EAMS for Future Grids

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

Objectives

- What is EAMS?
- Why EAMS?
- How EAMS helps?

DNV GL - Organized to maximise value for our customers

DNV·GL

MARITIME

OIL & GAS

ENERGY

BUSINESS ASSURANCE

SOFTWARE

RESEARCH & INNOVATION

150
years of operation

300+
offices

100
countries

16,500
Employees
Energy : 2,500

What is EAMS?

(EAMS: Energy Asset Management System)

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

Conventionally, EMS & AMS exist separately in the power system

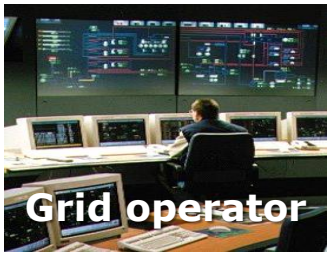
AMS
(Asset Management System)

- Monitor conditions of assets (E.g. Transformers, etc.)
- Reduce operational costs
- Control the risk of failure

EMS
(Energy Management Systems)

- Improve energy efficiency globally (E.g. frequency, voltage quality, loading percentage, power losses, etc.)

EAMS is the integration of EMS and AMS



EAMS

TP, SE, CA, PF, UC, AGC, …
Asset Health & Risk Management

Replacement, Maintenance procedure

DMS DB

Operation & Control

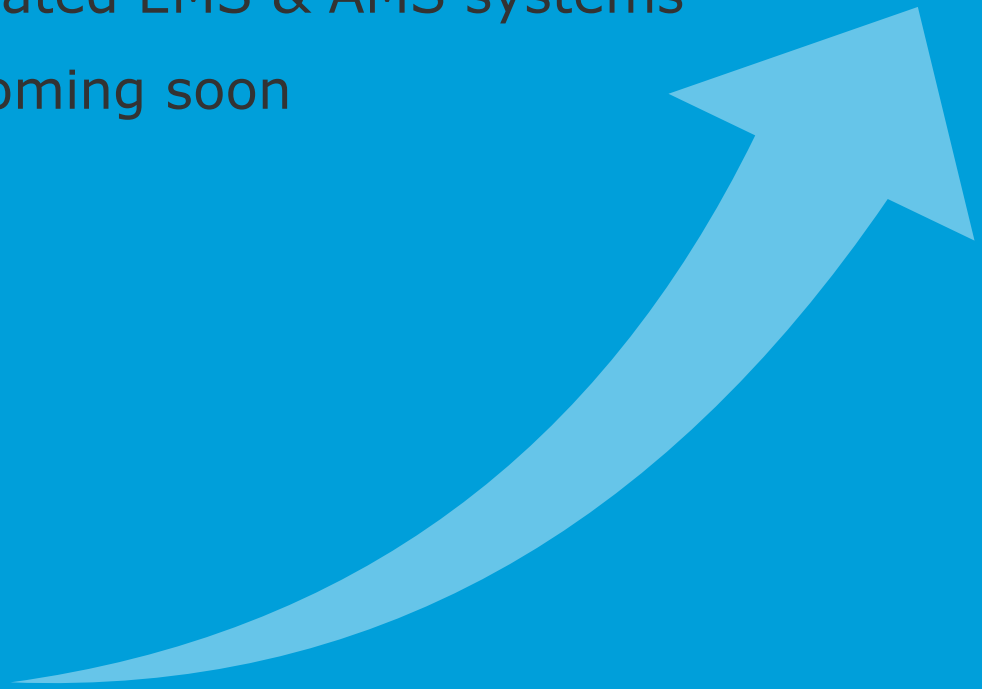
Middleware Services

Work orders

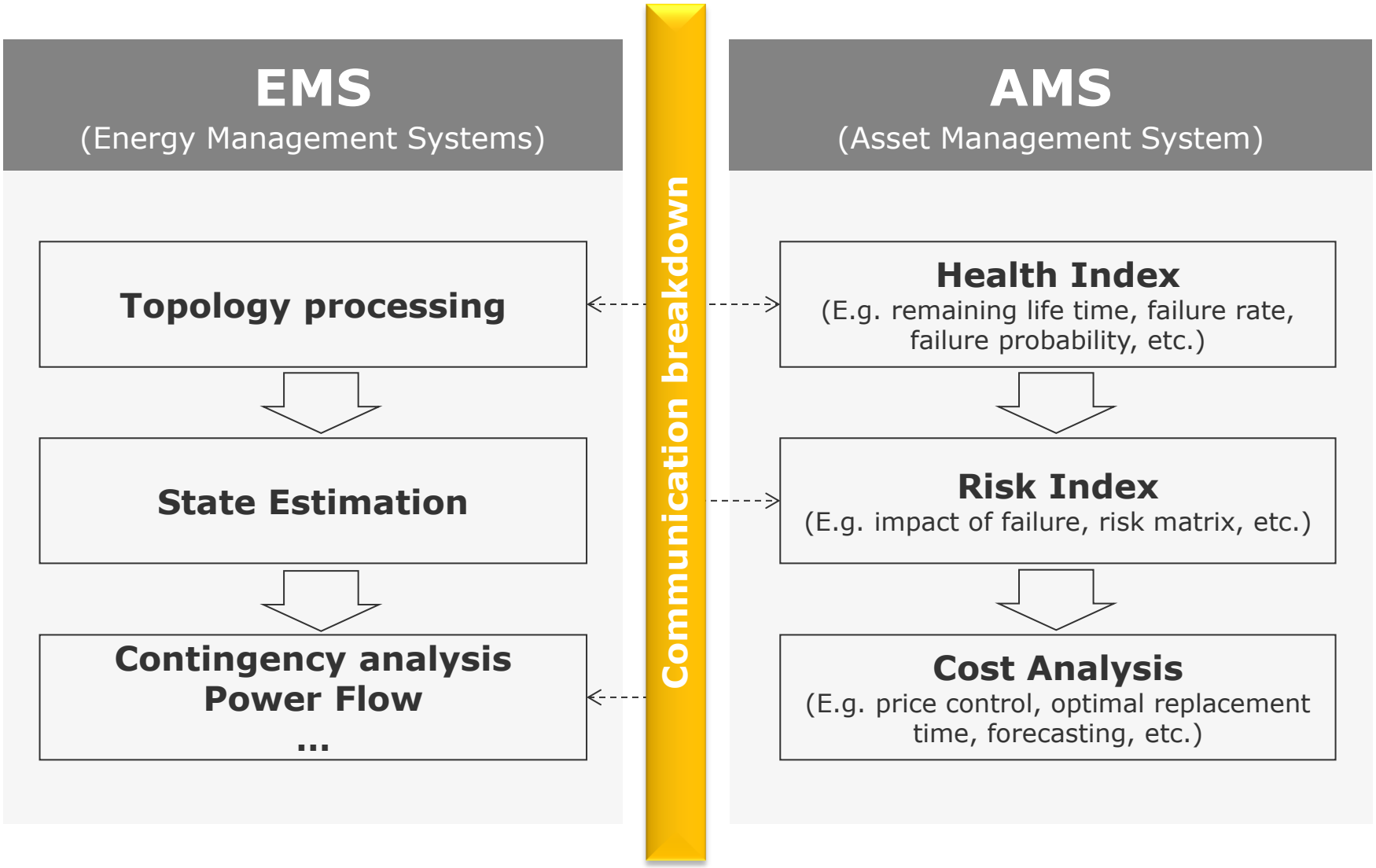
Assets

Why EAMS?

- Disadvantages of two separated EMS & AMS systems
- High penetration of DERs coming soon



