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How digitalization is enabling the energy transition

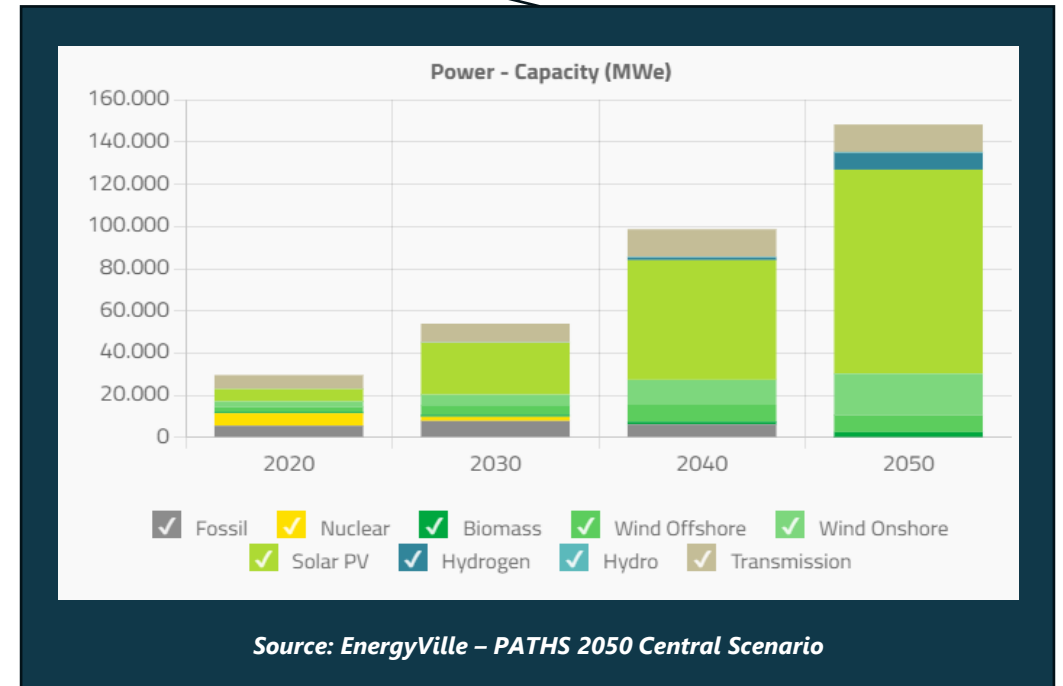
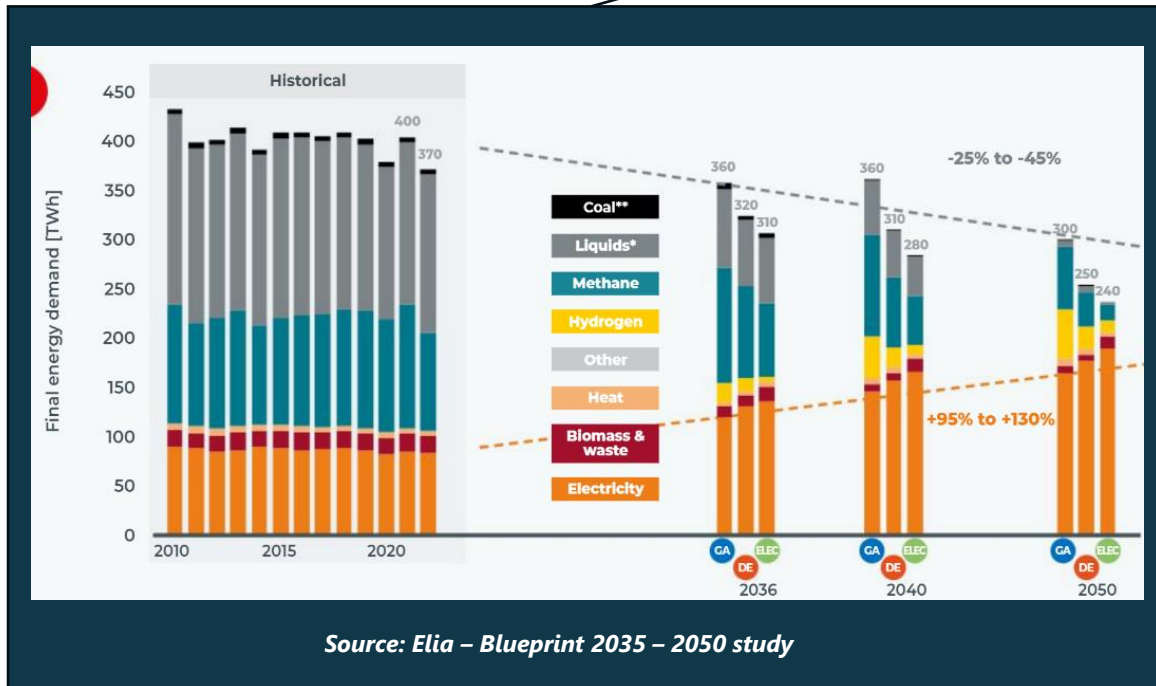
Arnout Van Bruwaene & Tom Pallini



Setting the scene

The energy transition

*"An energy transition (or energy system transformation) is a major structural change to **energy consumption** and **supply** in an energy system"*



Setting the scene

The energy transition brings challenges for the energy system

Operate an increasingly complex electricity system



Develop carbon neutral electricity & unlock flexibility

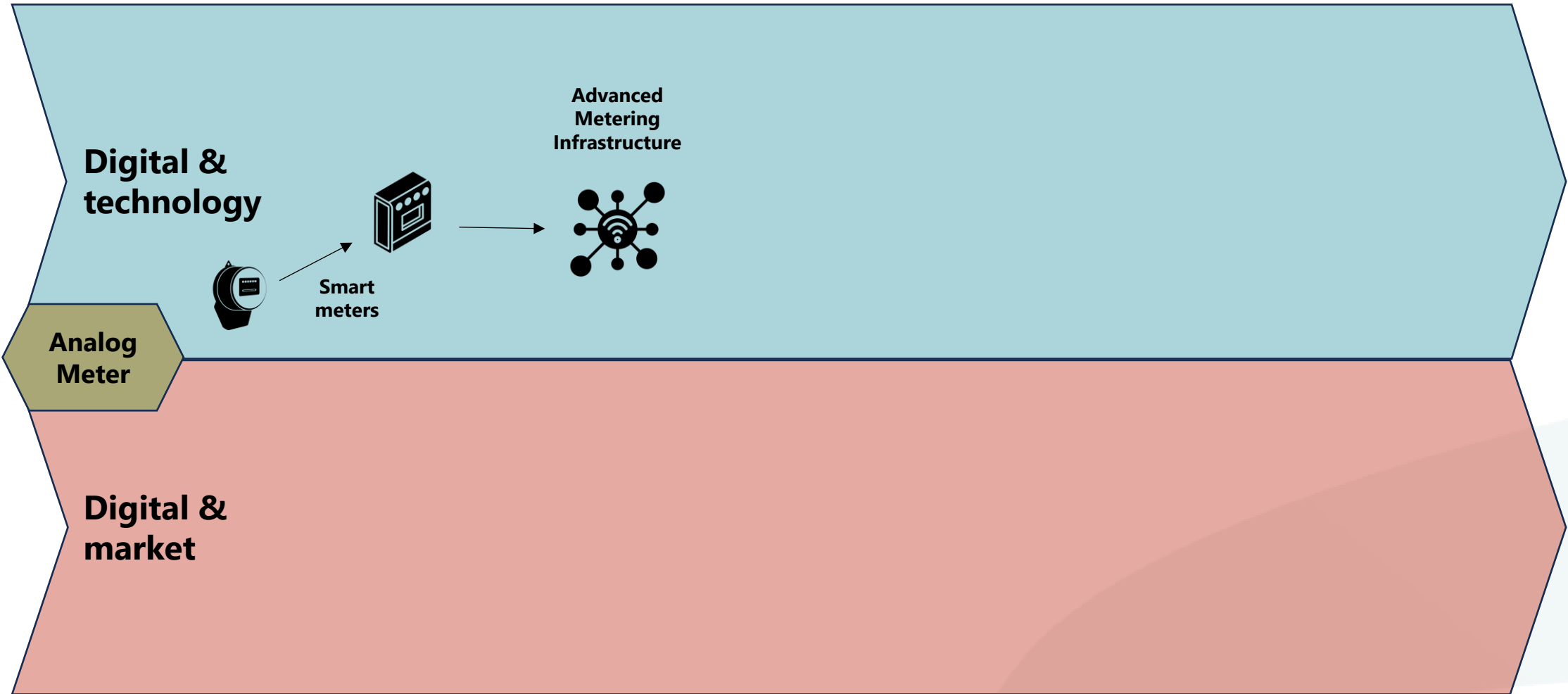
Interconnect and design innovative electricity & flexibility markets

2 digitalization waves

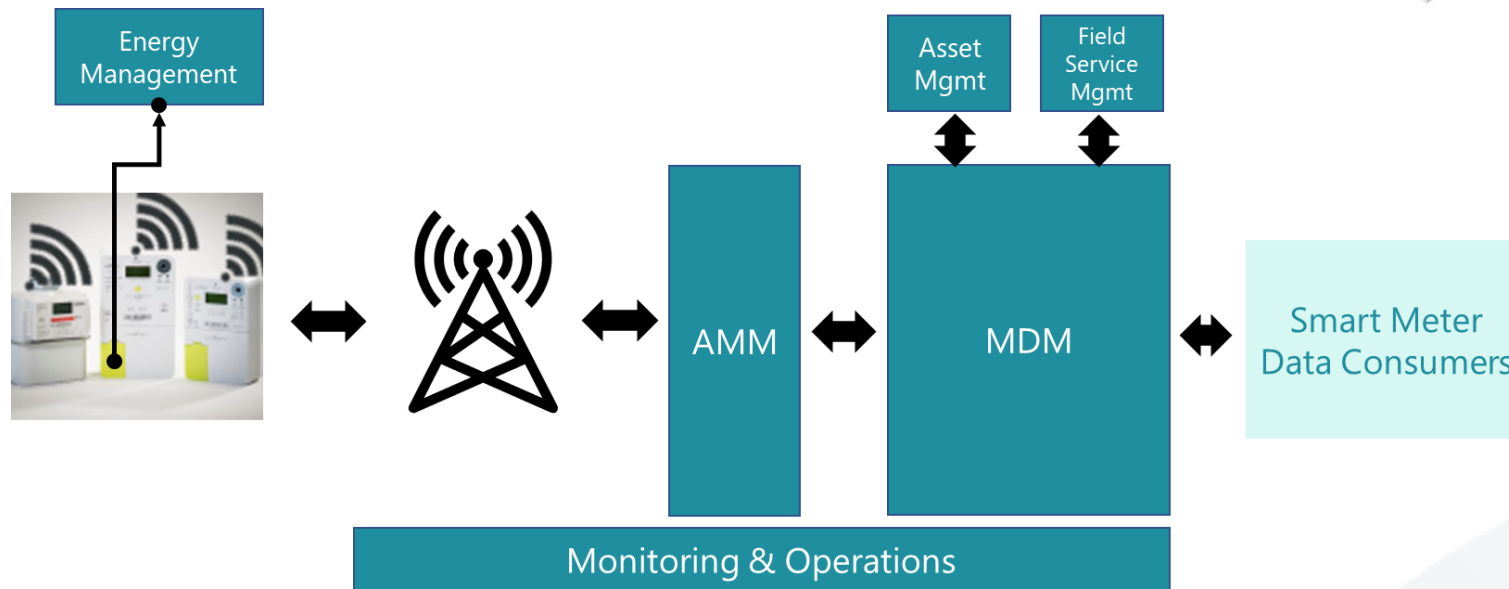
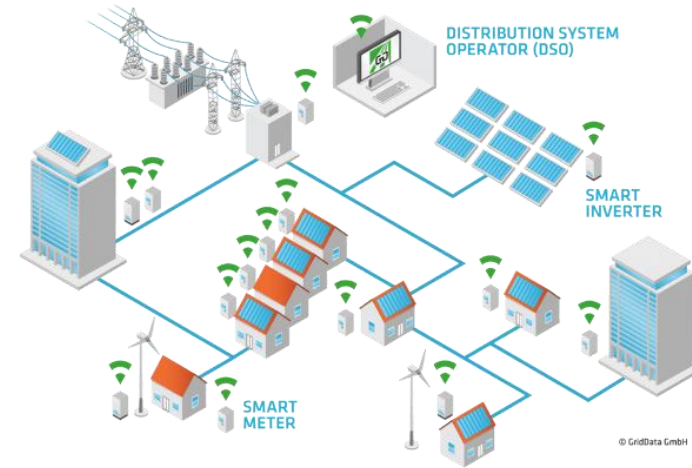
**From digital meter to
household flex**



