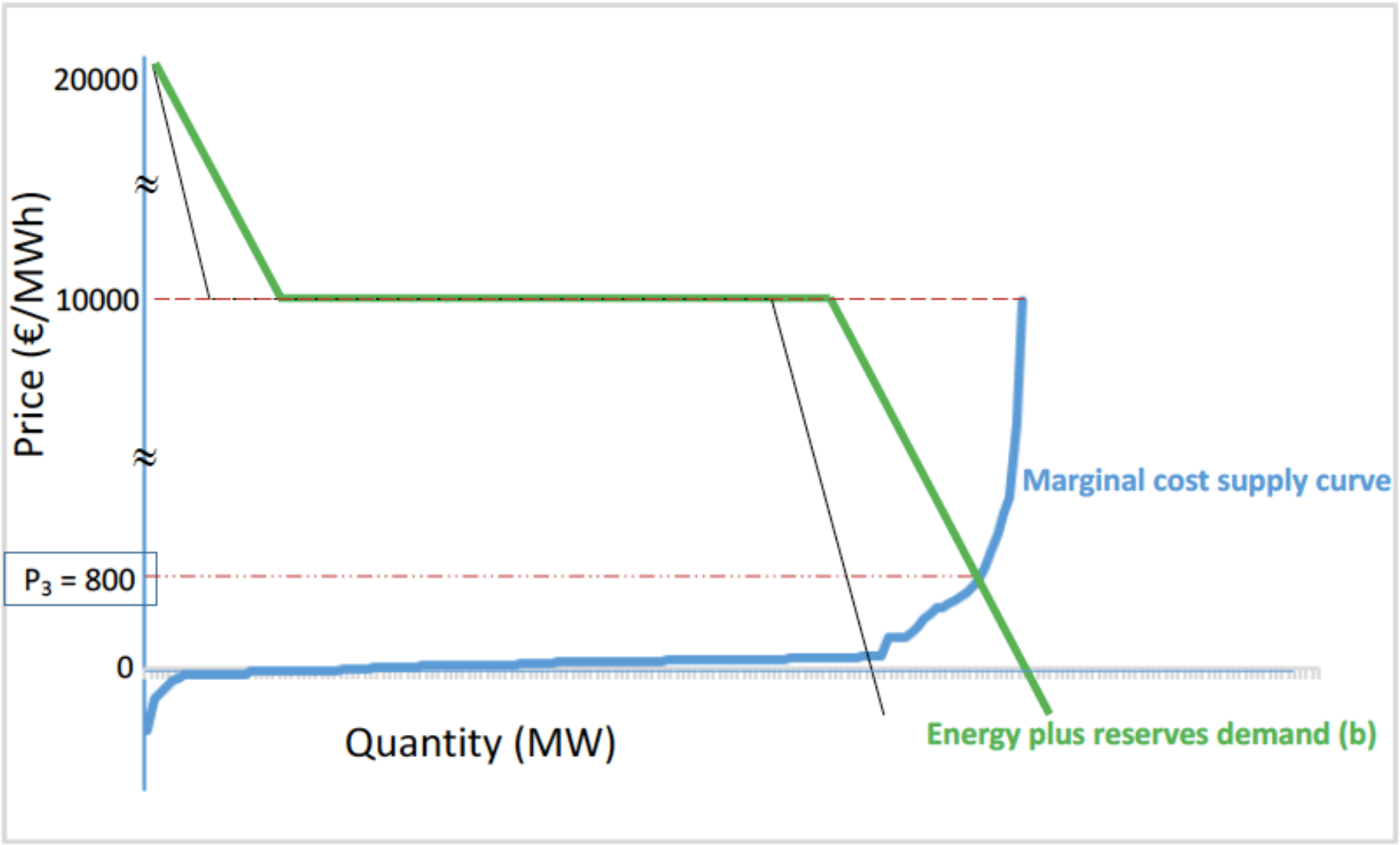
Source: Adapted from W. Hogan, "An 'Energy Only' Market Design for Resource Adequacy" (23 Dec 2005)