Challenges caused by two separated systems



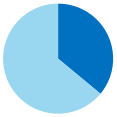
DER penetration is increasing rapidly

1900

DERs account for 100% of global capacity additions

1950

Less than 10% DERs

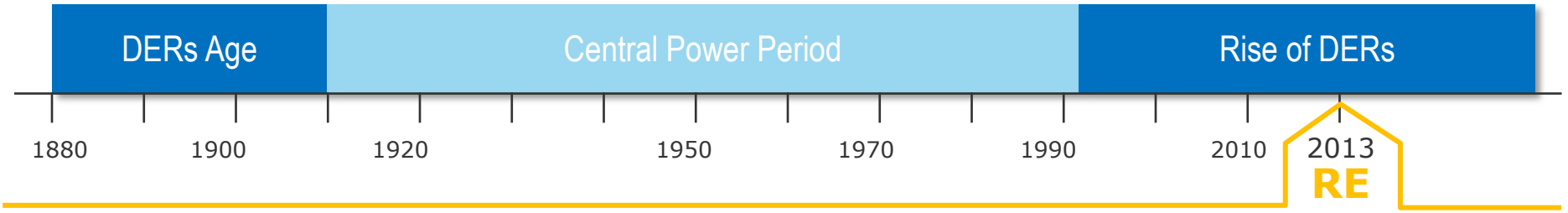


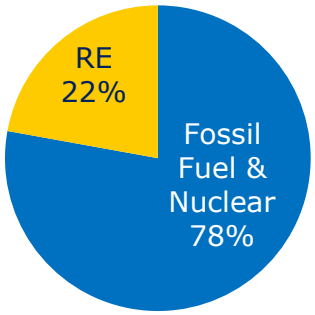
2010

36% DERs

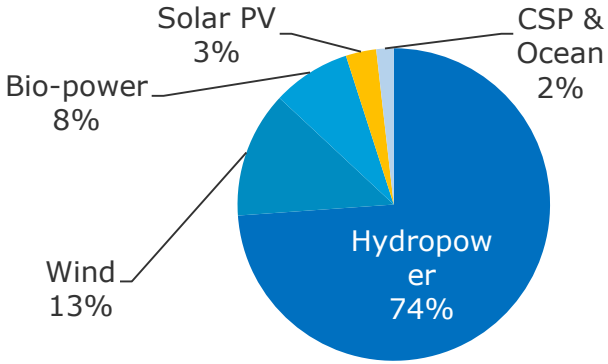
2013

56% RE





World total generation



World RE generation

- In 2013, **first time** PV added capacity is larger than wind capacity

Source: REN21, NREL, GE

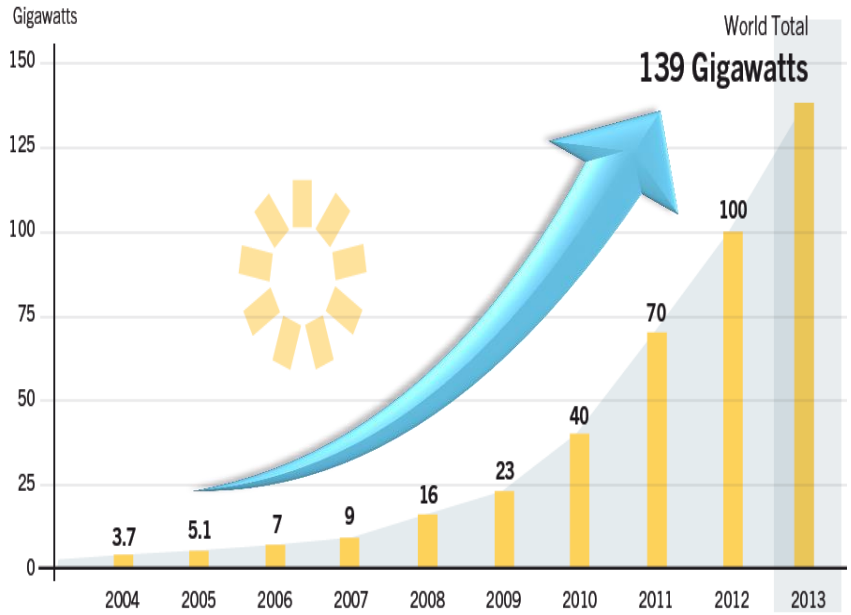
Especially PV & Wind

Globe:

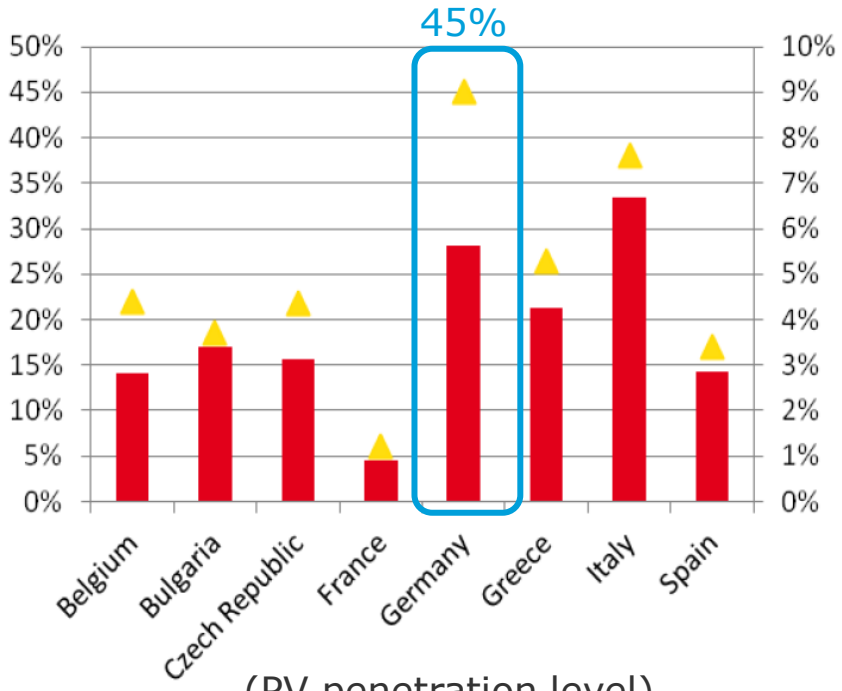
- PV has been fastest deployed in past few years, 139GW by 2013, 55% annually

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

The high DER penetration causes many challenges

Challenges:

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

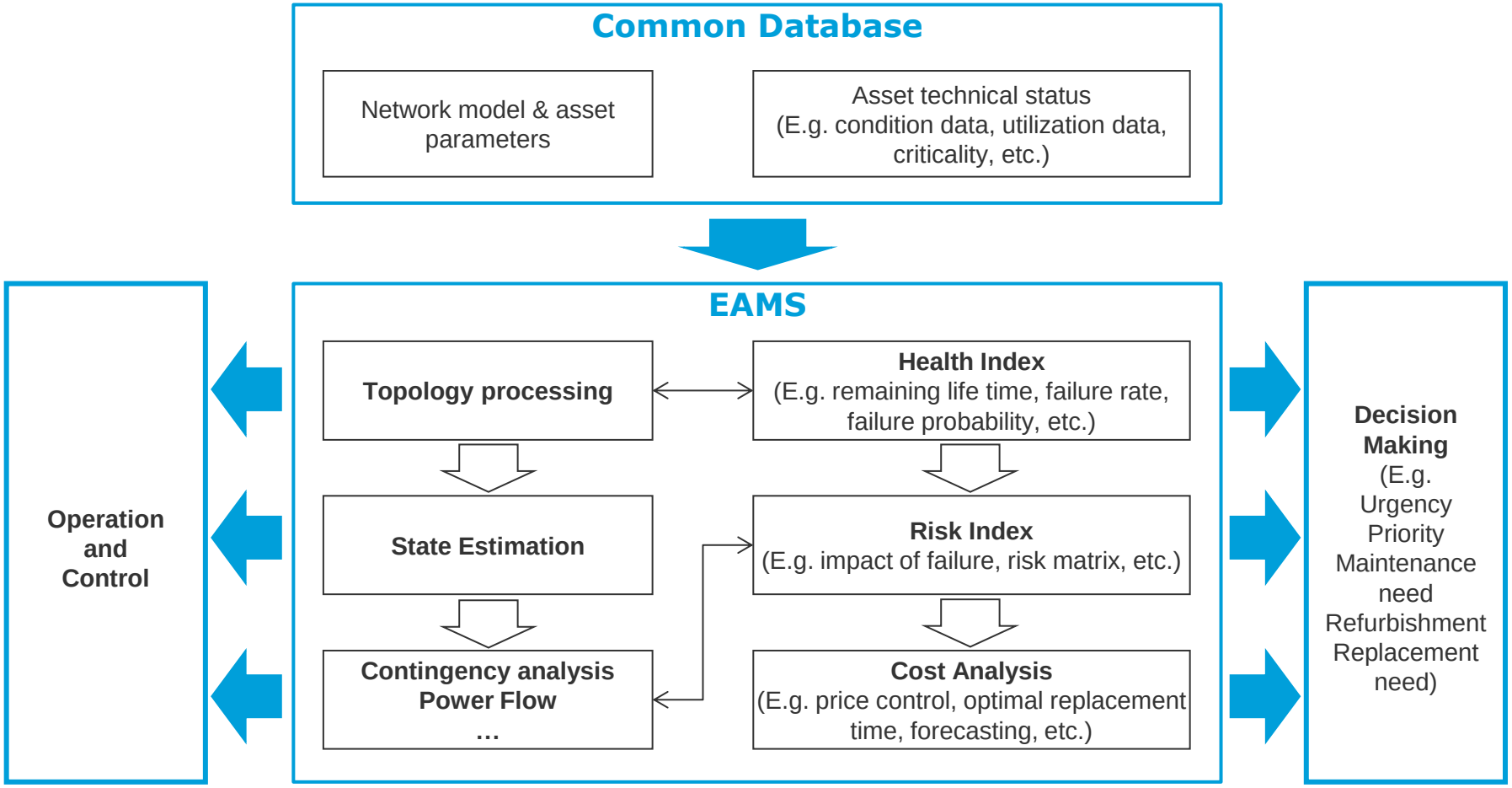
Benefits:

- Defer capacity upgrades with proper planning
- Improve power system resiliency
- Reduced energy losses
- Provide distribution voltage support and ride-through, improve voltage quality
- Reduce environmental impact

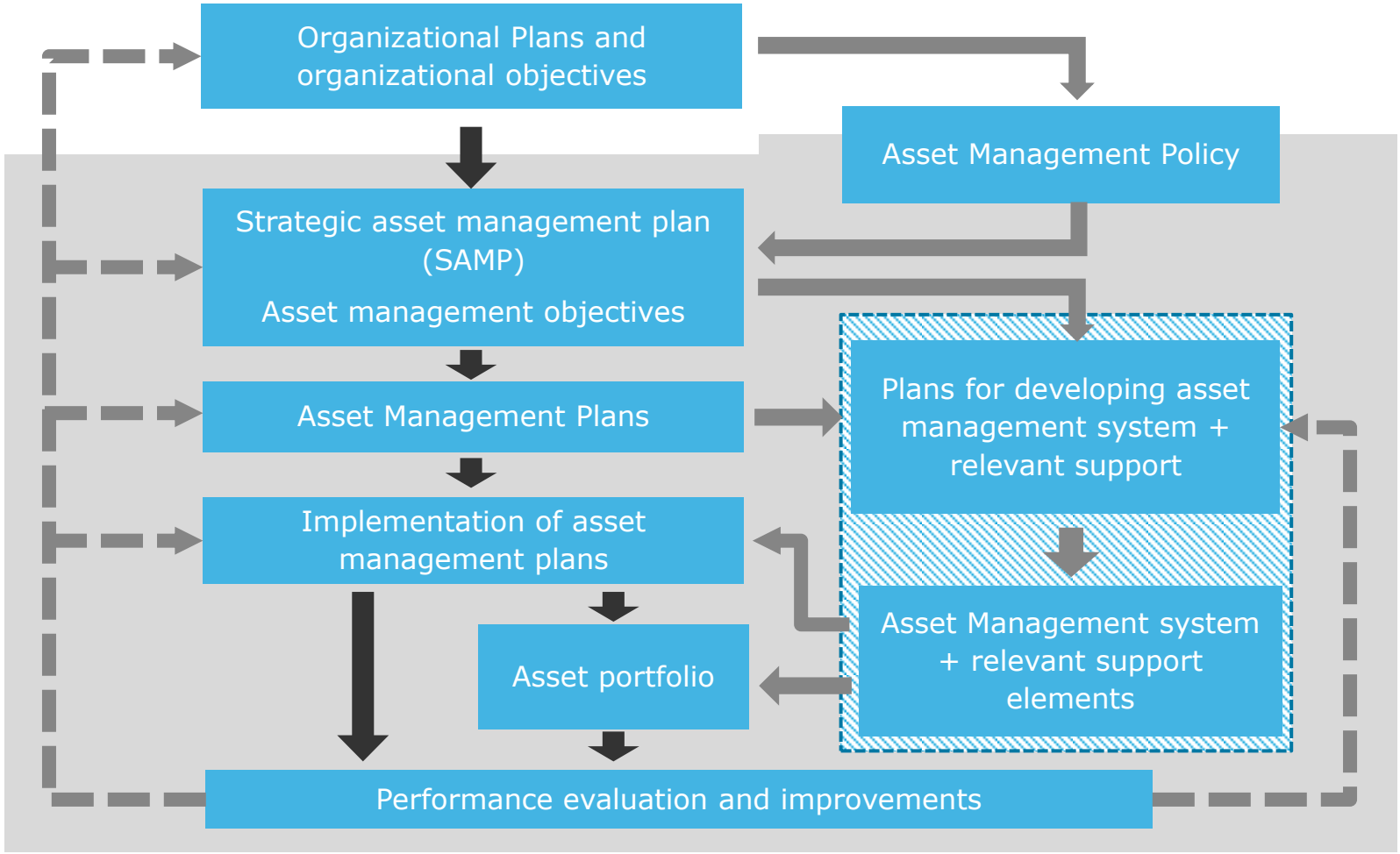
EAMS effectively deal with the complexities caused by high penetration level of DERs