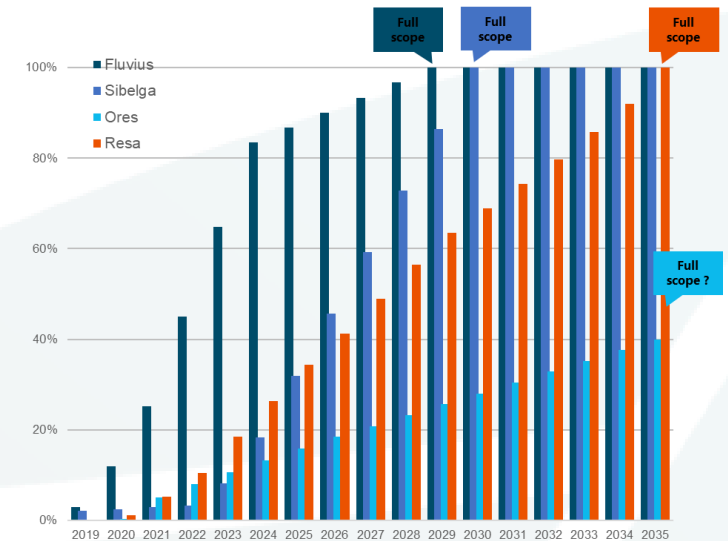
From smart meter to household flex



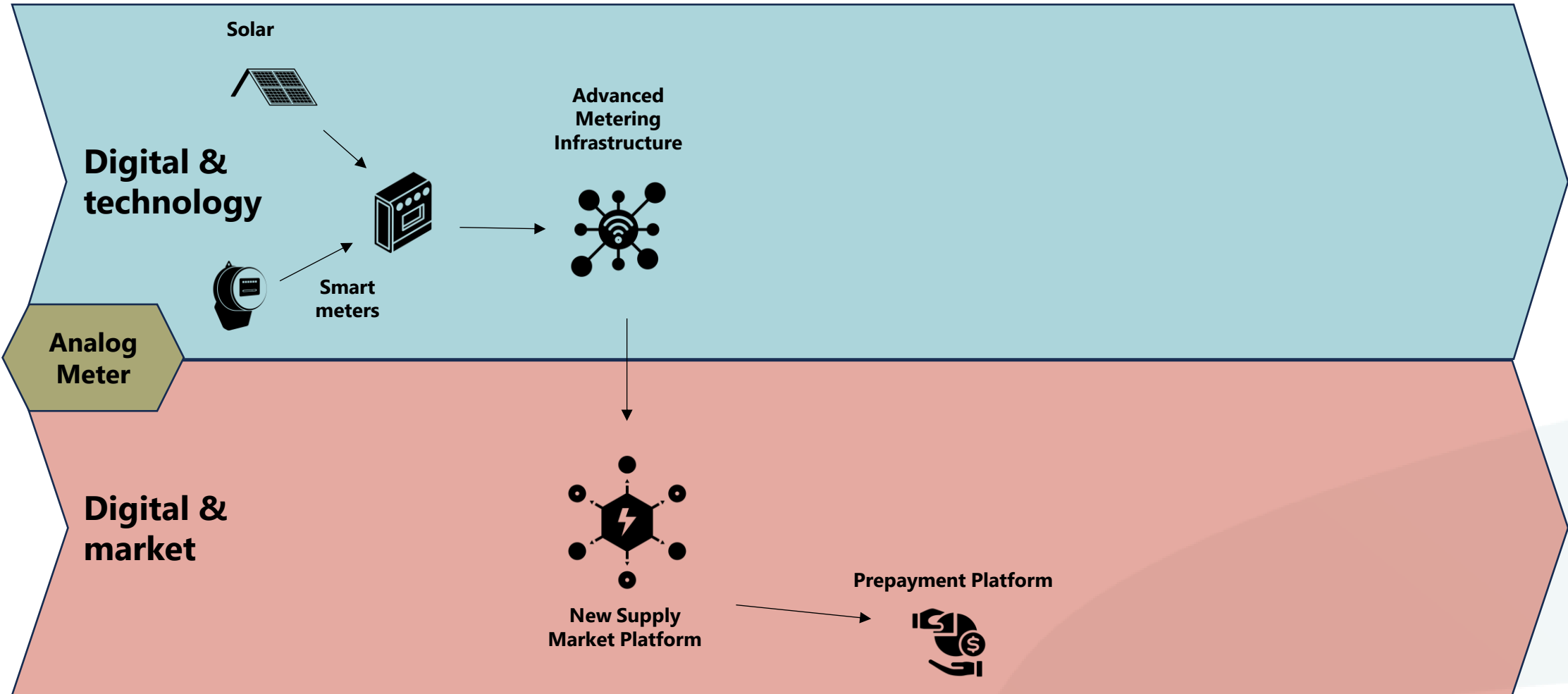
Smart meters & AMI



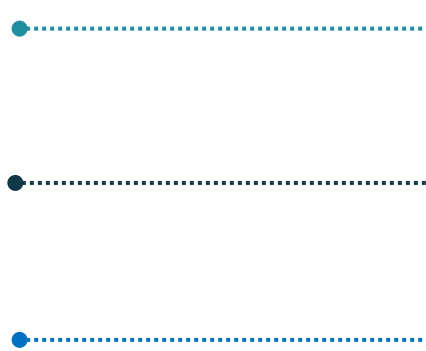
Rollout plan in %



From smart meter to household flex



First smart metering in the market



Telemetering

- No more metering rounds

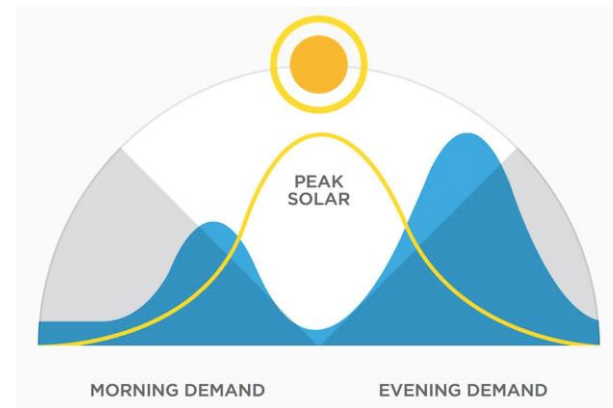
Device control

- Prepayment for social customers

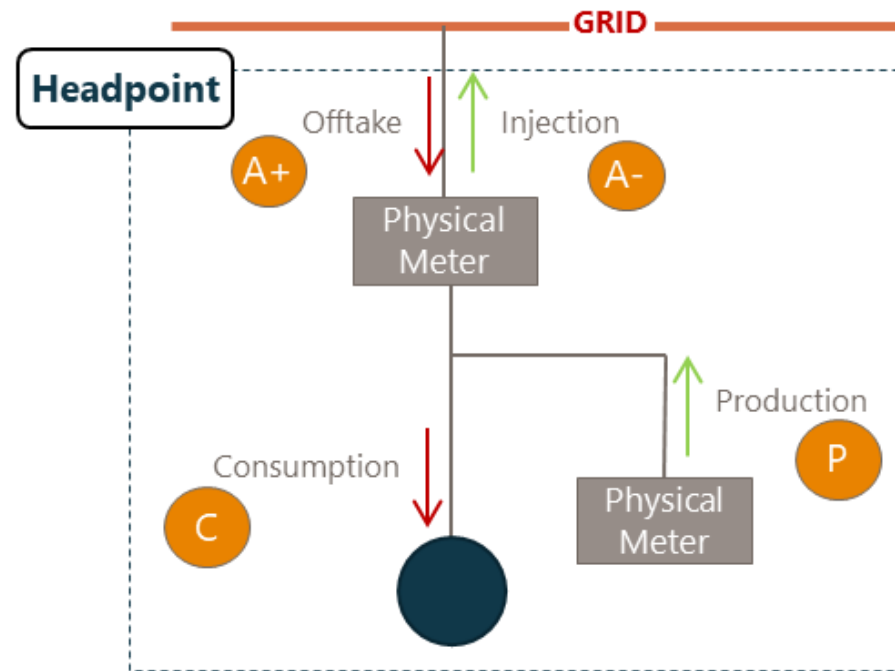
New measurement data

- Very granular **bi-directional** data (15' to ms)

