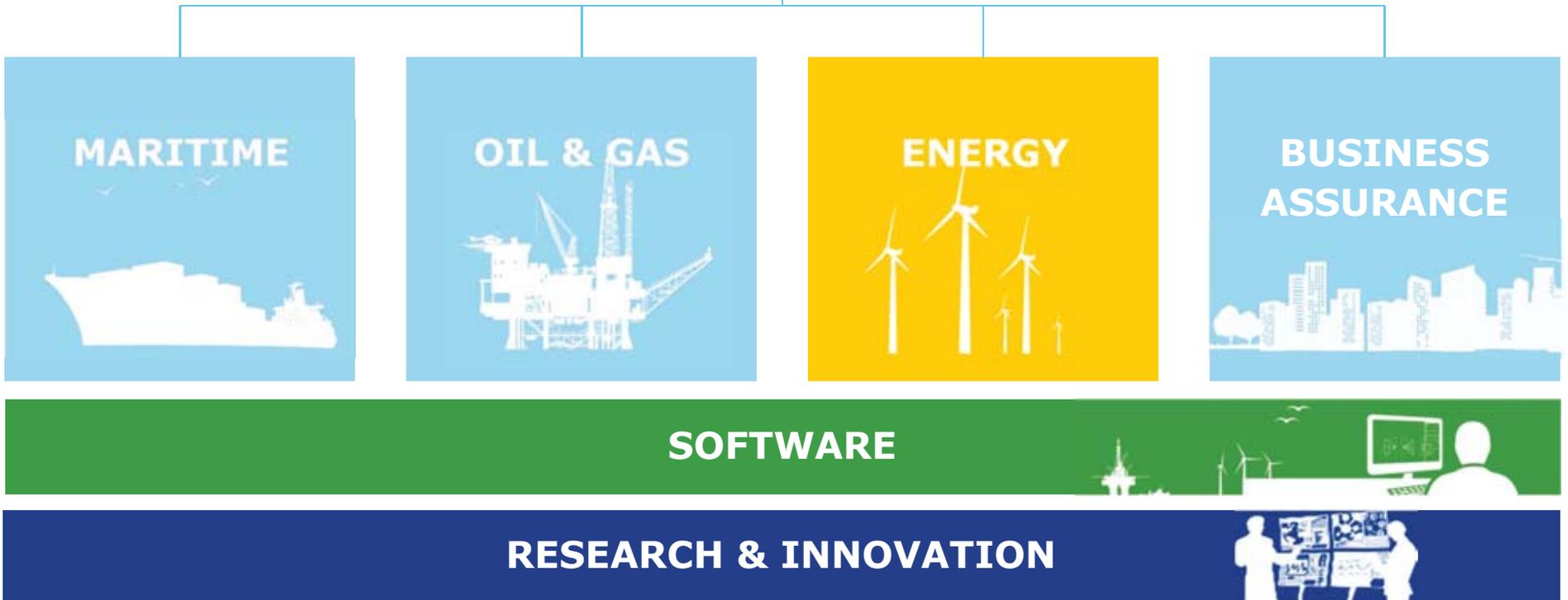




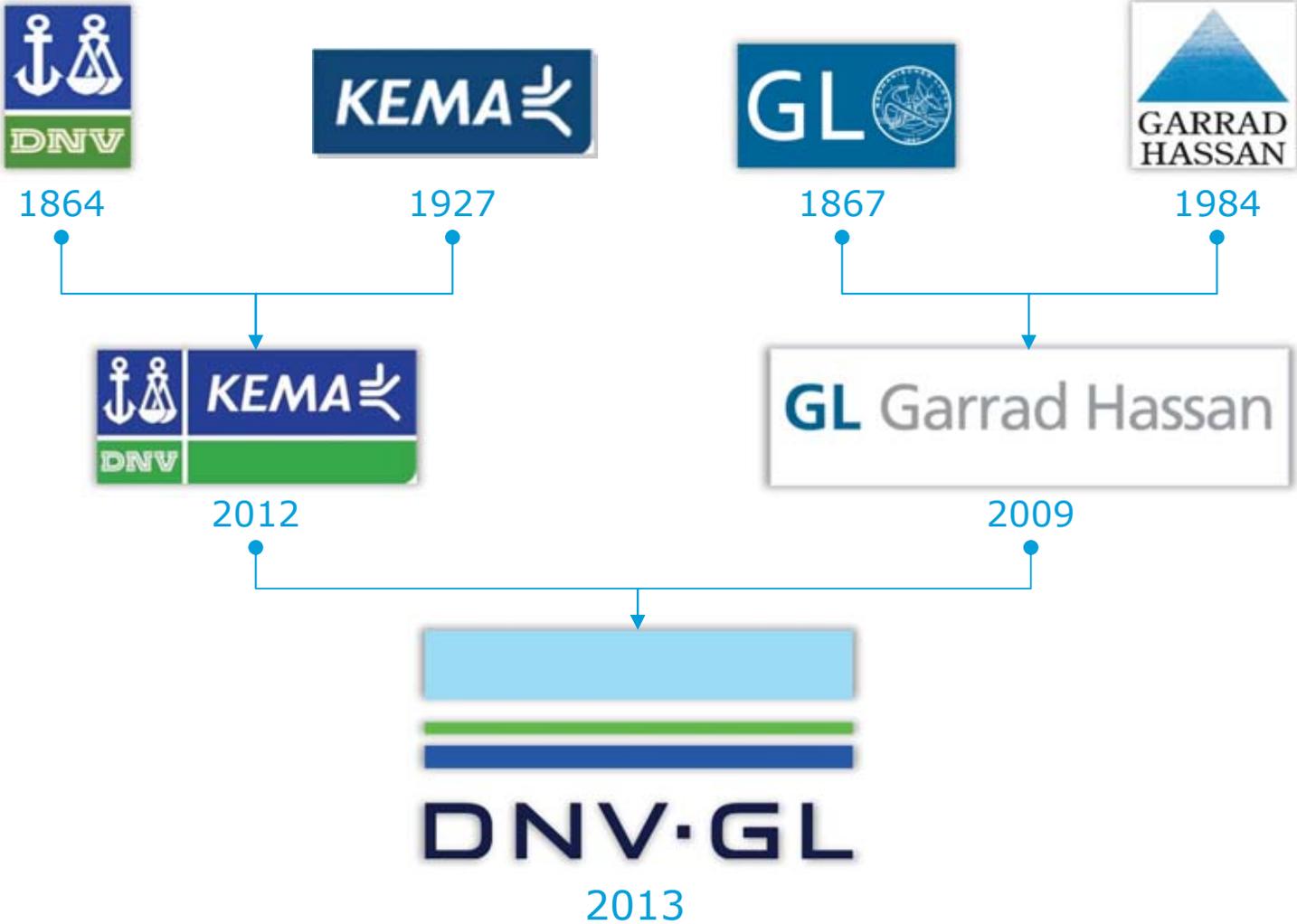
EAMS – Preparation for Future Grids with High Penetration of DERs