How EAMS Help?

EAMS Core Functions

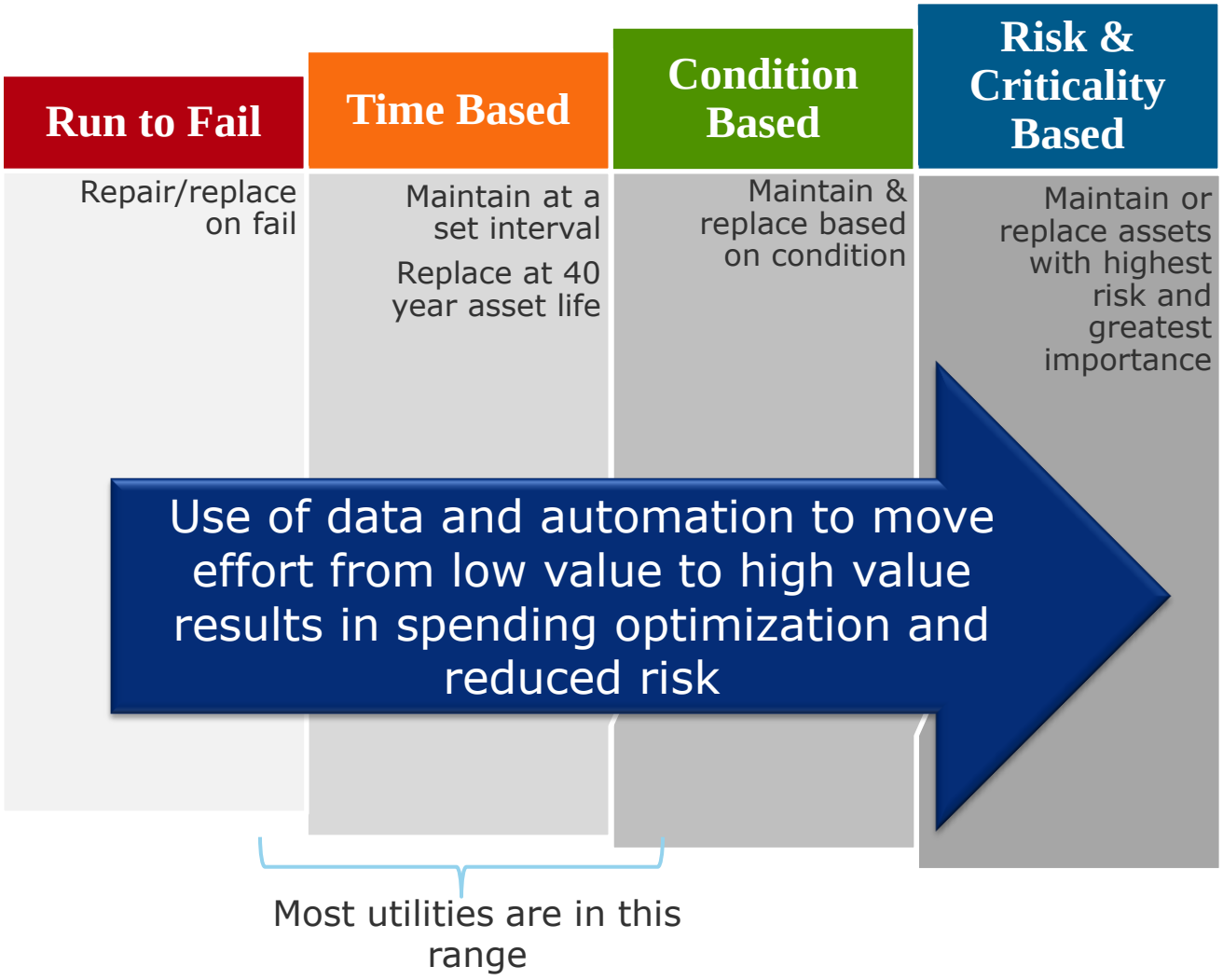


Standard for AM - ISO 55000



(ISO 55000 - Relationship between key elements of an asset management system)