*The beginning of the end for
the "terugdraaiende teller"*



First smart metering in the market



Service Catalogus

Compensatie*

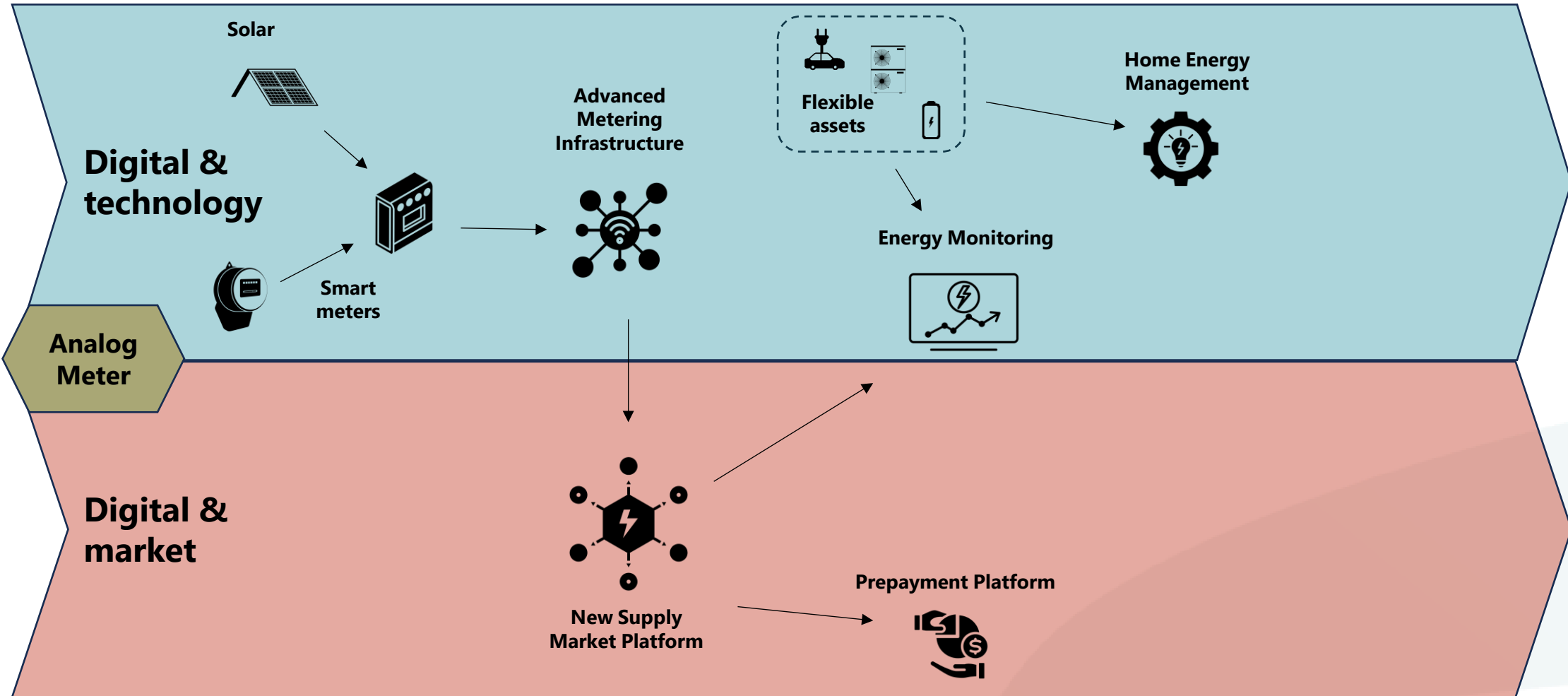
Vermarkting van de injectie

Vermarkting van de productie

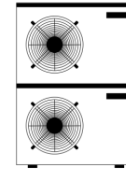
Beperkte vermarkting van de injectie

Beperkte vermarkting van de productie

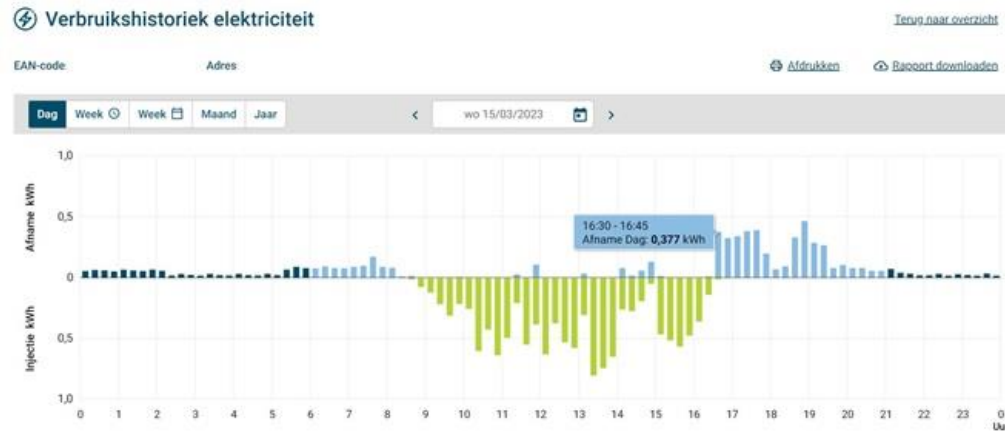
From smart meter to household flex



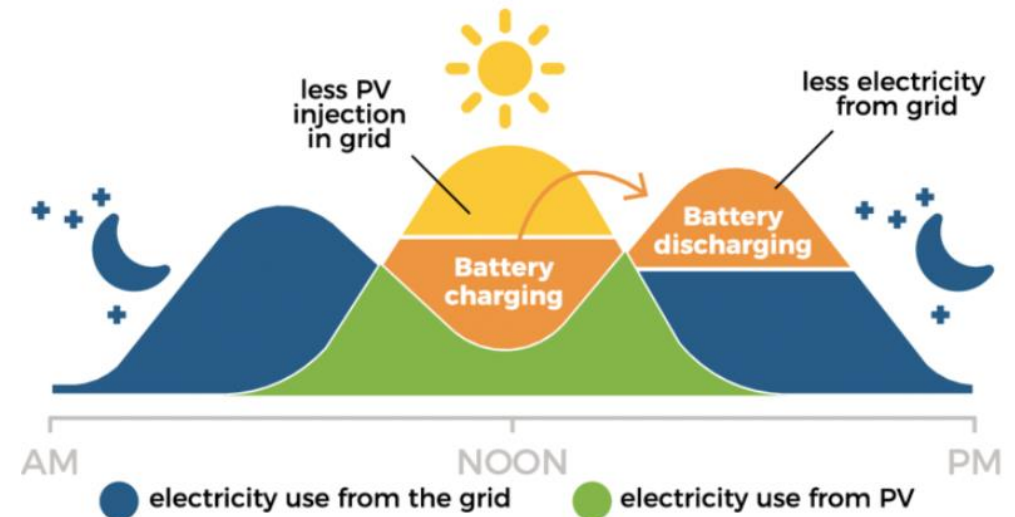
Flexible assets & HEMS



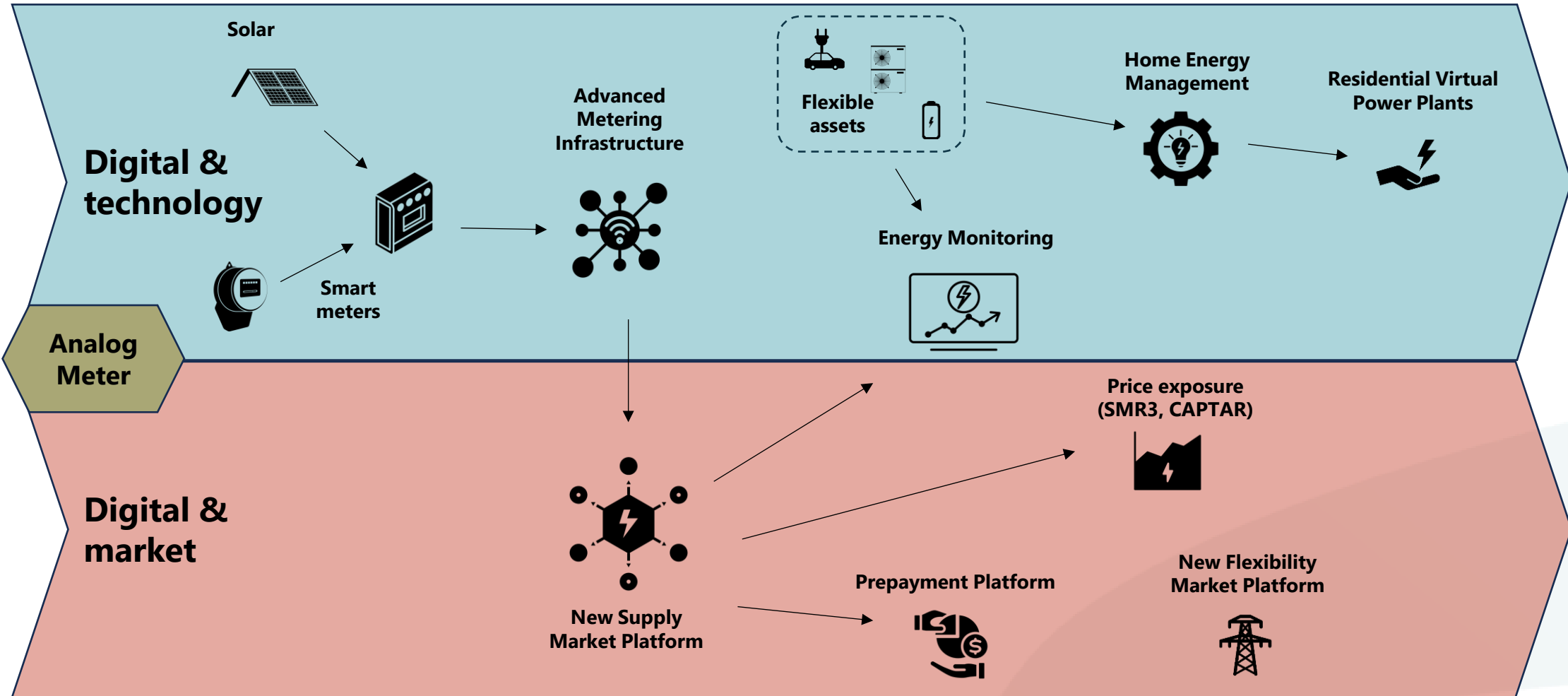
Energy monitoring



Active load shifting through HEMS

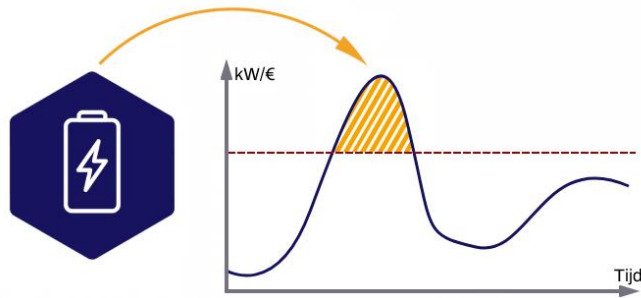


From smart meter to household flex



Evolving markets & opportunities

Capacity Tariff

