

The Asset Management System of a Distribution System Operator (DSO)

The PAS 55-Certification of „Stromnetz Hamburg GmbH“

AMMW 2015, DESY, 12-Oct-2015

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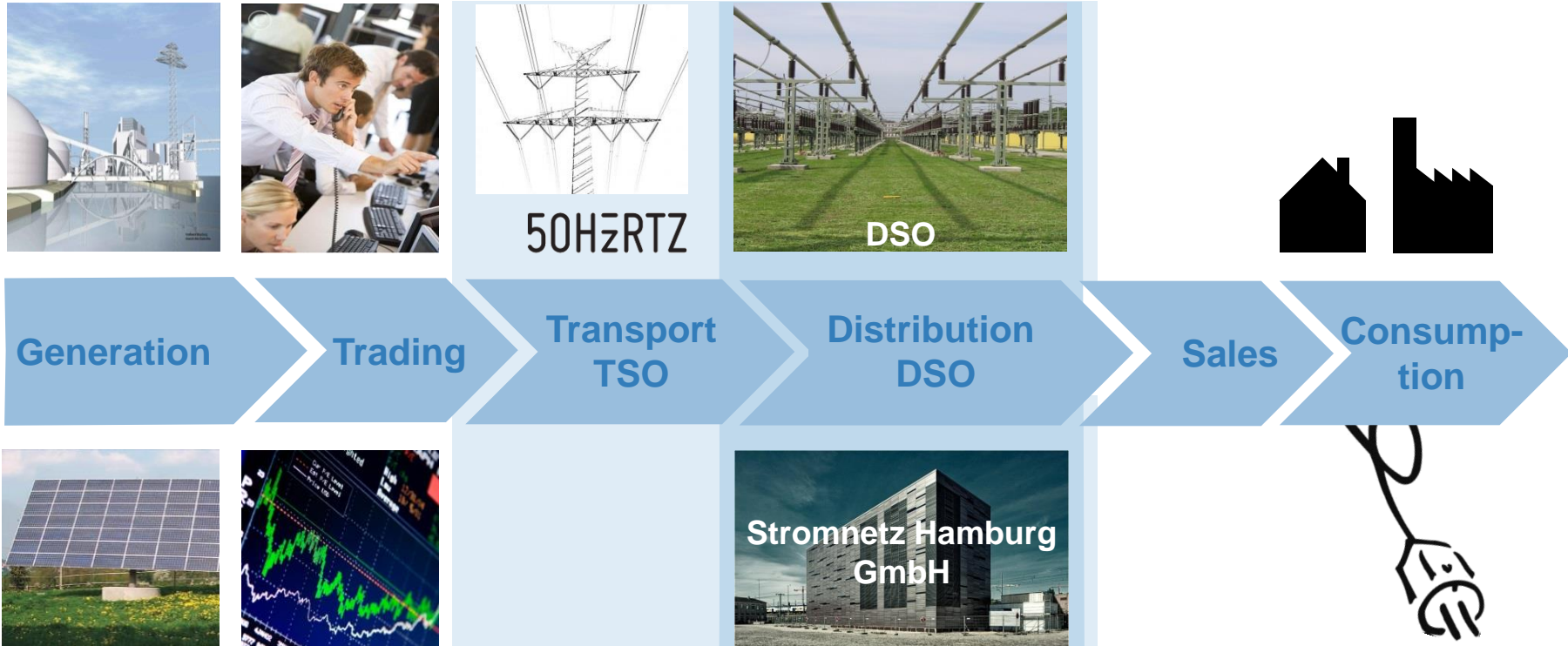
Stromnetz
Hamburg



- 1 What's the role of a DSO in the value chain of power supply?**
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- 4 The PAS 55 code: an overview**
- 5 PAS 55 certification process of „Stromnetz Hamburg GmbH“**
- 6 Outlook towards the ISO 55000 and conclusion**

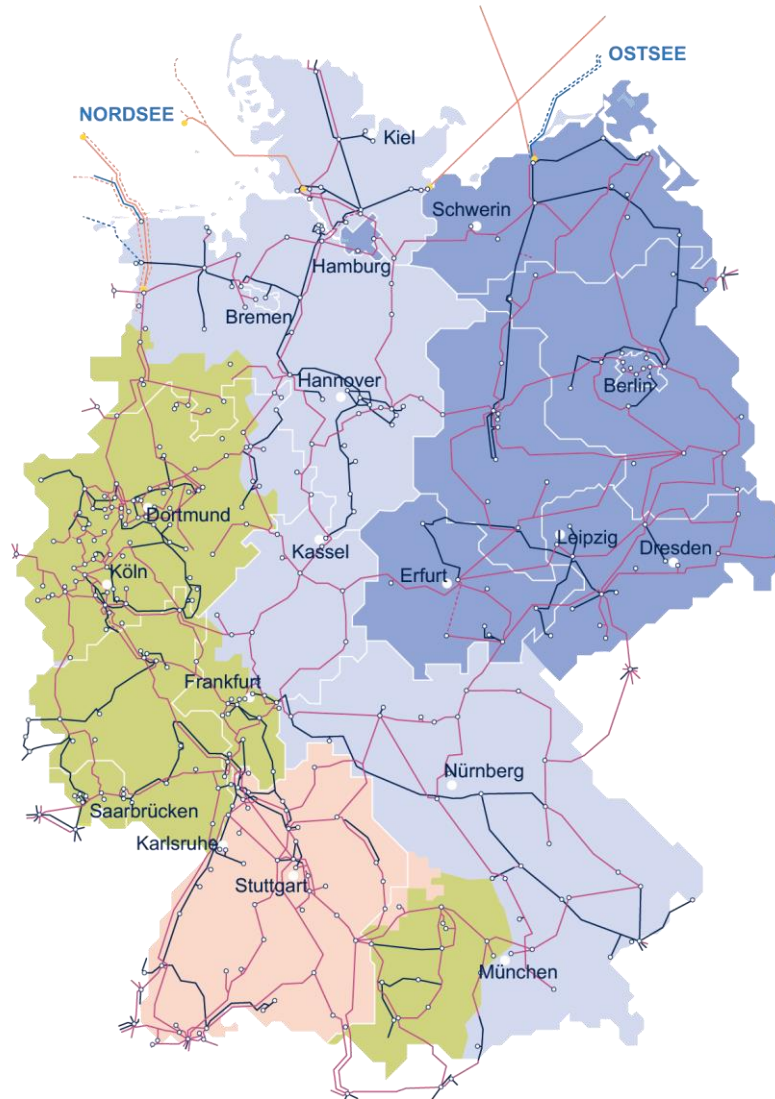
What's the Role of a DSO in the Value Chain of Power Supply?

Distribution System Operator „Stromnetz Hamburg GmbH“ in the Value Chain



- As monopolies transport systems and distribution systems are governmentally regulated to ensure free access to the power grid by everyone.