Maintenance Strategy Evolution



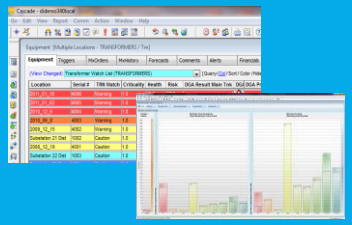
Example: Cascade – DNV GL's Asset Management Software Platform

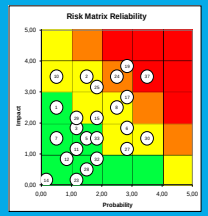
Decision Support

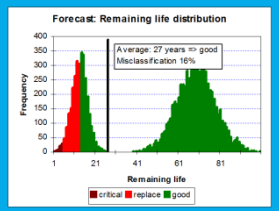
Analysis

Collect and Consolidate Data

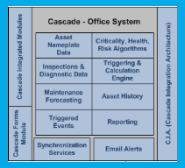
Asset Analytics

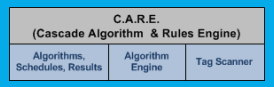




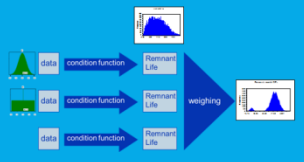


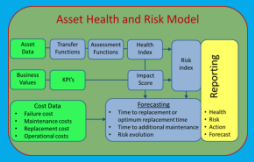
Cascade/CARE





AHRM





Failure Reporting

Visual Inspections

SCADA/EMS

Diagnostics

Cascade FieldUnit & 3rd party Modules

AHRM : Asset Health Risk Model
CARE : Cascade Algorithm & Rules Engine

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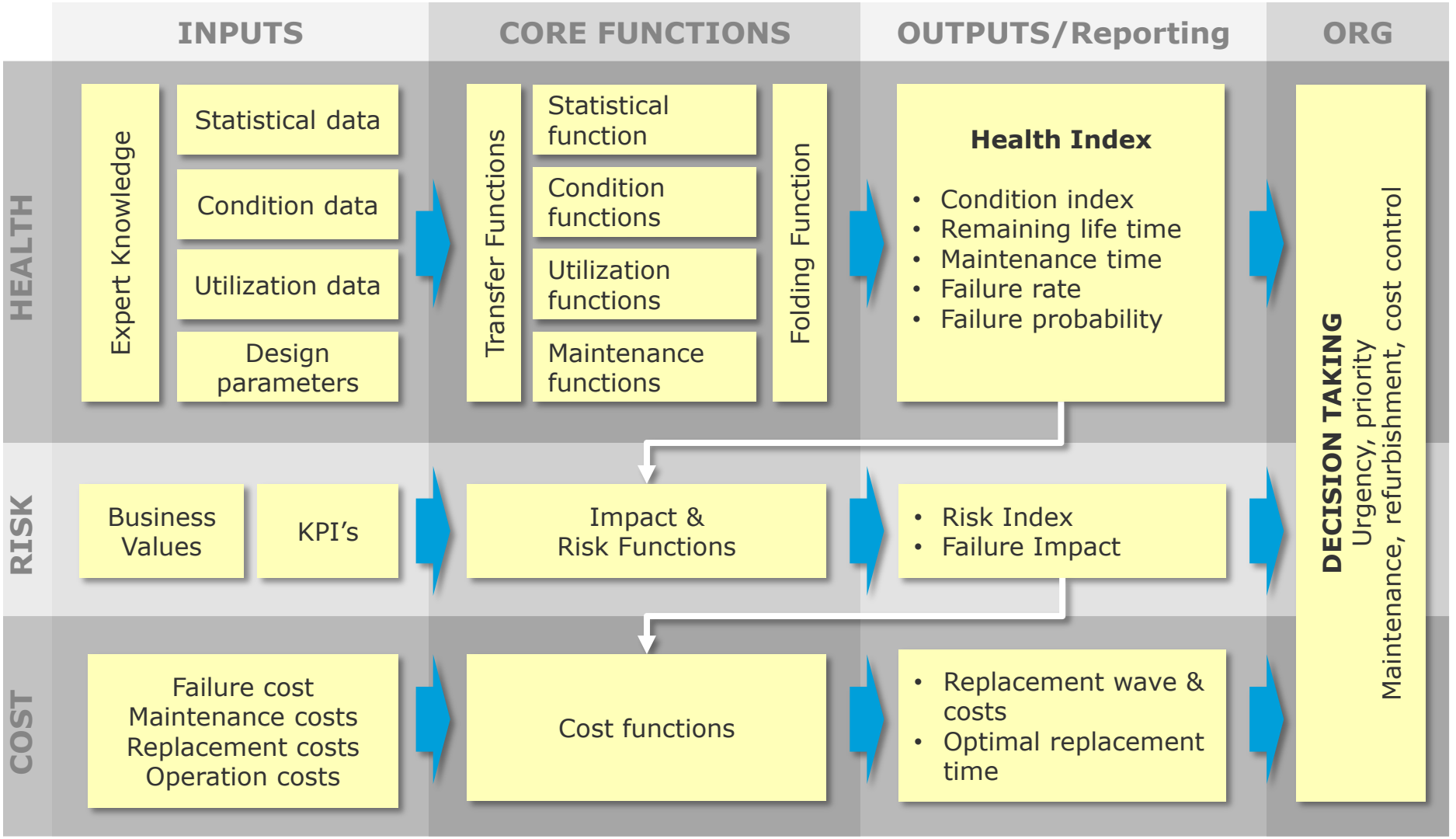
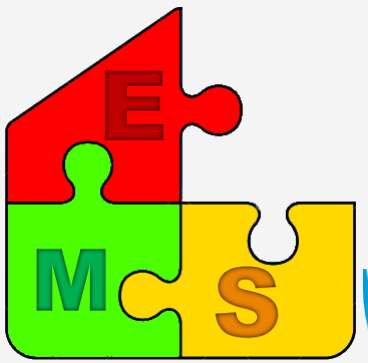
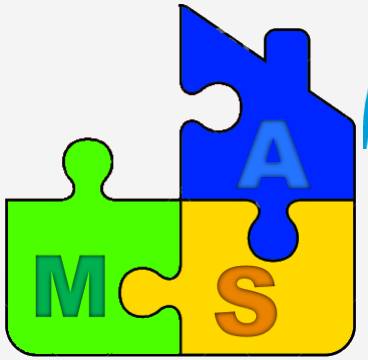
Example: AHRM – Advanced Asset Health and Risk Model



EAMS add values to utilities





EAMS

Additional Value:

- ❑ More intensively coordinated
  - Accuracy
  - Better big-data
  - Effectiveness
- ❑ Simple configuration
- ❑ Facilitate management process

- ❑ Cost saving

Technical Advantages

Advantage	EMS functions	AMS functions
More accurate	Full screen for high risk contingencies & high failure probability contingencies → do not miss out critical contingencies	Making use of more accurate component's criticality & utilization information (e.g. loading condition)
Higher performance	Fewer contingencies (e.g. filter out low failure probability)	Better incorporate the EMS functions into AMS algorithm
Better big-data management	One single database, more effectively coordinated	
More effective	Avoid redundancy of assessments and processes	
More optimal	Decisions are made based on a more comprehensive assessment considering both **global** and **local** aspects	

Benefits of EAMS

Technical

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

Financial

- Reduce manpower cost
- Reduce operation cost: cost of failure
- Optimizing maintenance & replacement cost

Organizational

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

Conclusion

EAMS is the choice for future grid

DNVGL Service & Solution

- Electricity transmission and distribution
- Energy management and operations services
- Energy efficiency services
- Software

- Power testing, inspections and certification
- Asset Management maintenance strategy review and optimization
- ISO 55000 based Asset Management system consulting

- **CASCADE**: 20+ year software for Asset Management, to 100+ power utilities
- **AHRM**: Asset Hearth & Risk assessment, cost analysis and decision support

Thank You for Your Attention!

Nguyen Khanh-Loc
khanh.loc.nguyen@dnvgl.com
+65-9299-4906

www.dnvgl.com

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