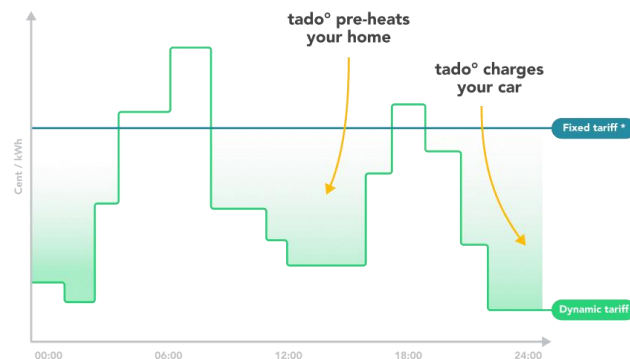


Imbalance steering

A real-time market price to reveal the true value of flexibility to consumers



Dynamic Tariffs

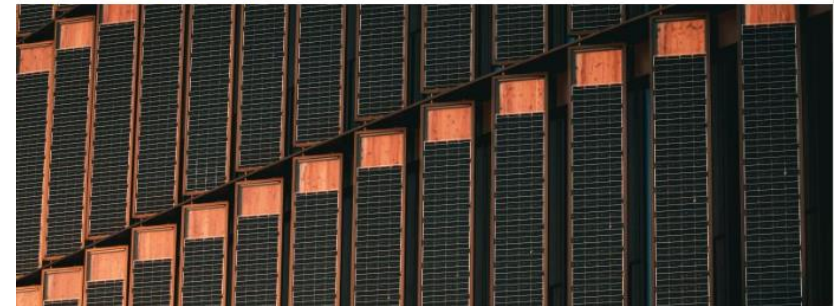


Balancing Services



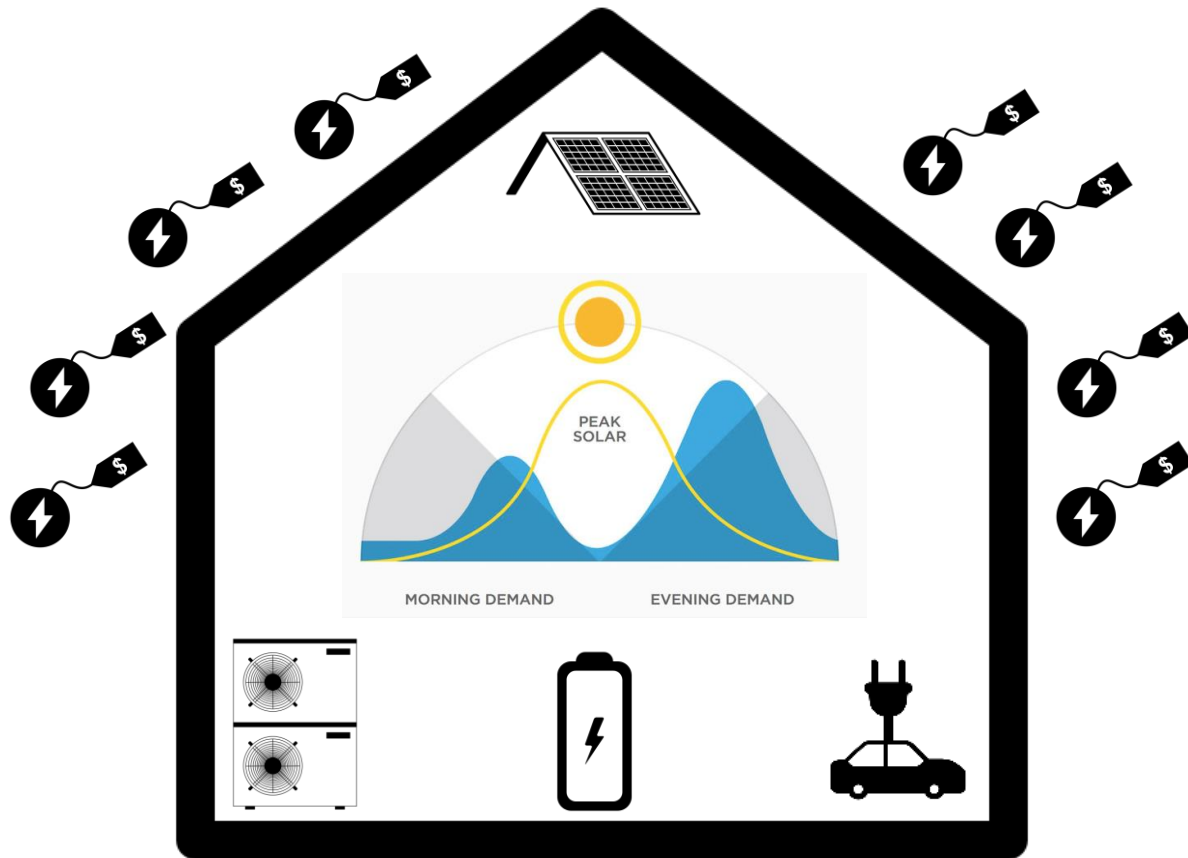
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A less noticed go-live than iCAROS took place last week. But it is one that marks an important moment for residential flex: the opening of the aFRR balancing service to low voltage grid users! ...more

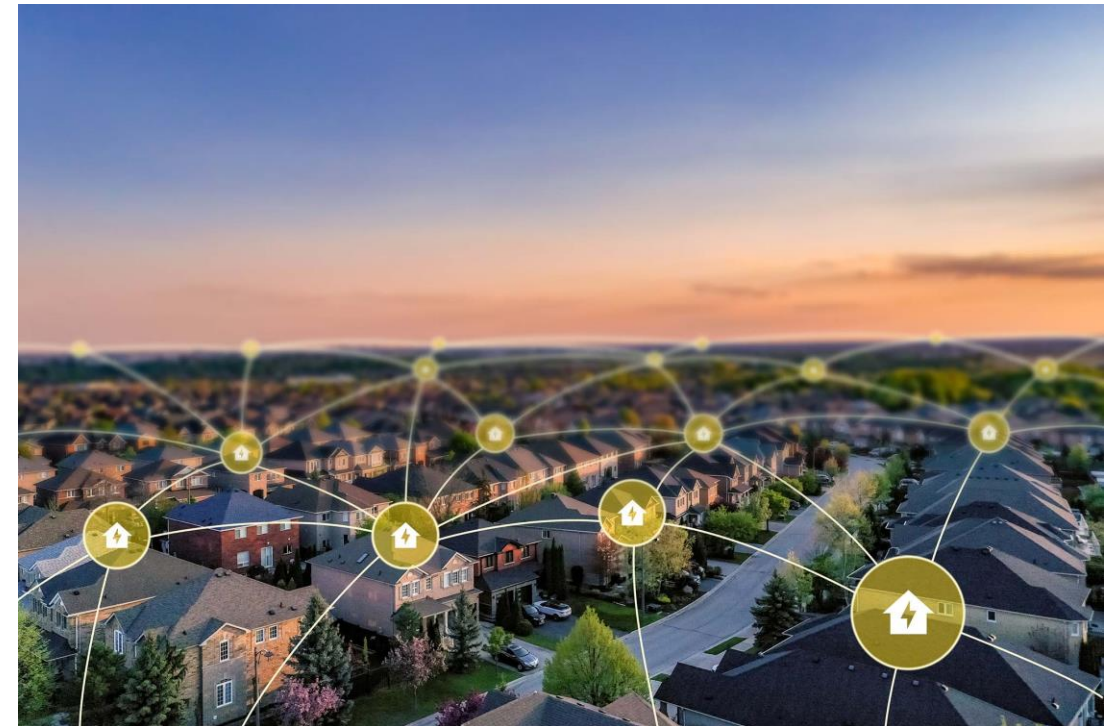


Evolving markets & opportunities

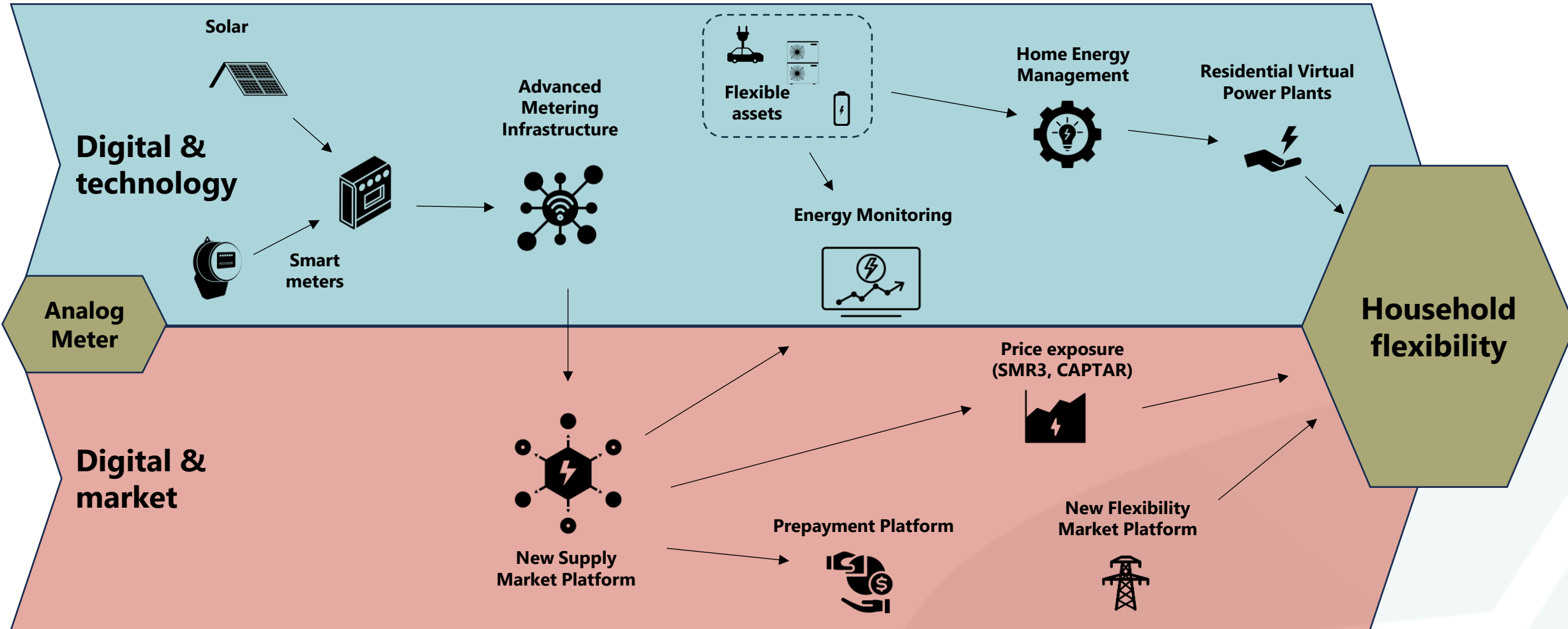
Cross market optimization



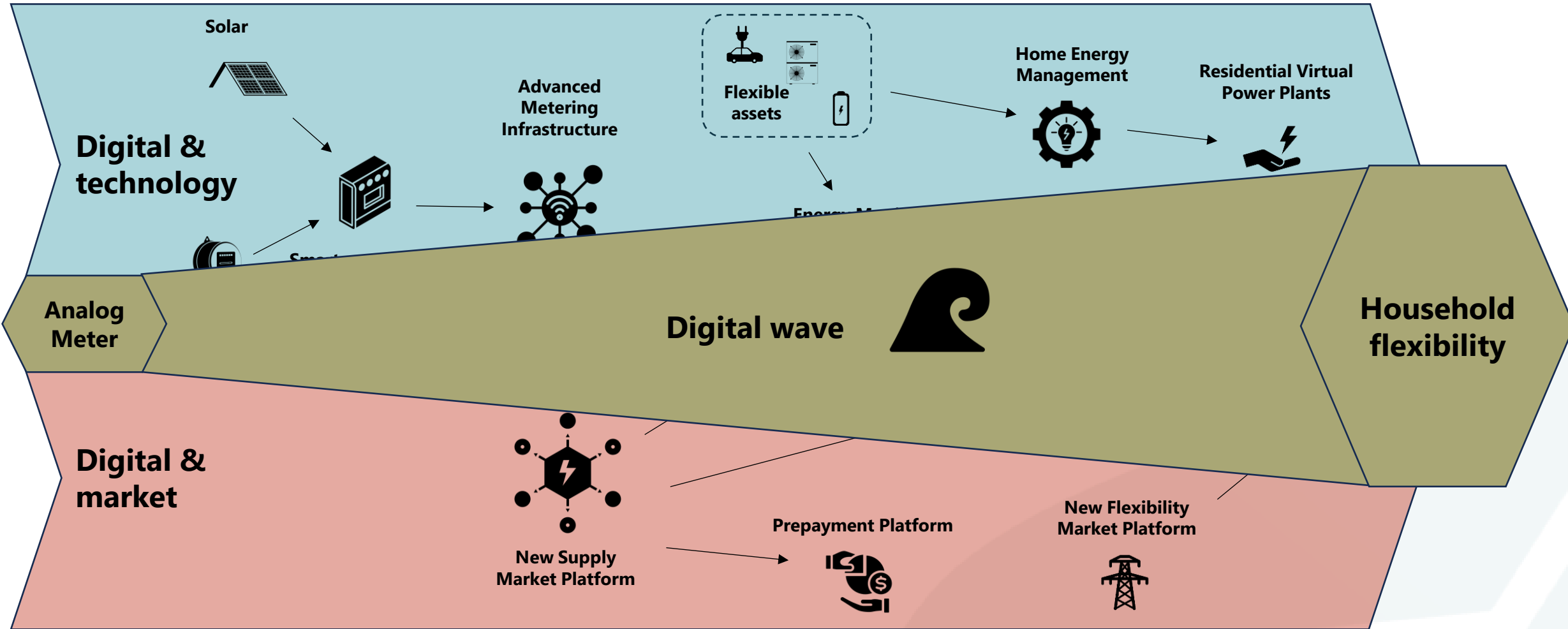
Household aggregation in Virtual Power Plants