Presenter: Nguyen Khanh-Loc
DNV GL – Clean Technology Centre – Singapore

Organized to maximise value for our customers



Industry consolidation through mergers

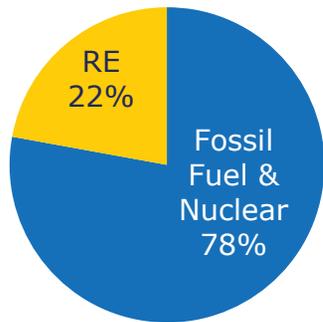
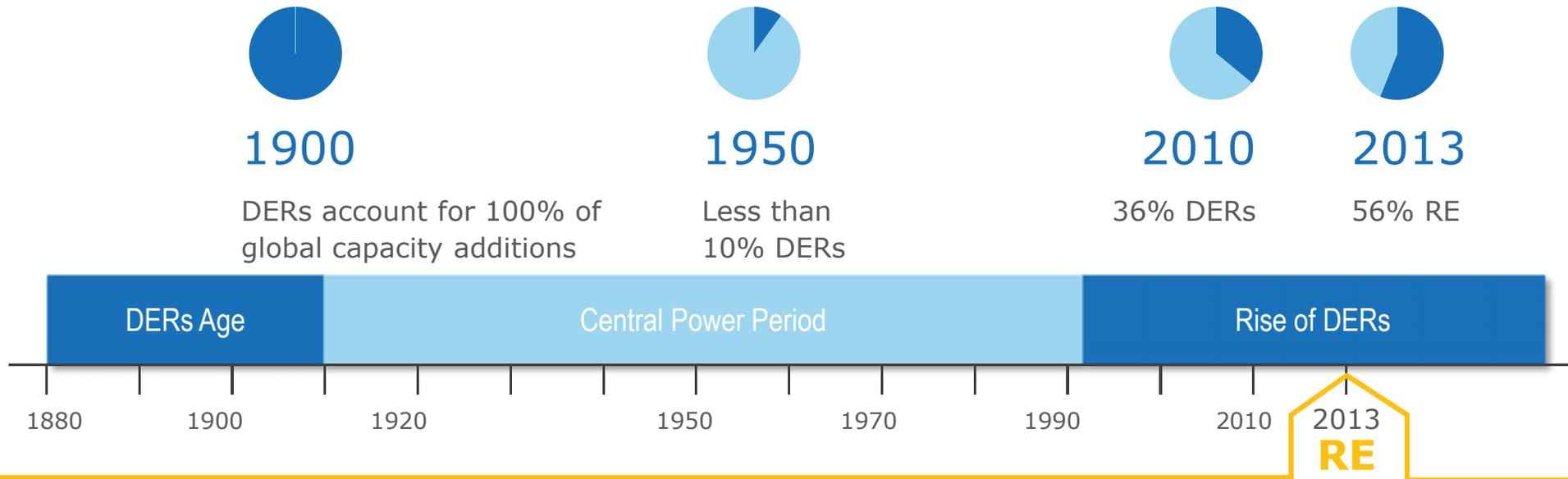


DERs

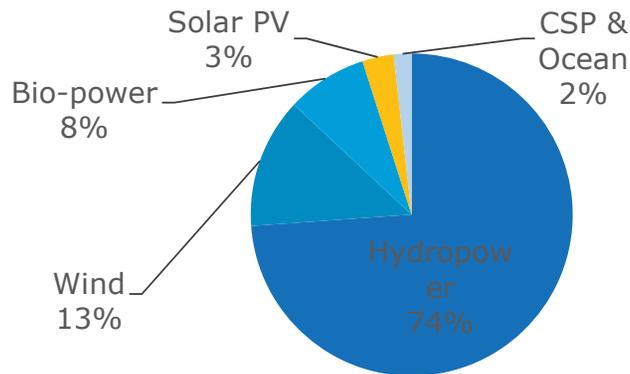
Trend, Challenges & Benefits



DERs History



World total generation



World total generation

- PV growth was **fastest** (55% annually)
- In 2013, **first time** PV added capacity is larger than wind capacity

Source: [REN21](#), [NREL](#), [GE](#)