The German Power Transmission Grid „Verbundnetz“



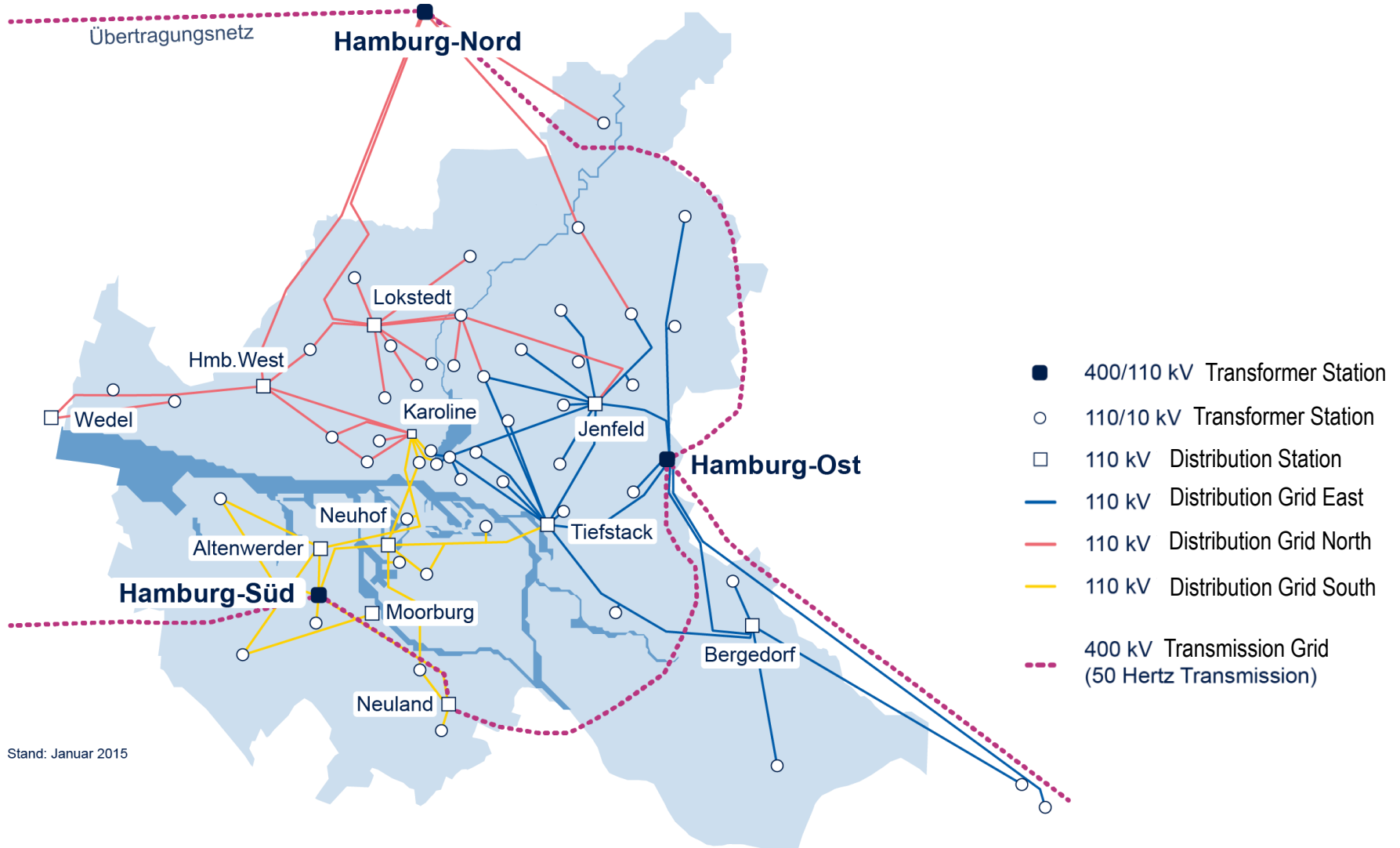
Wire connections

- / - - - 380 kV / in Bau
- 220 kV
- / - - - 150/220 kV / under construction (off shore connection)
- / - - - High Voltage DC Transmission
- Transformer stations
- Converter stations
- Cities

Transmission System Operators

- 50Hertz Transmission GmbH
- TenneT TSO GmbH
- Amprion GmbH
- TransnetBW GmbH

The Transmission and Distribution Grids in Hamburg



Stand: Januar 2015

That's How the Power Gets to the Client

1. Transmission Grid Lines

The transmission grid of the TSO 50Hertz, transports the power via super grid lines with a voltage of 380 kV to Hamburg.

2. High Voltage Transformer Stations

Three high voltage transformer stations transform the power from 380 kV into 110 kV. At this level the power is supplied into the distribution grid of „Stromnetz Hamburg GmbH“.

3. Large Scale Industry

Large industry clients get electrical power straight from the high voltage 110kV level. They transform this voltage by their own transformers according to their needs.

4. Transformer Stations

Transformer Stations convert the electrical power from the 110 kV level to 10 kV. This level supplies larger companies and enterprises as well as the distribution grid stations.

5. Industrial, Commercial and Service Companies

Such clients receive power from the 10 kV level and convert it according to their needs.

6. Distribution Grid Stations

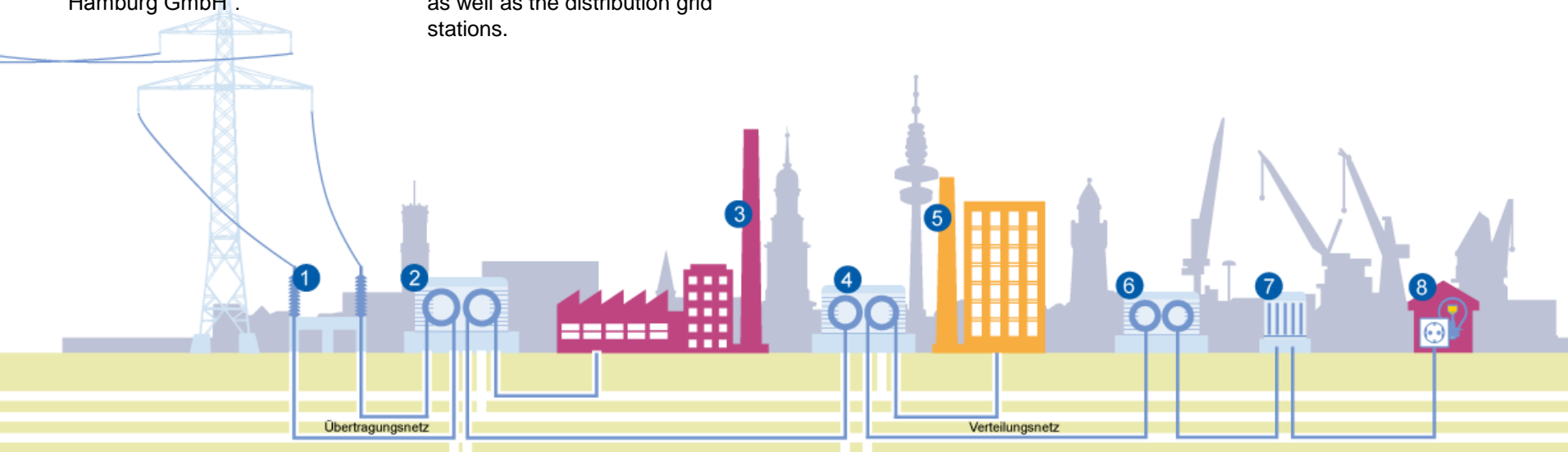
The electrical power is converted from 10 kV to the standard household voltage of 0.4 kV/230V at the distribution grid stations.