From smart meter to household flex



From smart meter to household flex

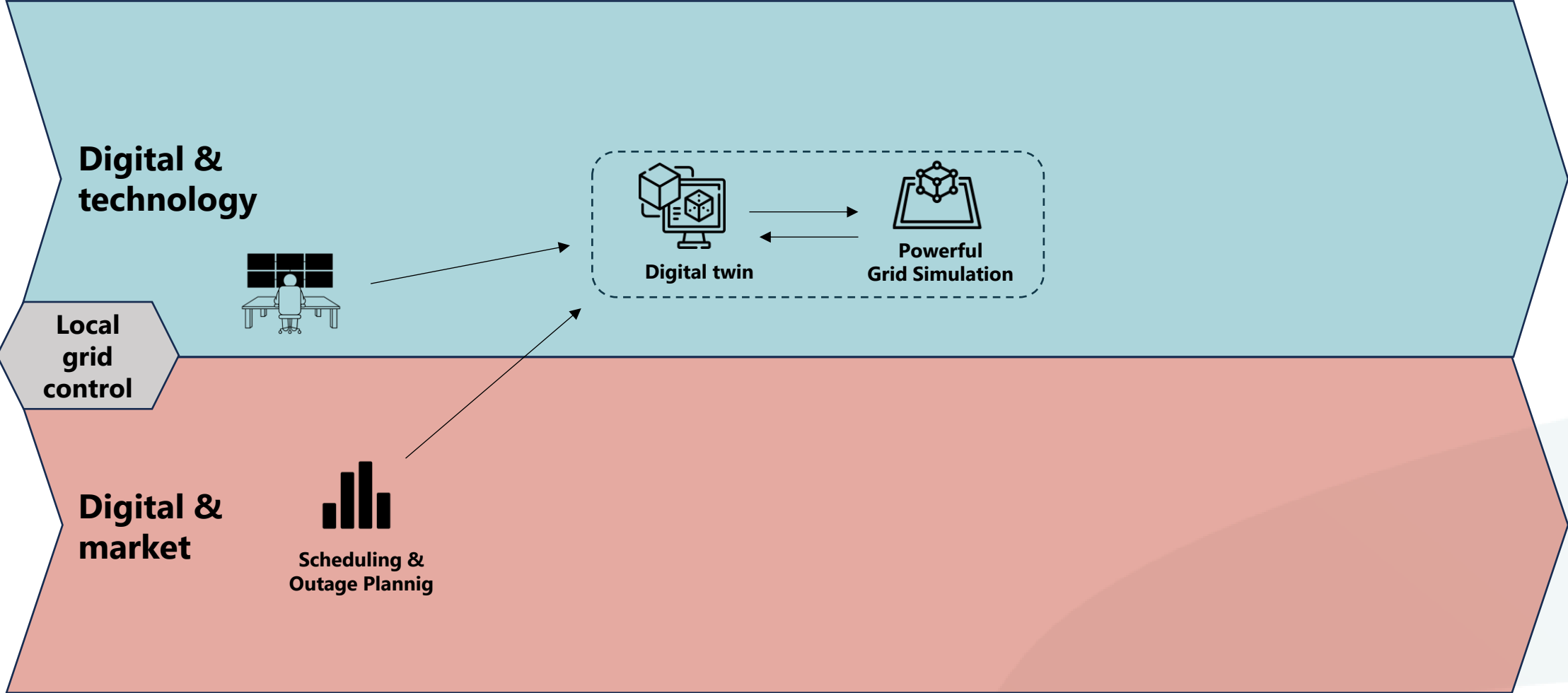


2 digitalization waves

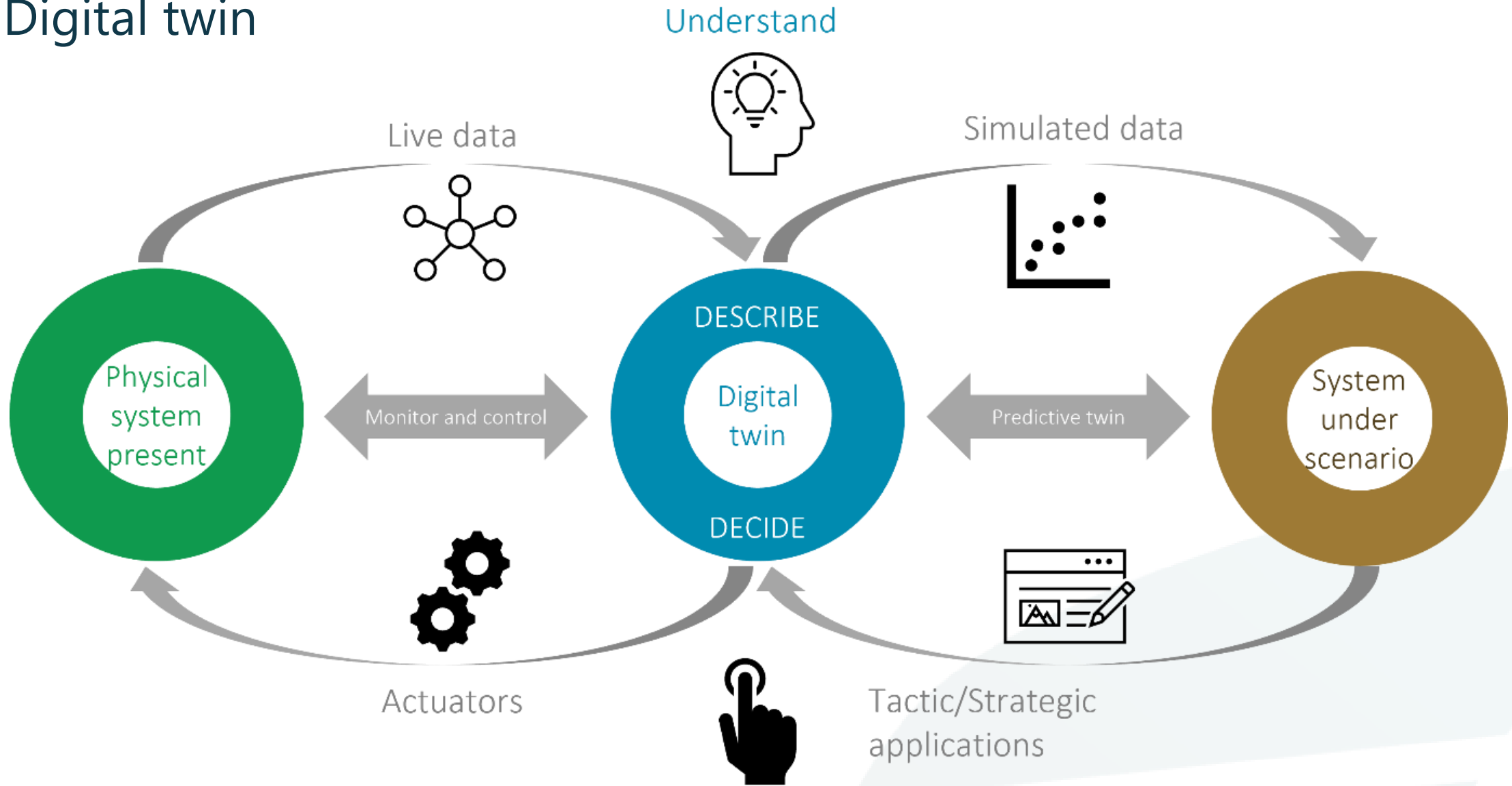
**From reactive to proactive
system management**



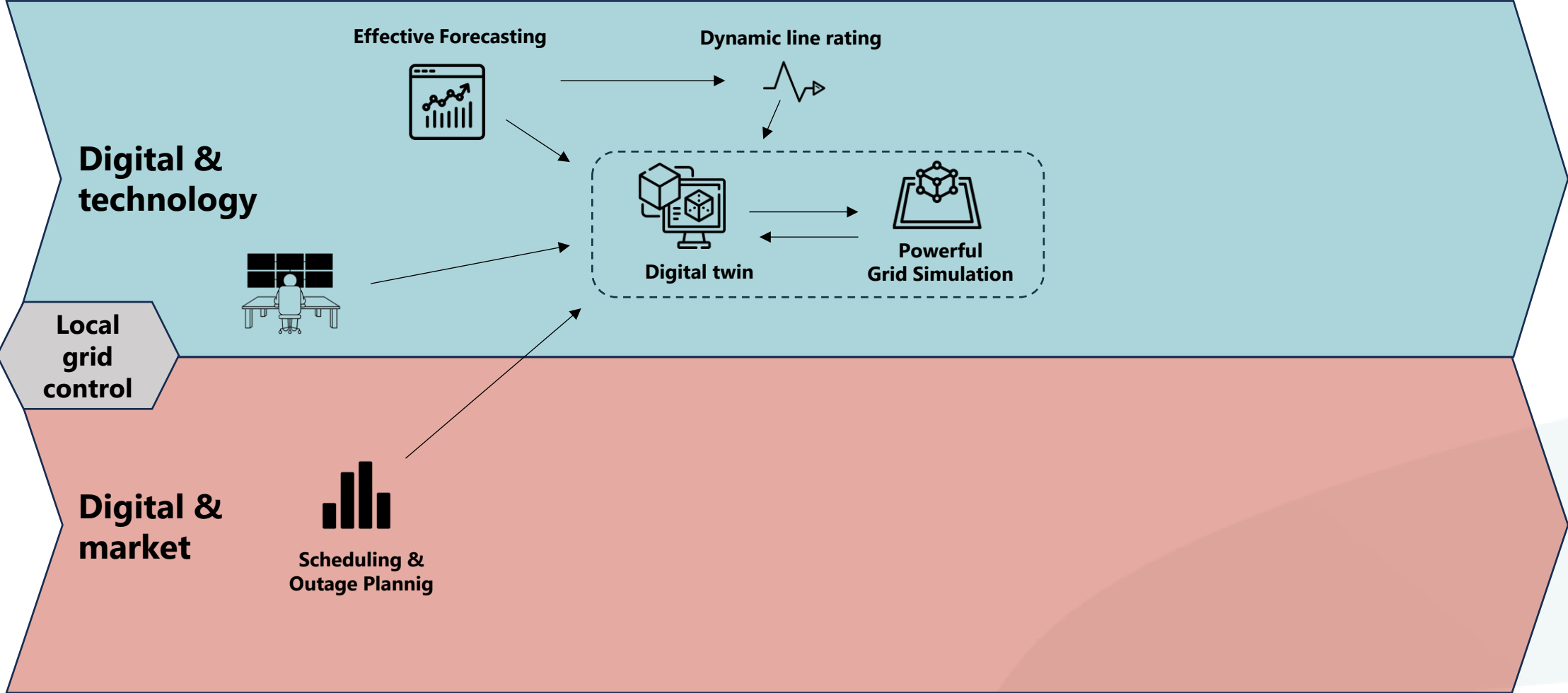
From reactive to proactive system management