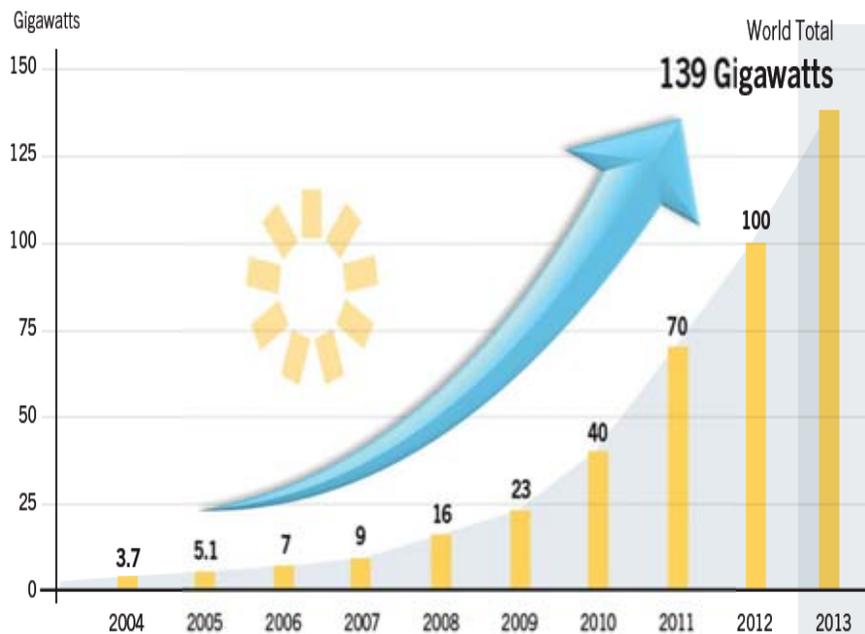
Grid-Connected PV

Globe:

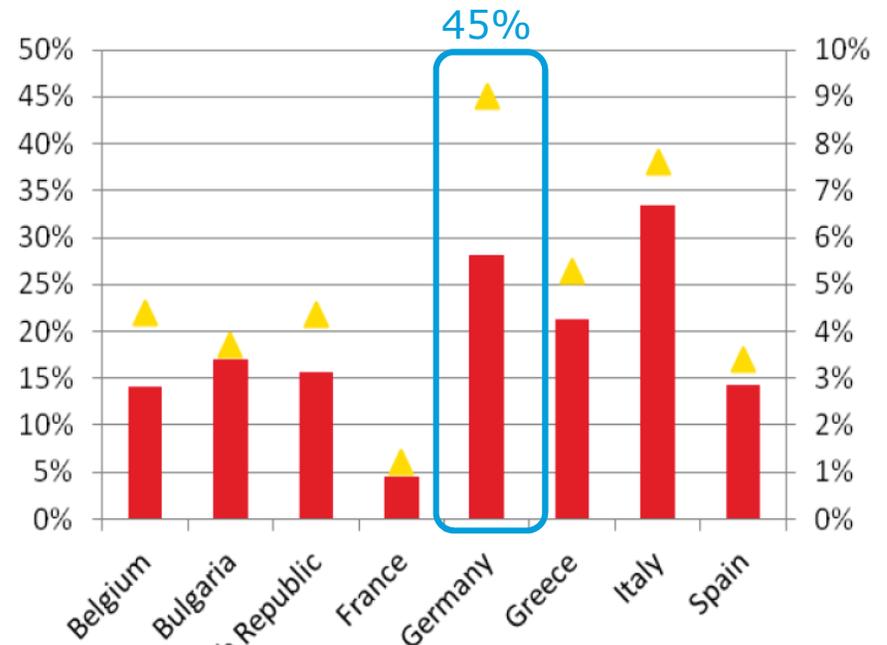
- PV has been fastest deployed in past few years (139GW by 2013)

Germany:

- Deployed largest capacity of PV in the world (33GW by 2013)
- Has **high penetration level**



(World total installed PV capacity)



(PV penetration level)

Source: [PV Grid](#), Bundesnetzagentur

Challenges and Benefits



Challenges:

- Reversed power flow in distribution system
- Additional power flow in transmission system
- Grid congestion
- Operation, control, and protection
- More uncertainties
- High risk

Benefits:

- Provide distribution voltage support and ride-through
- Optimize distribution operations by coordinated control of DERs
- Participate in demand response programs
- Improve voltage quality and reduced system losses
- Reduce environmental impact
- Defer capacity upgrades with proper planning
- Improve power system resiliency