7. Distribution Box

The distribution boxes branch off the low voltage 0.4 kV grid into streets, street sections and house laterals.

8. House Connection Lines

At this point the power enters the house hold. The building connection is the interface to the lines of the clients. It further connect to the flats and offices.



Unser Netz für Ihre Energie

The „Stromnetz Hamburg GmbH“ at a Glance

Main Facts

- Employees 229
- Clients (households, enterprises and industries) 1.330.000
- Suppliers > 350
- Monthly changes of supplier Ø 10.000
- Total grid length 27.497 km
- Distributed annual work 12,6 TWh *2
- Maximum provided power HV (110kV) 1.904 MW
- Distribution grid stations 7.500
- Power generation EEG/KWK*3 3,0 TWh*2
- Installed decentralized generation 1.146 MW
- maximum decentralized generation 497 MW*4
- Asset base replacement value in the range of 3 B€



*1 all figures as of February 2015

*2 1 TWh = 1.000.000 kWh; 1MW = 1000 kW

*3 Renewable energies' law(Erneuerbare Energien Gesetz)/power heat coupling (Kraft-Wärme-Kopplung)

*4 at the time of maximum decentralized generation

- As a „**generic monopole**“ “Stromnetz Hamburg” is subject to the **regulation of grid usage charges** by the “Bundesnetzagentur” according to § 3 Sec. 3 EnWG
- The business of Stromnetz Hamburg is governed by the **regulatory framework** especially the so called “**Anreizregulierung**” (incentive regulation).



24/7 services 365 days a year

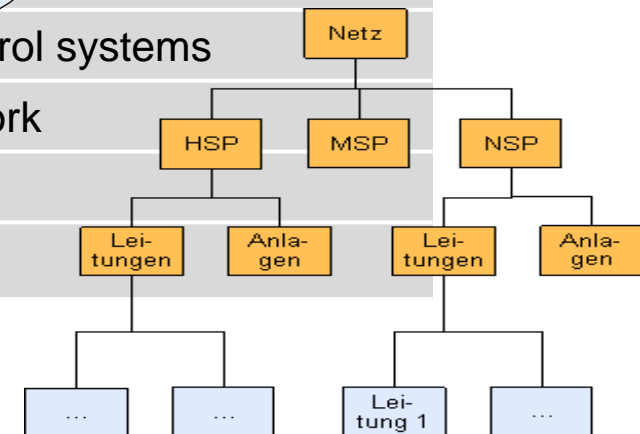
- Grid access management
- Provision of electrical power
- Management of grid usage
- Operation of distribution system
- Metering and measurement
- Incident management
- Inspection und Maintenance

Assets are Grouped into 21 Equipment Categories

Equipment categories

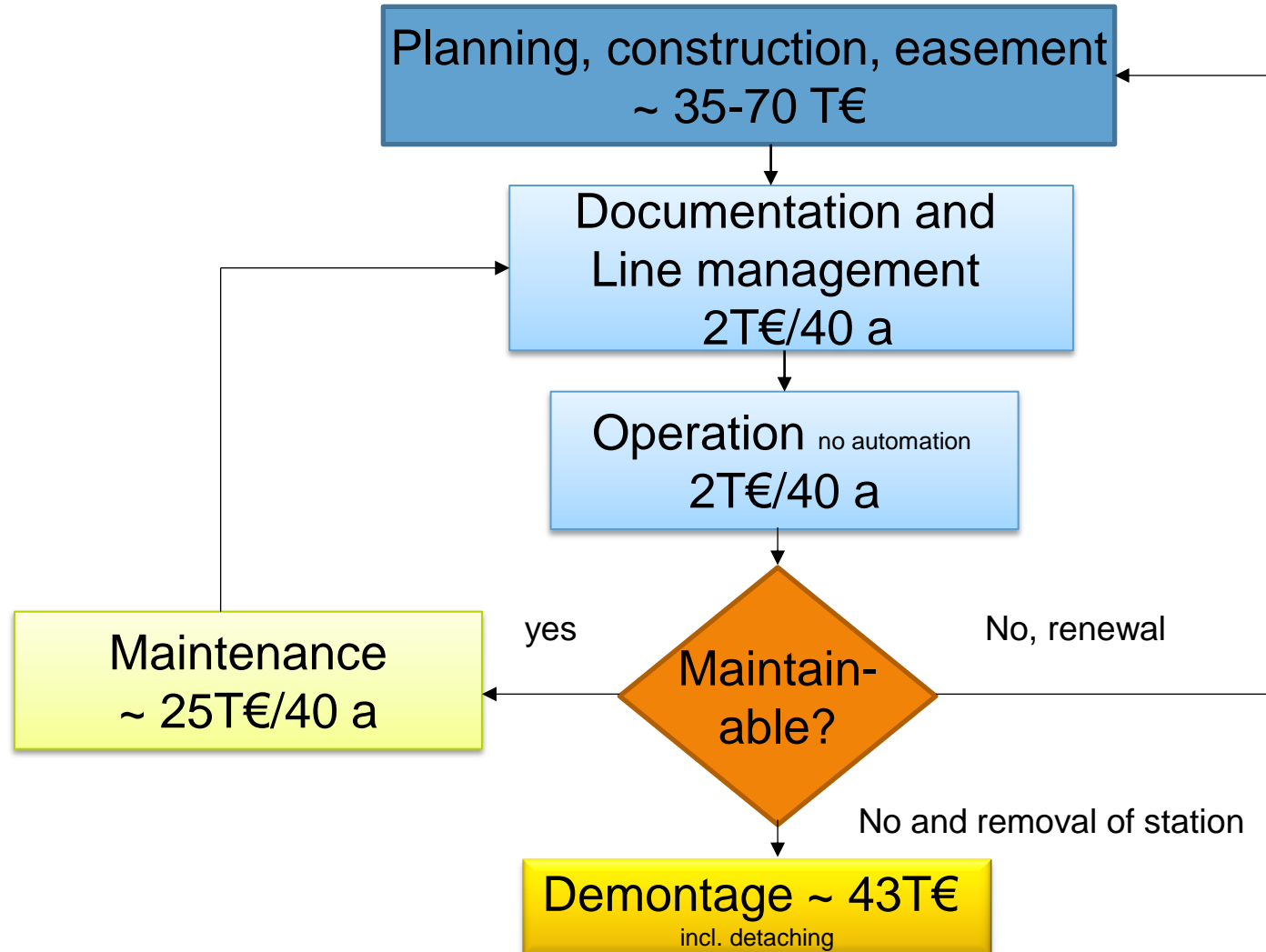
1. High-voltage cable	13. Protective relaying HV substation, line
2. Medium-voltage lines	14. Protective relaying HV/MV transformer
3. Low-voltage lines	15. Protective relaying MV substations
4. High-voltage overhead lines	16. MV/LV stations
5. High-voltage switchgear	
6. Medium-voltage switchgear	
7. N.N.	
8. MV/LV substations	
9. Land and buildings	17. Protection and control systems
10. HV/MV and MV/MV transformers	22. Secondary network
11. N.N.	23. Meters
12. MV/LV transformers	

How to manage and maintain these safely and reliably?