Digital twin

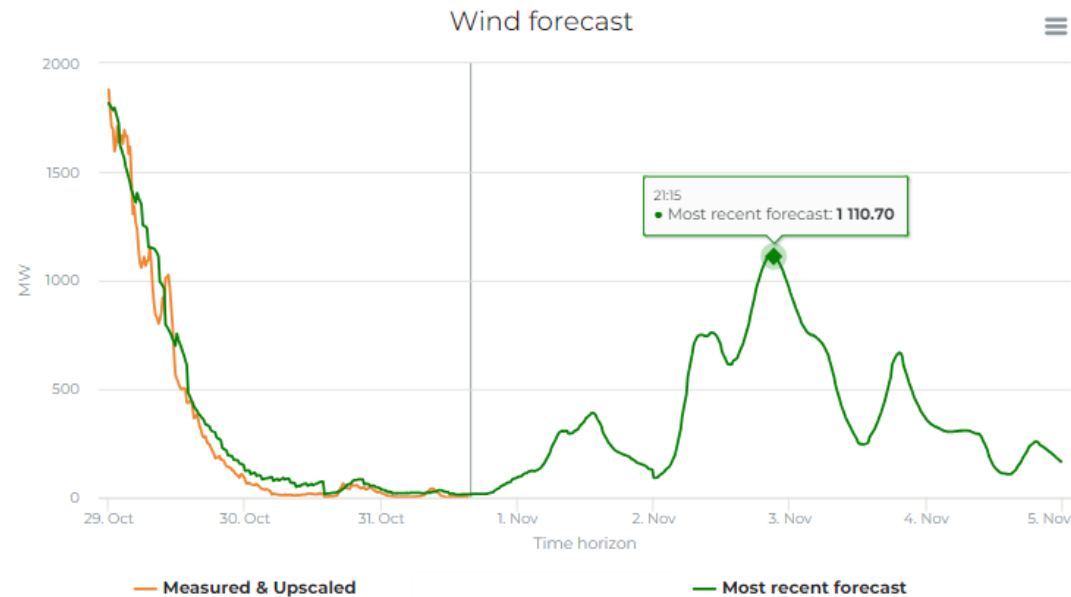


From reactive to proactive system management



Better and more detailed grid simulations

AI-powered Forecasting

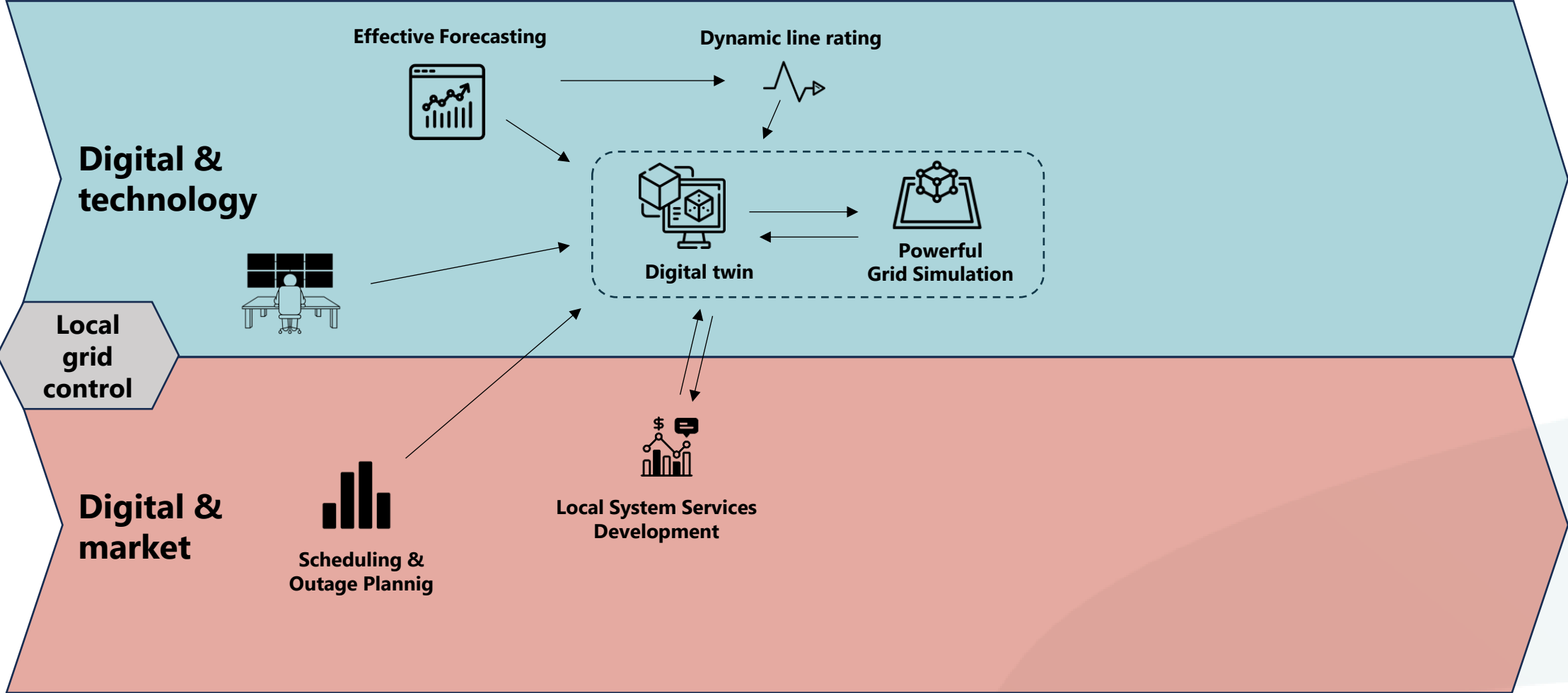


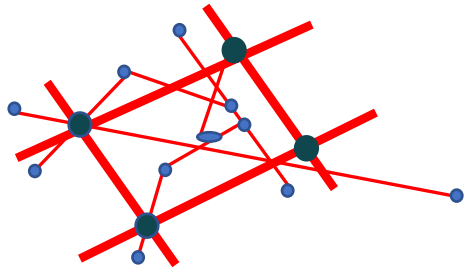
Dynamic Line Rating



"If a steady wind blows, the capacity of a high-tension cable increases at least by a factor 2"