Energy price formation: corrected



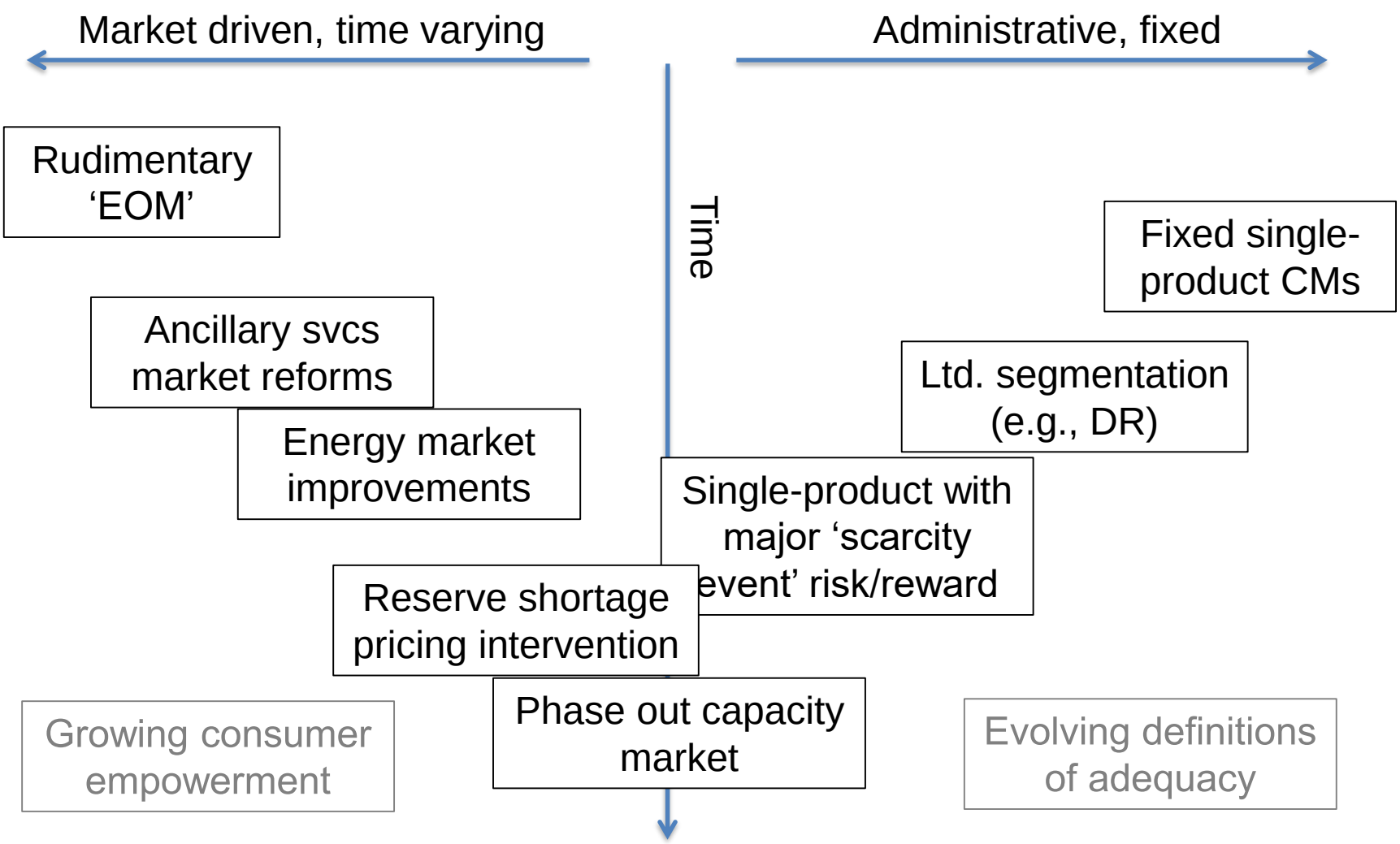
Source: Adapted from W. Hogan, "An 'Energy Only' Market Design for Resource Adequacy" (23 Dec 2005)

Energy price formation: evolved



Source: Adapted from W. Hogan, "An 'Energy Only' Market Design for Resource Adequacy" (23 Dec 2005)

Evolution away from binary model



What are the effects of liberalization on the energy industry?

What part of the "energy industry"?

1) We can't afford a passive customer class anymore - customers must and will demolish traditional business models and give rise to new ones

2) Grids remain regulated monopolies, but otherwise investment becomes more dispersed and will be made in the face of unprecedented uncertainty *whether we like it or not* – who should bear the risks and reap the rewards of investing under that uncertainty?

3) As investment becomes less centralized and riskier, system operation and services must become more centralized and better at managing risk

N.B. Buy-side mitigation in capacity markets

About RAP

The Regulatory Assistance Project (RAP) is a global, non-profit team of experts that focuses on the long-term economic and environmental sustainability of the power sector. RAP has deep expertise in regulatory and market policies that:

- Promote economic efficiency
- Protect the environment
- Ensure system reliability
- Allocate system benefits fairly among all consumers

Learn more about RAP at www.raponline.org

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