From Life Cycle Management to Asset Management (AM)

Life Cycle Management for Example of Grid Stations



Maintenance guideline for distribution grids

Stromnetz Hamburg GmbH

Author
...

Status: xx.xx.2013

- Description of maintenance task for inspection and servicing of equipment types incl. determination of cycles
- Determination of criteria for condition assessment of equipment types
- Determination of measures from maintenance and servicing for future-oriented maintenance
- Basis for planning, contracting of service providers and monitoring of maintenance

- The physical assets of the DSO are grouped into 21 equipment categories (EC)
- The asset management department underpins each EC with an equipment strategy
- An annual strategy for maintenance and replacement planning is developed for each EC based on inventory data, conditions assessments incl. fault statistics and age distribution.

Equipment strategy Medium-voltage cable Guideline – GL

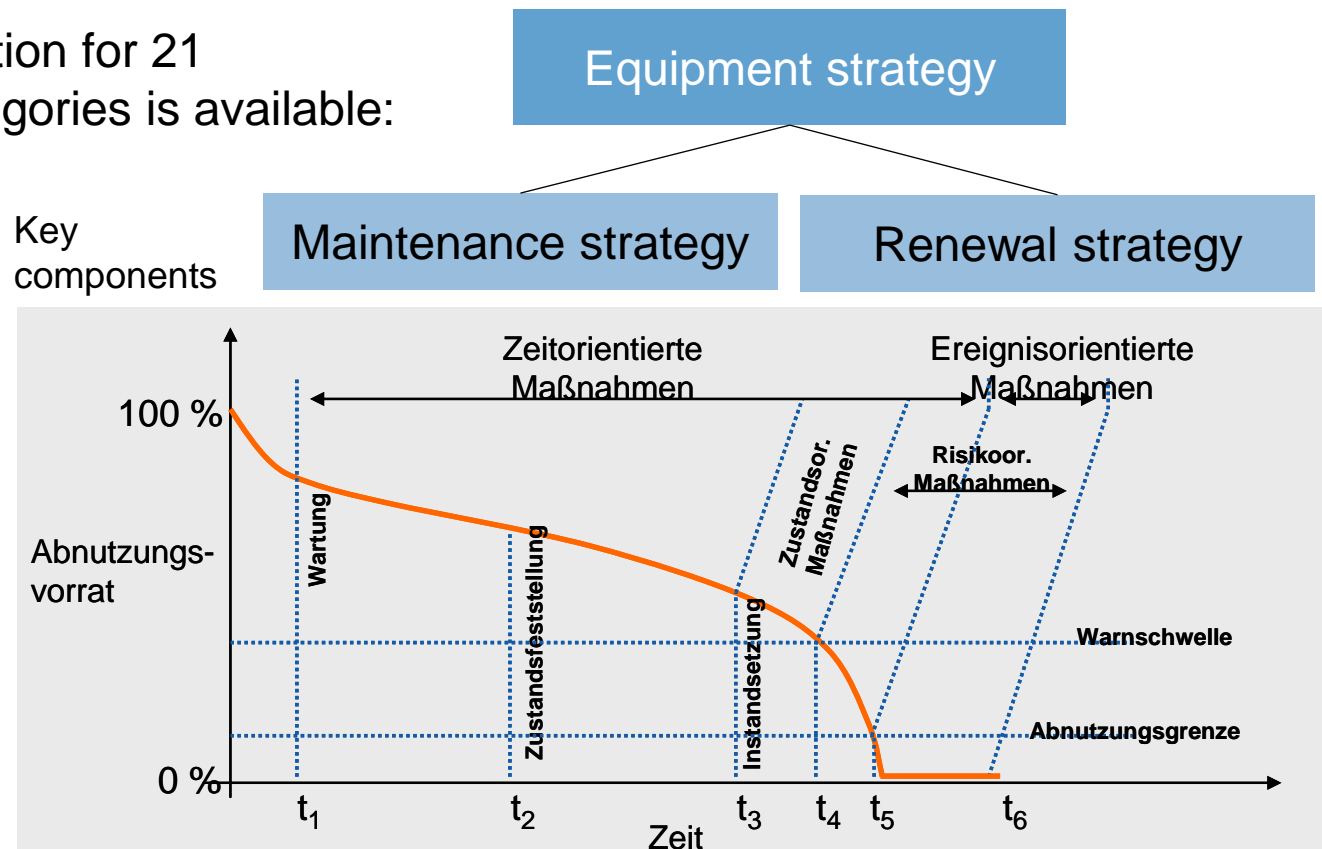
Stromnetz Hamburg GmbH

Author
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Status: xx.xx.2013

Equipment Strategies for Life Cycle Management

- The systematic handling of equipment along its lifecycle is documented and updated periodically
- The documentation for 21 Equipment Categories is available:



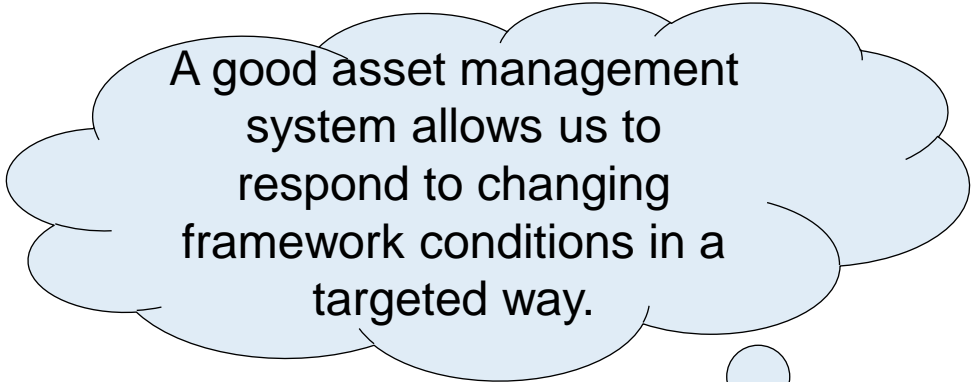
- The Equipment Category strategy is adapted to the corresponding wear margin

A Good Asset Management System is Adaptable

Requirements on asset management

- Objectives are multi-faceted and partially competing
- Objectives are increasingly complex with different temporal effects

→ New standards for process efficiency, transparency and objectification of decisions.