EAMS



EMS & AMS play key roles in managing the system and assets



EMS

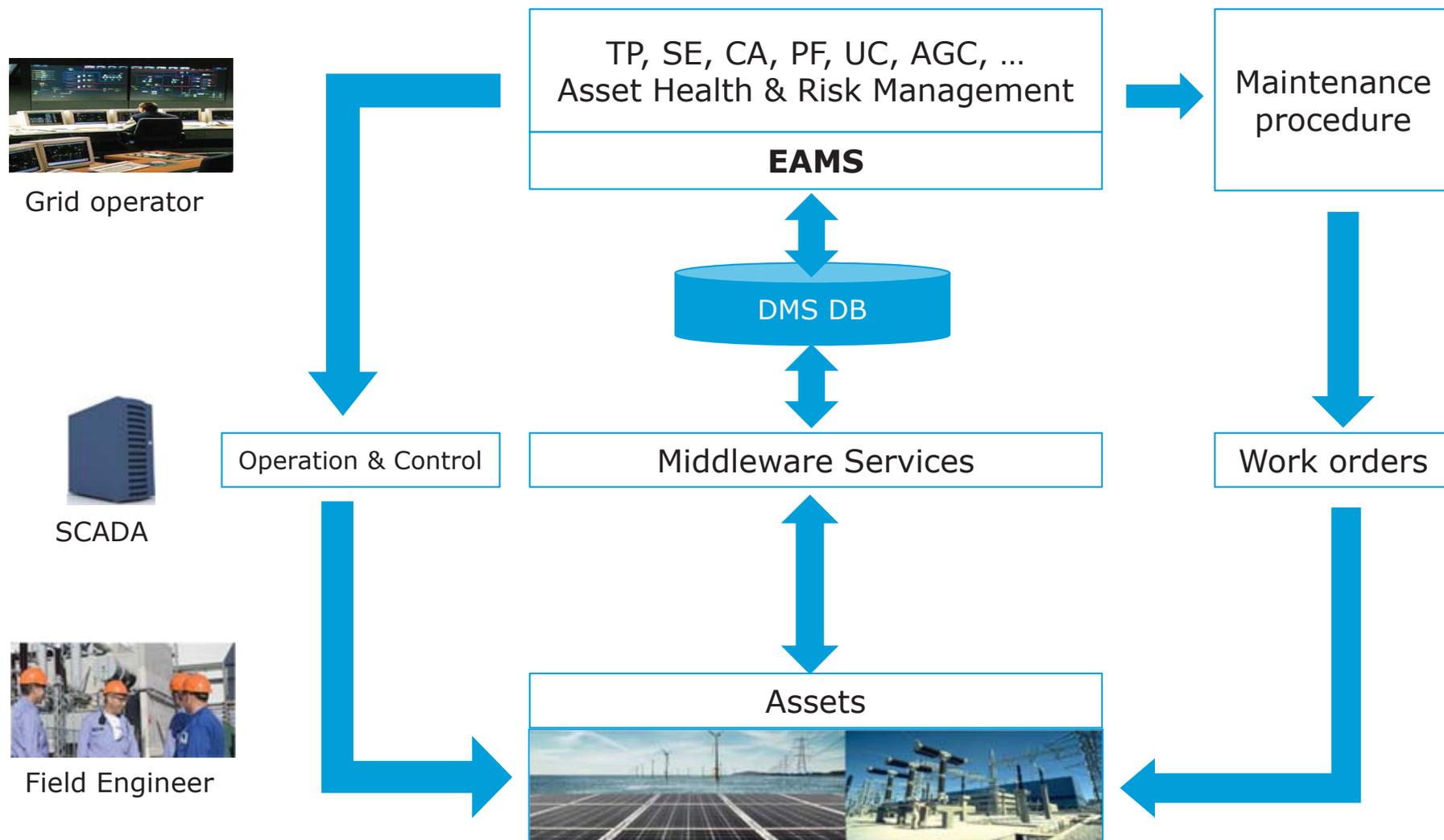
Optimizes grid operation globally

AMS

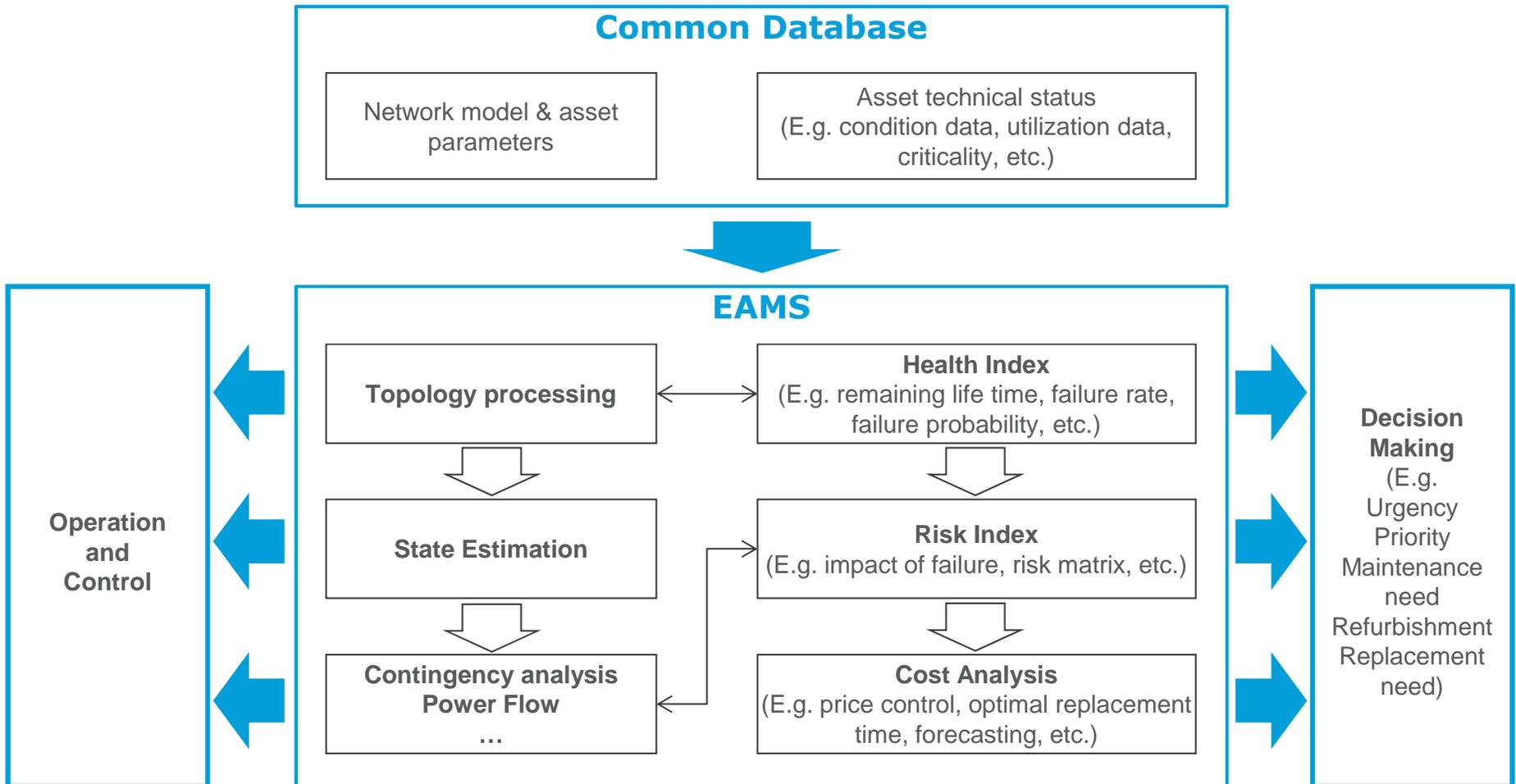
Optimizes the operation cost and minimize the risks and cost of operation of assets

EMS & AMS need to be more robust to deal with the complexity while maximizing the benefits of DERs