From reactive to proactive system management

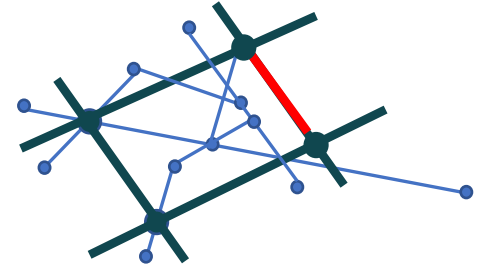




Managing imbalances between production and consumption

System Balancing

Congestion Management

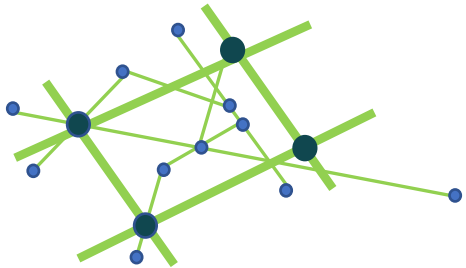


Anticipating and resolving thermal overloads on grid elements

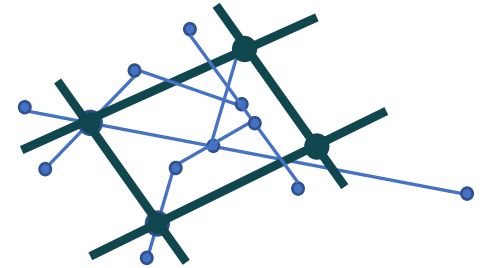
System Services

Voltage Control

Defence & Restoration

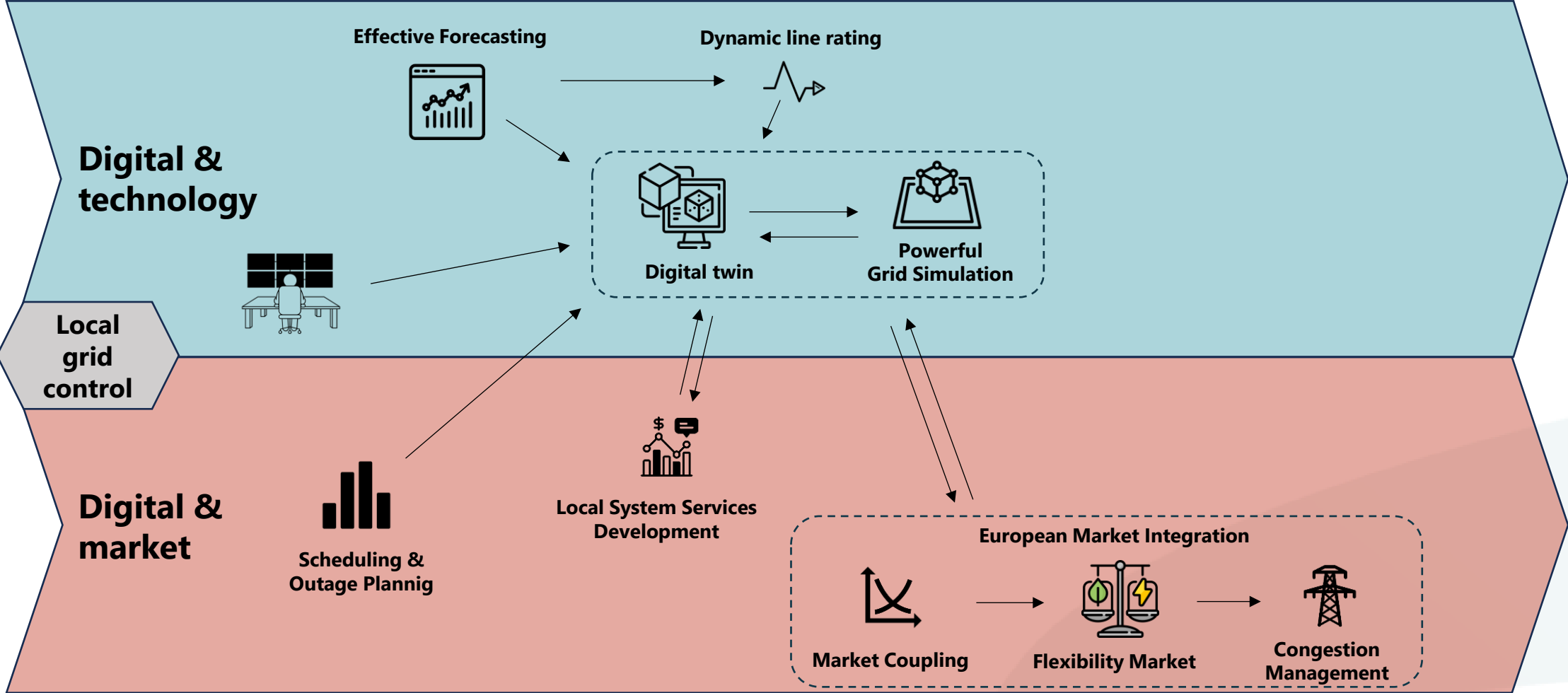


Stabilizing the voltage

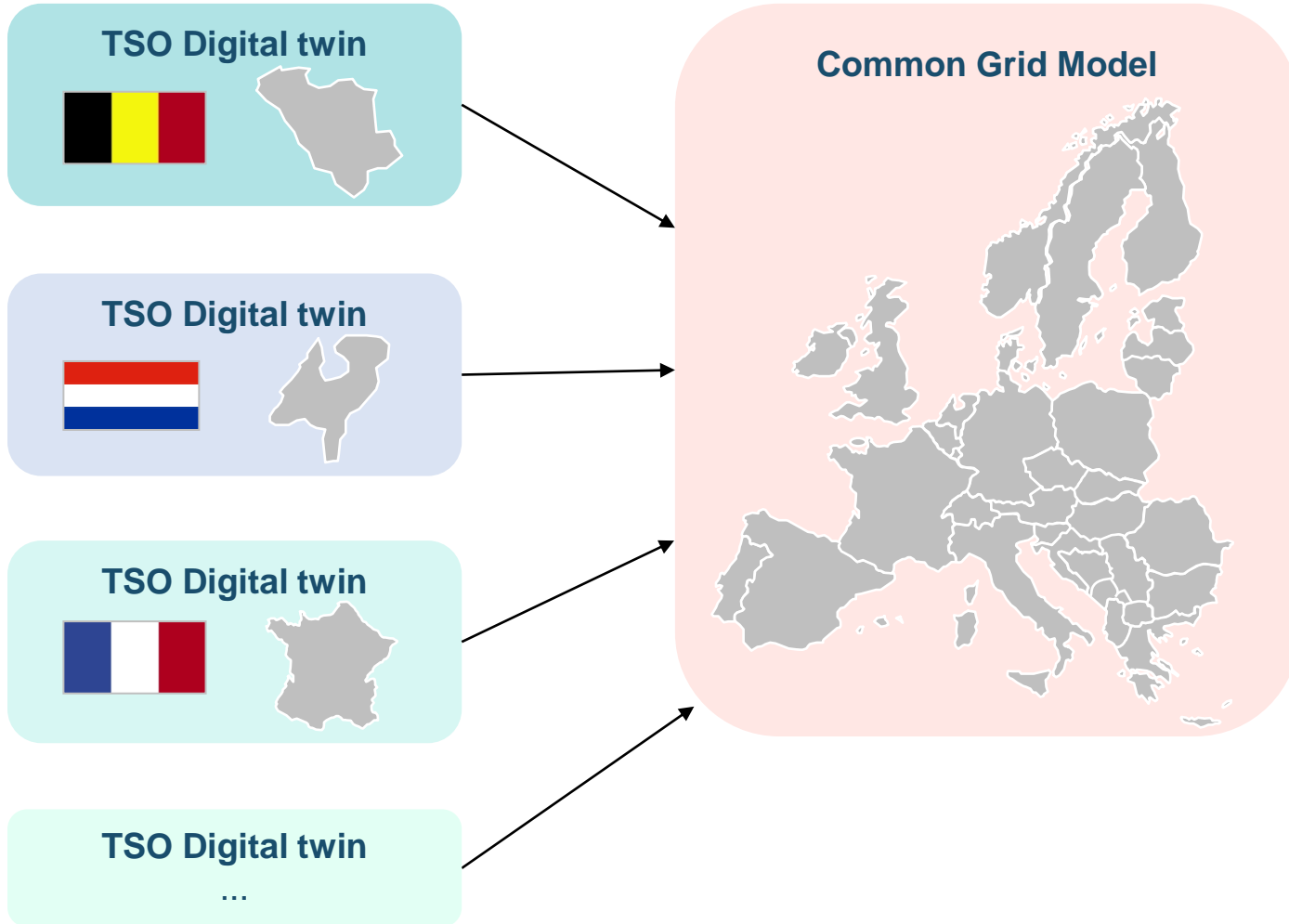


Emergency services used in case of blackout scenarios

From reactive to proactive system management



European Market Integration



TSO Digital twin



TSO Digital twin



TSO Digital twin



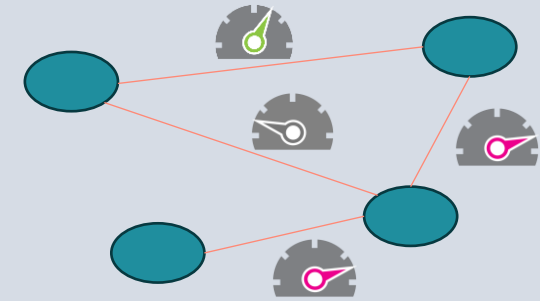
TSO Digital twin

...

Common Grid Model



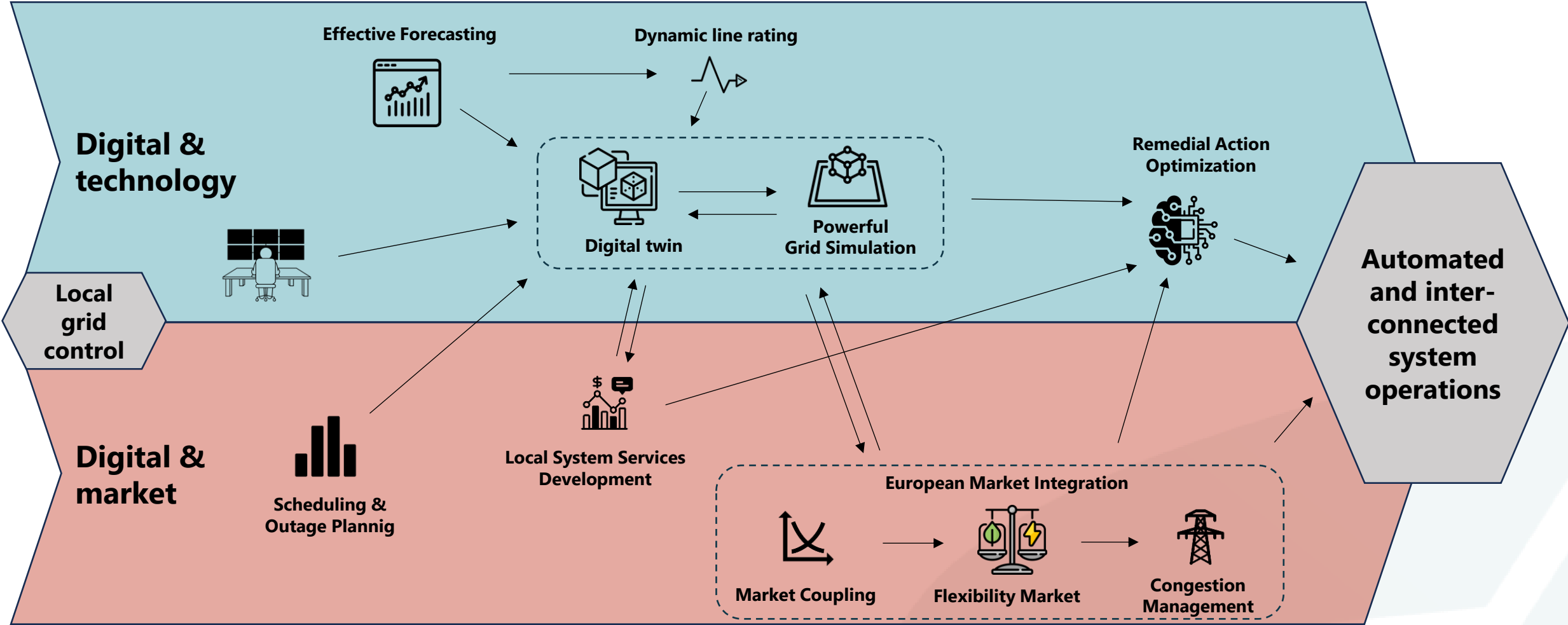
Cross-border Capacity Calculation & Allocation



Electricity markets

	Total border capacity	Markets
Years, months ahead		Long term
D-1		Day ahead
Delivery day (D)		Intraday
(Close to) real-time		Balancing

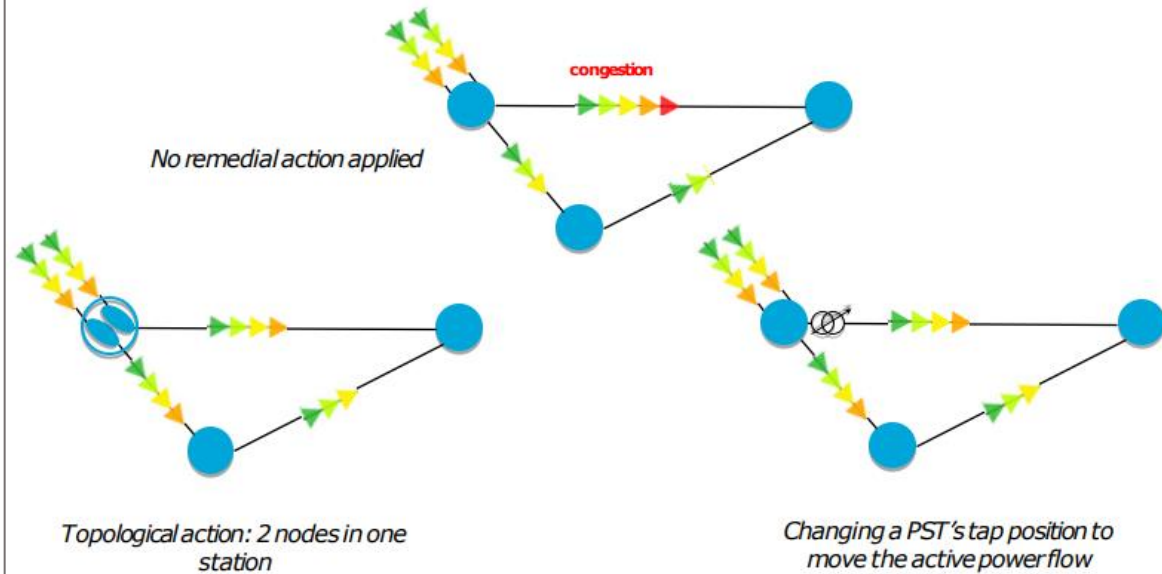
From reactive to proactive system management