A good asset management system allows us to respond to changing framework conditions in a targeted way.



Meeting requirements through

Implementation of an Asset Management System



- **Structured** documentation
- Structured and transparent processes
- **Consistency** of strategy, policy and plans
- Improved **transparency** and control of work processes
- Better understanding of **risks**
- More trust by the **stakeholders**

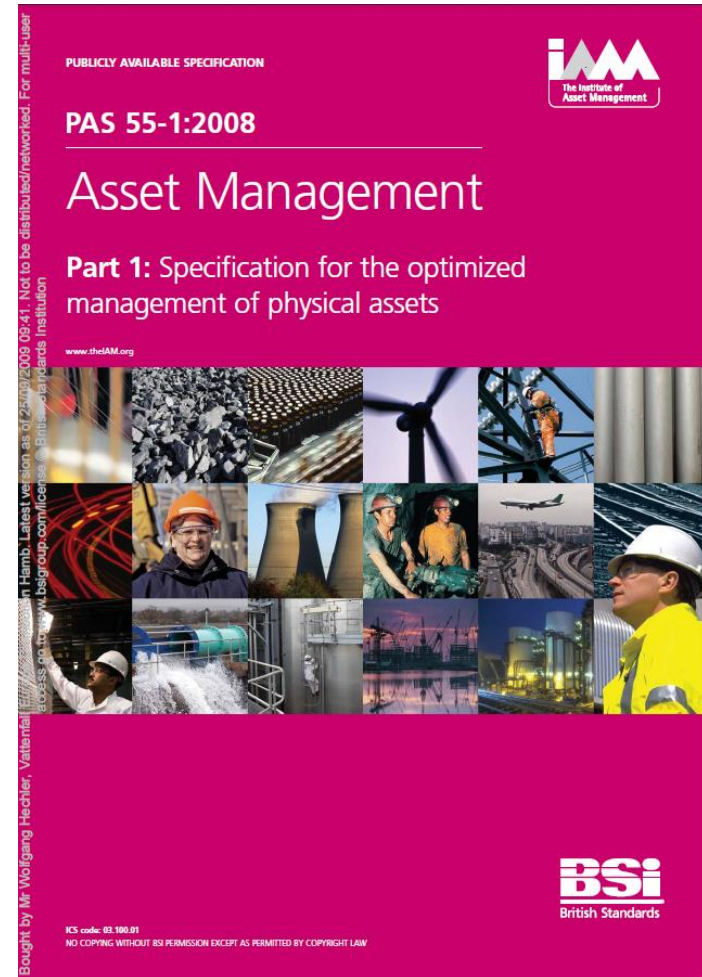


The PAS 55 Code: an Overview

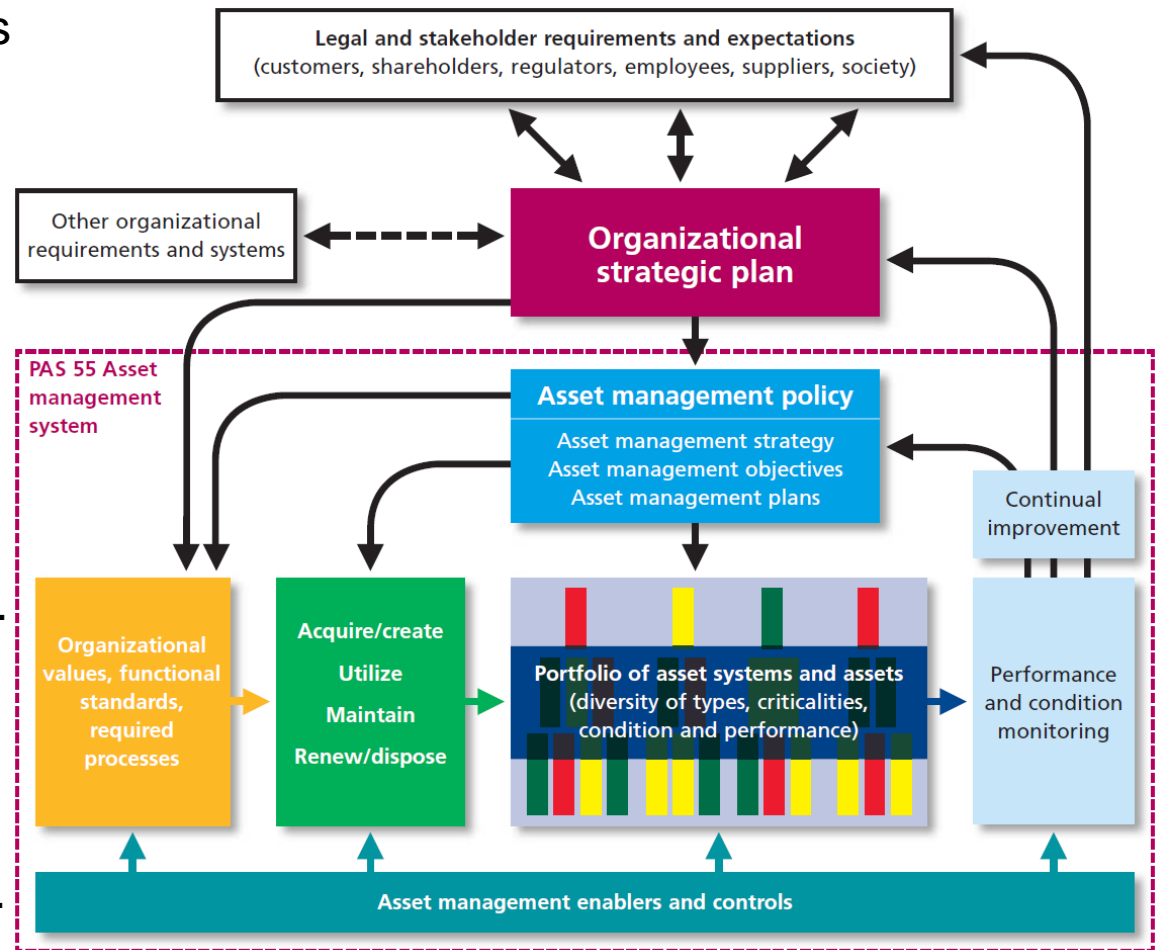
PAS 55

(Publicly Available Specification #55)

- This is a British standard (first industry standard) for good asset management that is known internationally
- It calls on the organisation to define clear objectives, processes and responsibilities
- Facilitates the consistent implementation of defined asset management objectives through its taxonomy.
- Defines 28 requirements along the entire lifecycle of assets.



The PAS 55 AM system links the requirements of asset(s) /systems to the organizational strategic plan defined by the stakeholders. The link is made via an AM policy, AM strategy, AM objectives, and AM plans. This link is the important **line of sight** that all involved parties should recognize and work towards. Further essential elements are the **monitoring** and **continual improvement** processes as well as the **risk based** decision making.