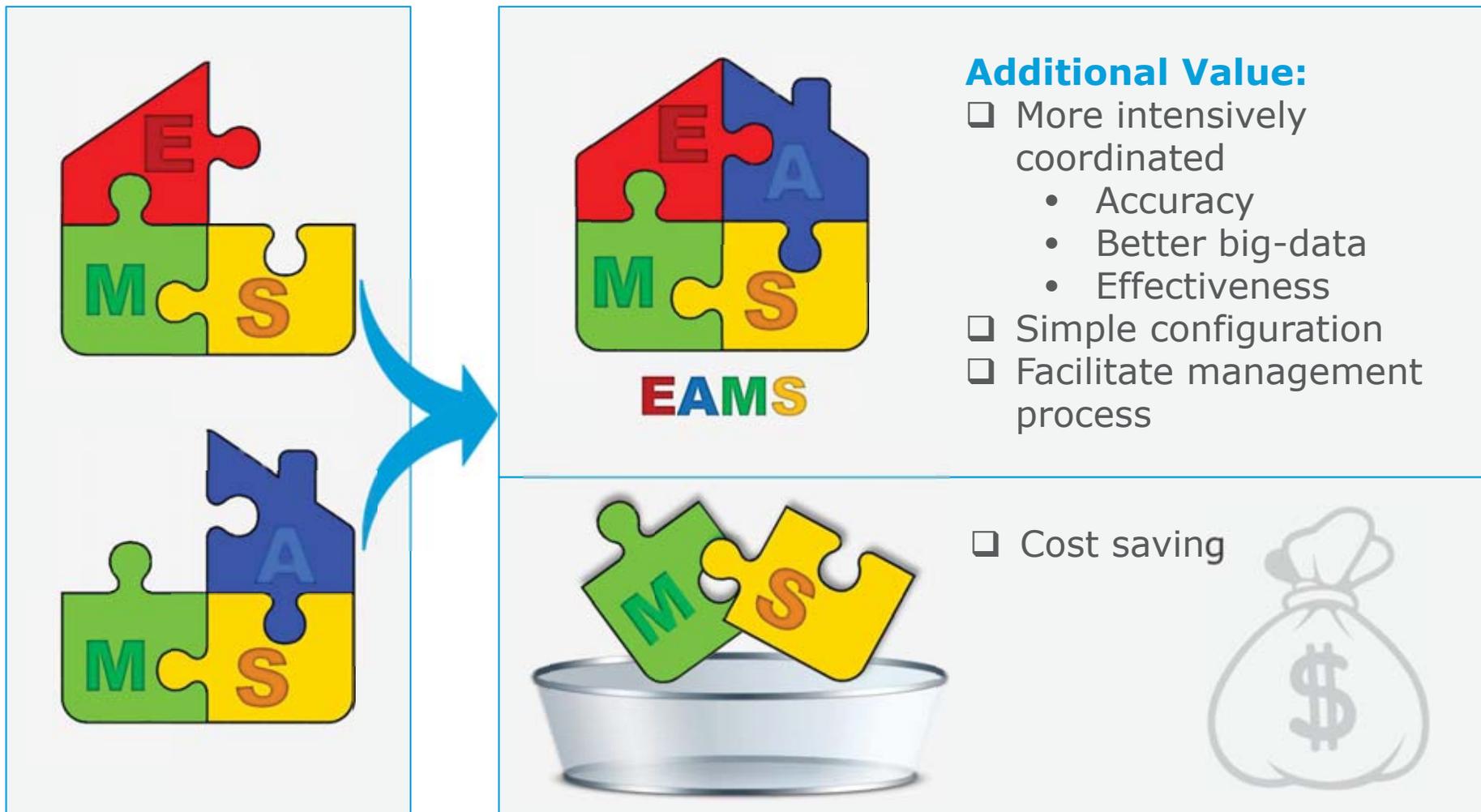
EAMS Conceptual Design



EAMS Core Functions



EAMS is more robust, stable, and cost saving



Conclusion



Technical Benefits

- More accurate assessment results
- Higher performance
- More effective
- More optimal
- Better big-data management



Financial Benefits

- Reducing operation cost: cost of failure
- Optimizing maintenance & replacement cost



Organization Business Value

- Simplify management process
- Improving organization's KPIs
- Improving reputation obtain other business values

Thank You for Your Attention!

Presenter: Nguyen Khanh-Loc

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