Remedial Action Optimization

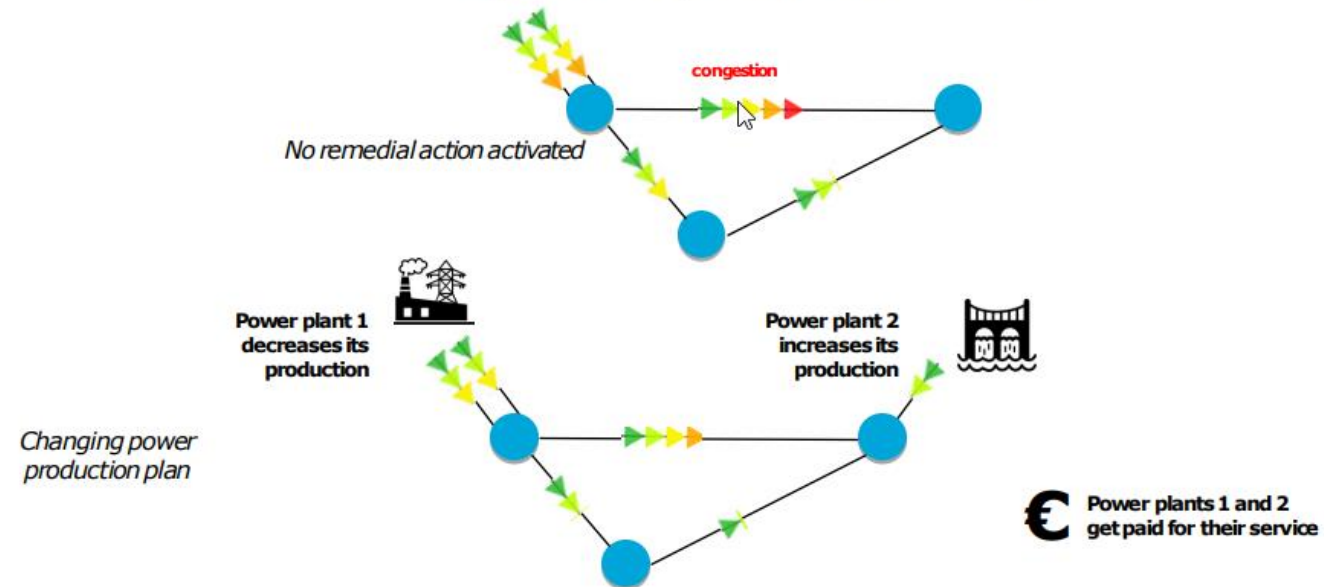
Remedial Actions

Examples: non-costly remedial actions

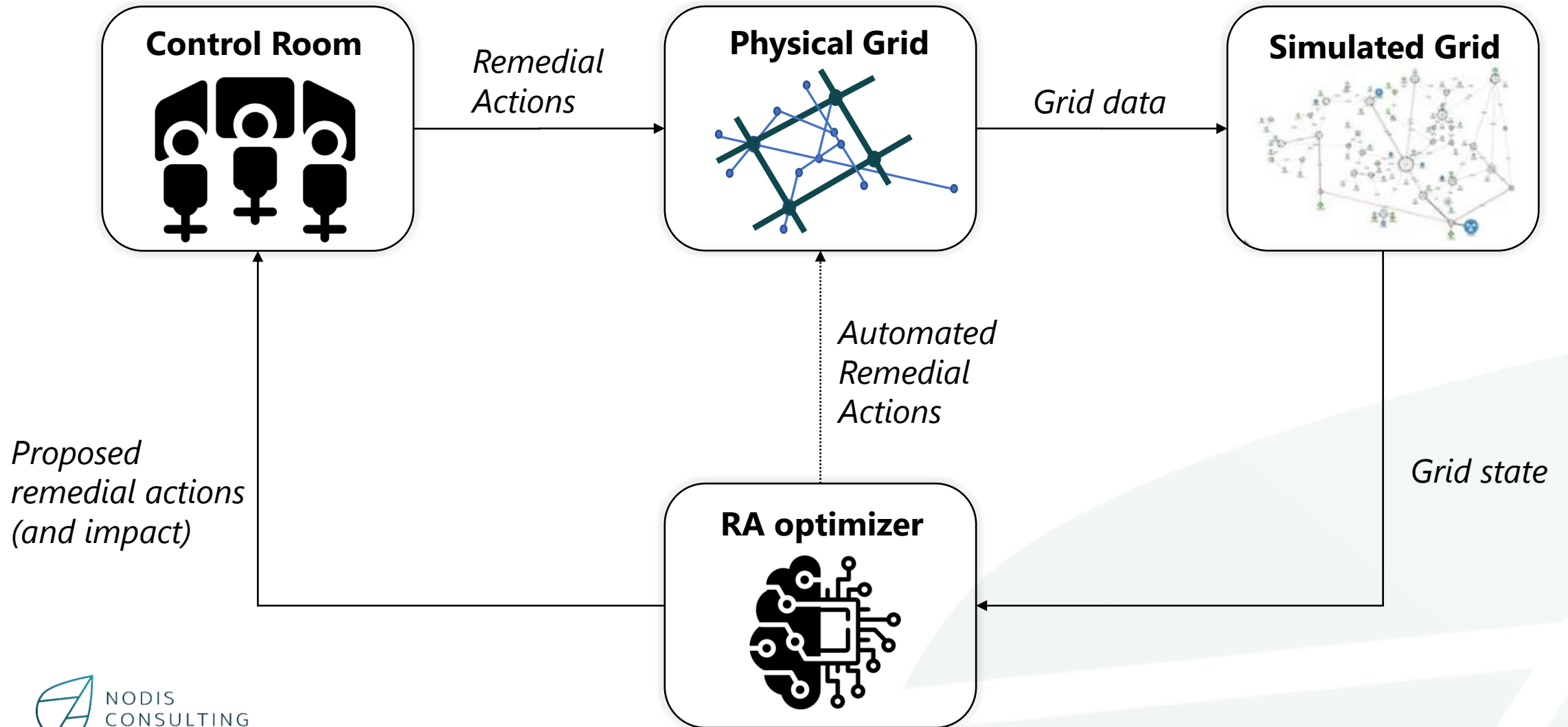


Remedial Actions

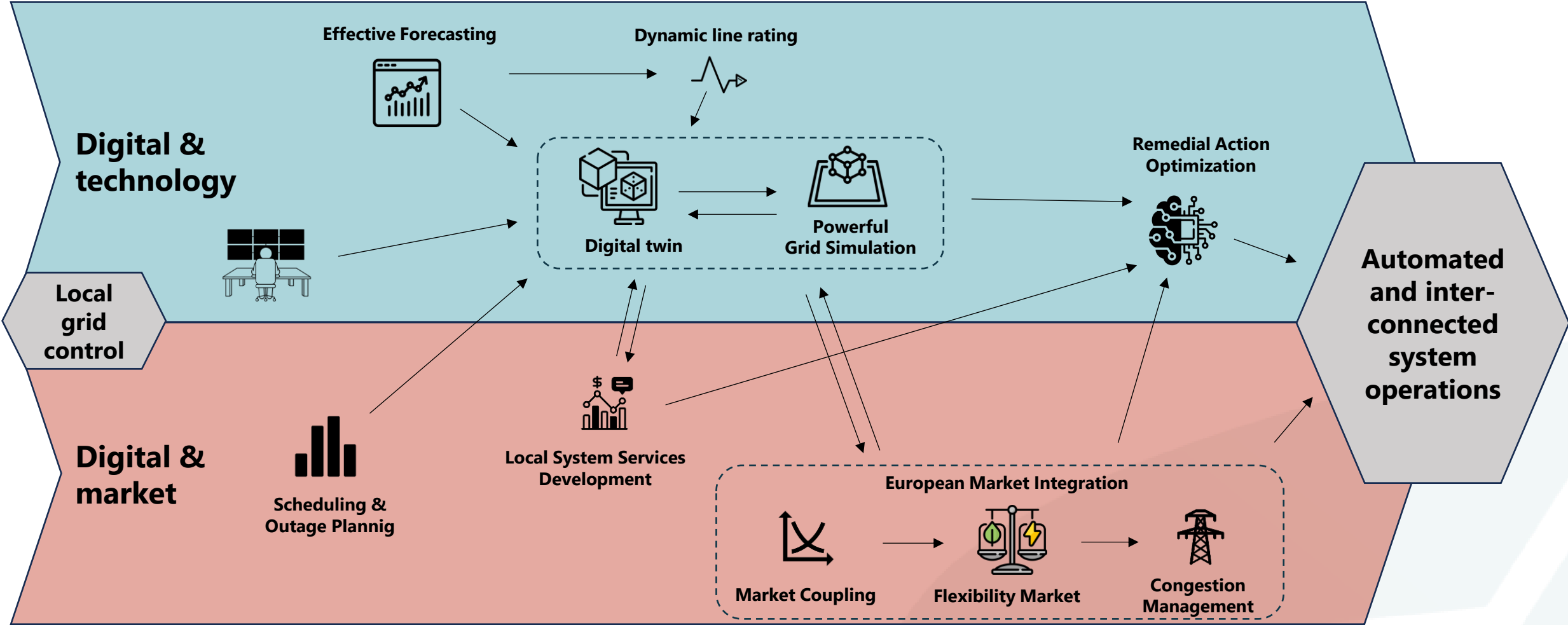
Example: costly remedial actions



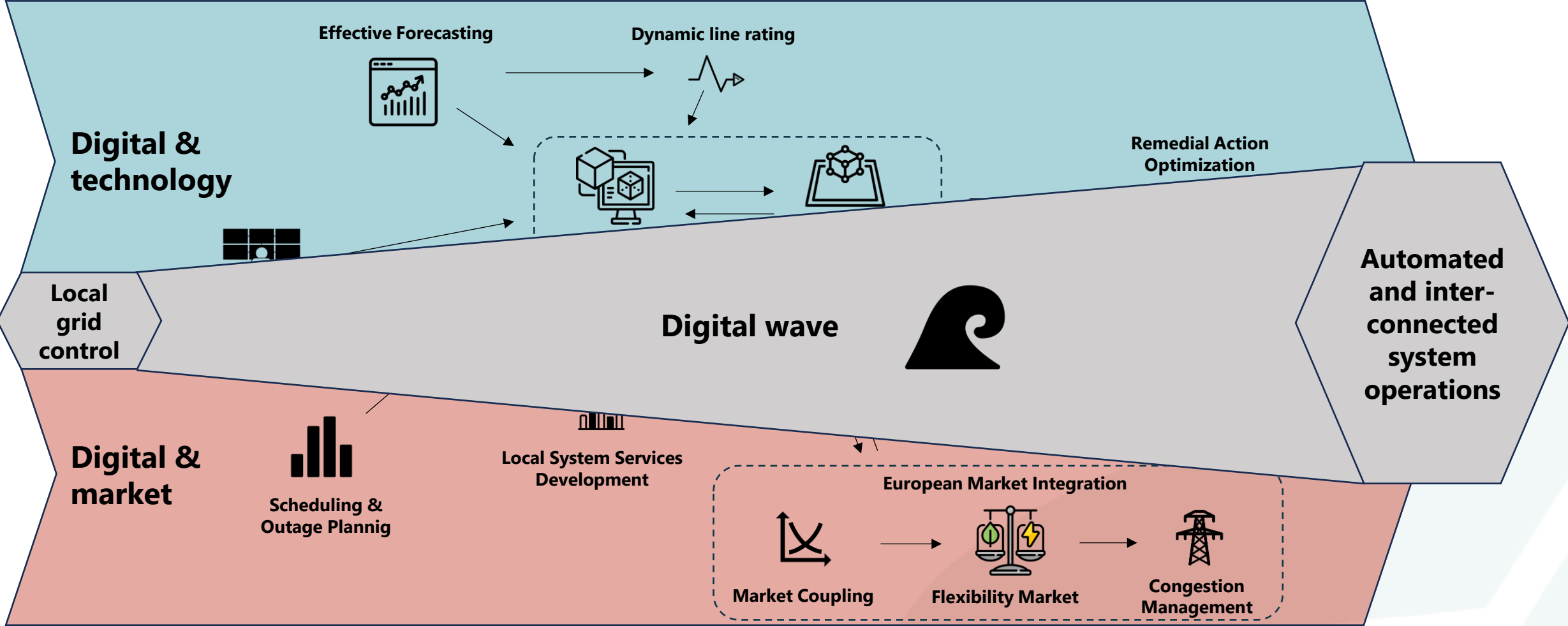
Remedial Action Optimization



From reactive to proactive system management



From reactive to proactive system management





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From Nodes to Synergy

*Expert Consulting
In Energy &
Digital Transformation*