Source: PAS 55 1-2008, Fig. 4

Organizational strategic plan defines

- strategic business goals and policies

AM policy breaks these down into

- requirements and principles for the management and control of the assets

AM strategy lays down

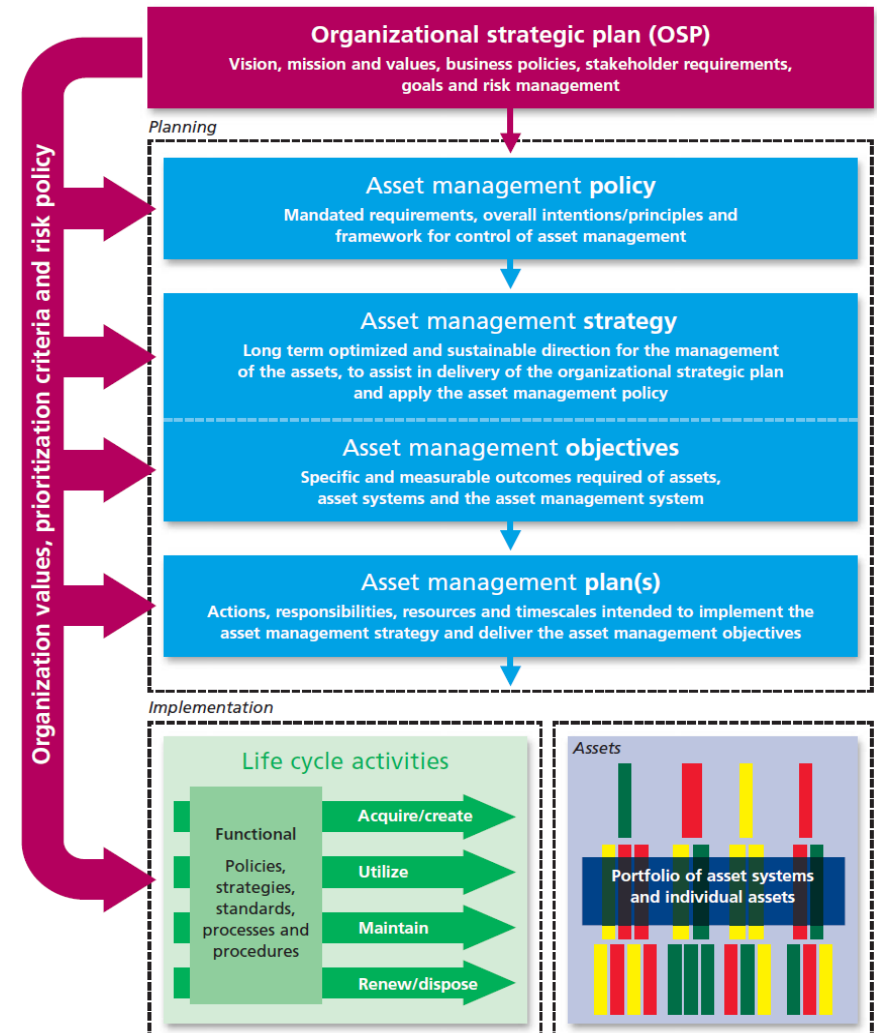
- Long term direction of managing assets to fulfill the organizational strategic plan according to the AM policy

AM objectives give

- specific measurable results of the asset portfolio (assets/asset systems within AM system)

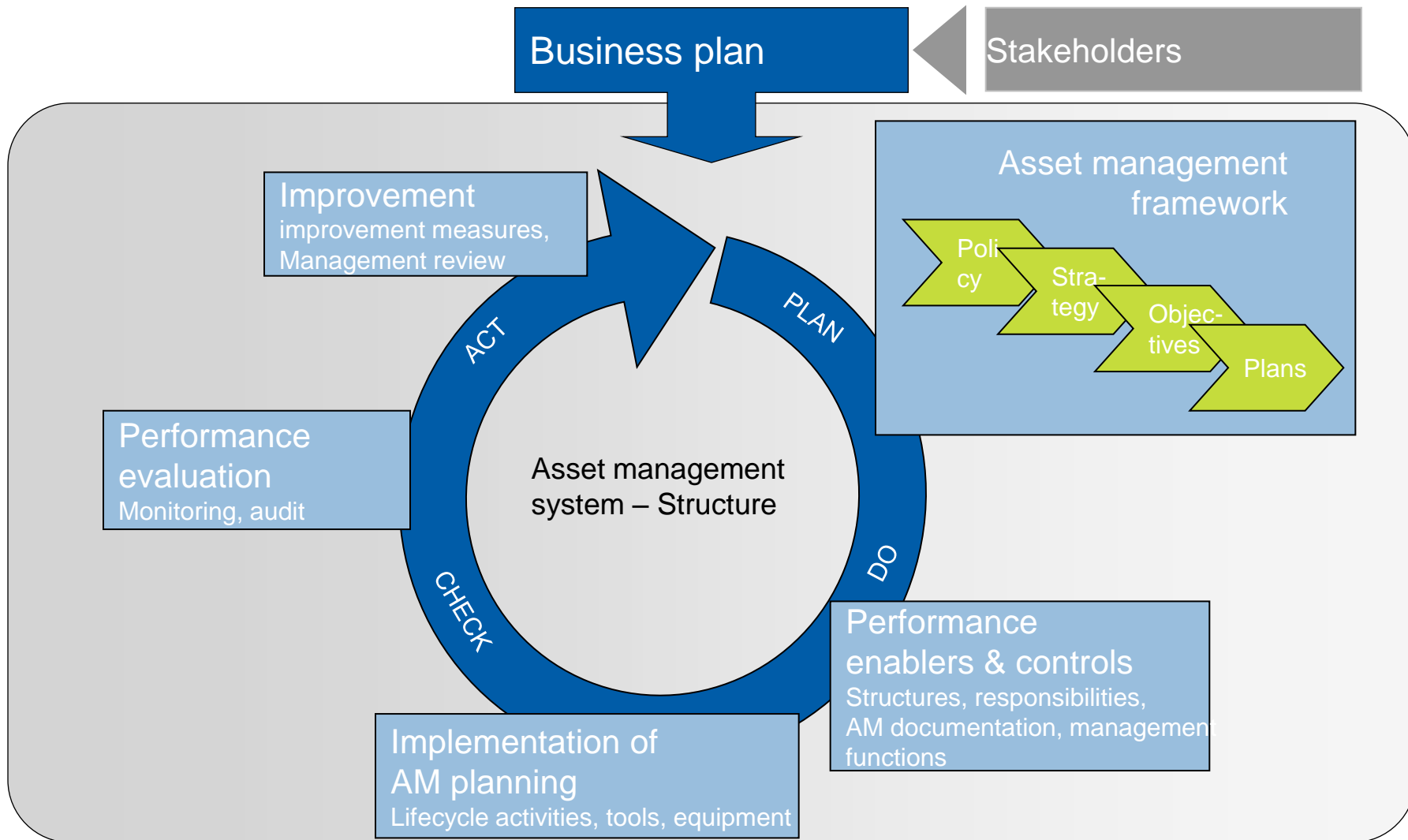
AM plans detail per asset/asset system

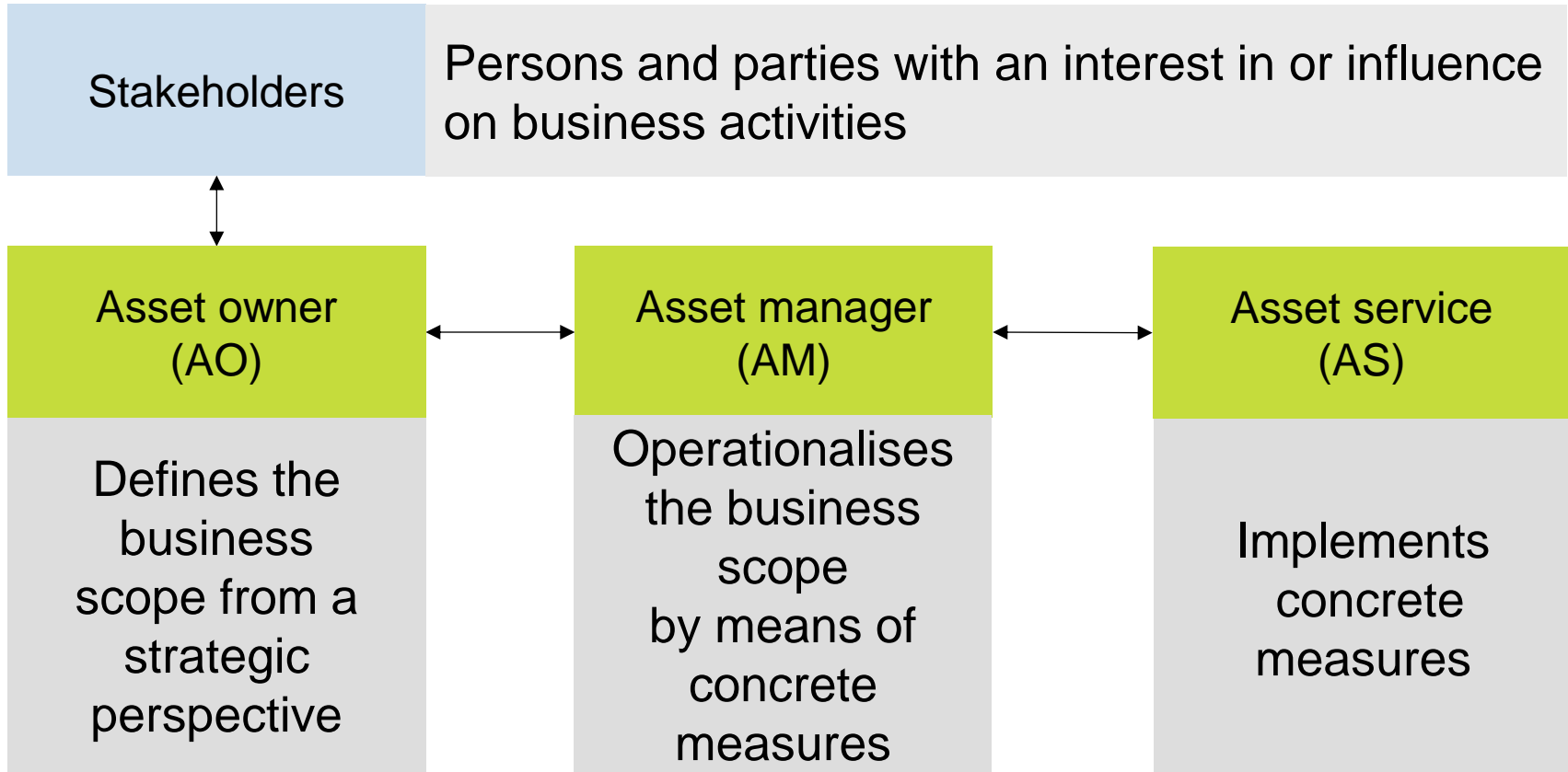
- measures, responsibilities, resources, and timescales to implement the AM strategy and deliver AM objectives



PAS 55 Certification Process of „Stromnetz Hamburg GmbH“

Structure of the Asset Management System





Typical Stakeholder Requirements of a DSO

I like to order a lateral line for my house.



“Stromnetz Hamburg” should obey obligations of the concession contract.



The average interruption rate shall be reduced further.



I like to install a windmill as a client.



As clients we look for low grid usage fees.



Electro mobility shall be supported by charging infrastructure.



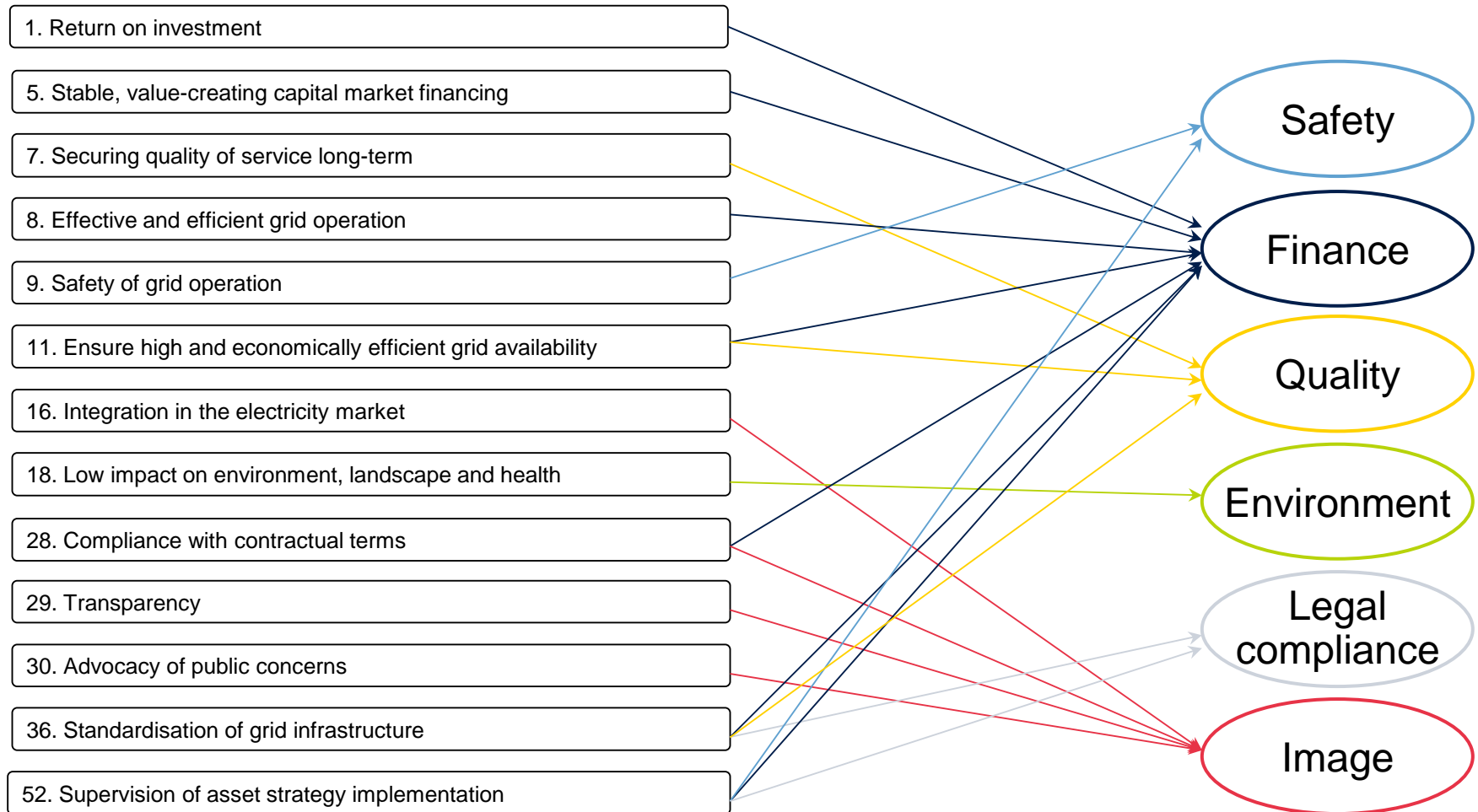
We as industries demand high reliability of the distribution system.



The distribution system shall generate reasonable profit.

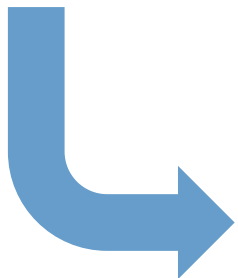


Business Values Derived from Prioritized Stakeholder Requirements



Overview of business values

Safety	Reduction of accidents
Finance	Ensure long-term financial success
Quality	Provision reliable power supply
Environment	Implementation of environmental protection measures
Compliance	Comply with all relevant laws, guidelines, norms and contracts
Image	Supports achieving a respectable image



Asset Management policy Stromnetz Hamburg GmbH

Commitment:

As asset managers, we are responsible for the economically efficient maintenance and development of the grid infrastructure in the city of Hamburg, thereby ensuring safe and high-performance electricity supply.

Mission:

We manage and develop the assets on the basis of the following criteria:

- Safety
- Finance
- Quality
- Environment
- Legal compliance
- Image

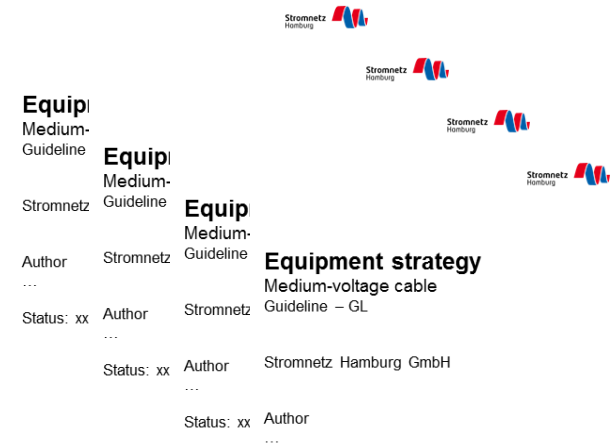
Mandate:

We manage the strategy, develop concepts and plan the maintenance, renewal as well as the further development of our assets. We make decisions in consideration of efficient risk management. We commission capable service providers to implement these measures.

Equipment Categories

1. High-voltage cable	17. Station service units
2. Medium-voltage lines	18. Cable distribution cabinets
3. Low-voltage lines	19. Service connections
4. High-voltage overhead lines	20. public lighting
5. High-voltage switchgear	21. SCADA and control systems
6. Medium-voltage switchgear	22. Secondary network
7. N.N.	23. Meters
8. MV/LV substations	
9. Land and buildings	
10. HV/MV and MV/MV transformers	
11. N.N.	
12. MV/LV transformers	
13. Protective relaying HV substation, line	
14. Protective relaying HV/MV transformer	
15. Protective relaying MV substations	
16. Protective relaying MV/LV stations	

- ➔ The AM strategy is rendered by the equipment strategies of the 21 equipment categories (EC) of the physical assets
- ➔ The asset management department defines and annually updates the equipment strategies based on the risks of each EC to the business objectives*. => AM Objectives
- ➔ Along with this annual strategies for maintenance and inspection planning are developed for each EC based on inventory data, condition assessments incl. fault statistics and age distribution. => AM Plans/Maintenance GL

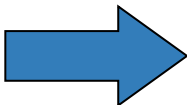


Scheduling of Maintenance – AM Plans

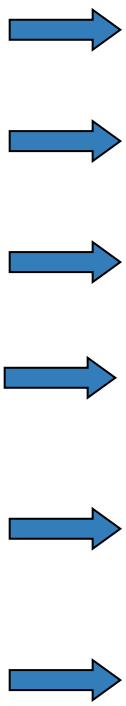
Equipment

Data capture sheet

Zustandserfassung		HS/MS	
BM-Bereich: Trafo und Spulen	Datum der Erfassung: 19.03.2007		
BM-Gruppe: Transformatoren	Aktivität: TRF 2110 11 Insp.		
BM-Art: 110/10 kV Transformator			
BM-Typ: Entwurf!			
Umspannwerk: Amalienhof	BM: Transformator A	Leistung	
Recording with catalogues			
	Err.	VW	ZO
Inspektion Funktionsprüfung TRF 2110 11	2007 Keine Mängel	Instandsetzung in max. 2 Jahren notw.	2 5
Standard-Öl-Analyse TRF 2110 12	2007 Ablauf der Gewährleistung	Keine Maßnahmen notwendig	5 2
Gas-in-Öl-Analyse TRF 2110 13	2007 weitere Diagnosen erforderlich	Keine Maßnahmen notwendig	6 2
Elektrische Messung TRF 2110 14	2007 weitere Diagnosen erforderlich	Keine Maßnahmen notwendig	6 2
Laufsichereremung TRF 2110 W02	2008 Keine Mängel	sofortige Instandsetzung notwendig	2 6
Luftentfeuchter TRF 2110 W03	2008 Keine Mängel	Keine Maßnahmen notwendig	2 2
		Wert für die Wartung 1	2
		max. Wert aus ZO	e
Catalogue automatically assigns classes			
nächste Wartung/ Inspektion	2007 1	2009	
	2007 Standard-Öl-Analyse	2009 5	
	2007 Gas-in-Öl-Analyse	2007 6	
	2007 Elektrische Messung	2007 6	
	2008 Wartung: Laetschalter	2011 2	
	2007 Wartung 1 (Reinigung)	2011 2	
nächste zustandsorientierte Instandsetzung	2007 Ölaubereitung		
	2007 Abdichtung		
	2007 Überwachungsgeräte/ Sekundärverdrahtung/ Motorantrieb/ Lüfterschrank		x
	2007 Reparatur Pumpen bzw. Lüfter		
	2007 Luftentfeuchter		
	2007 Sonstiges		



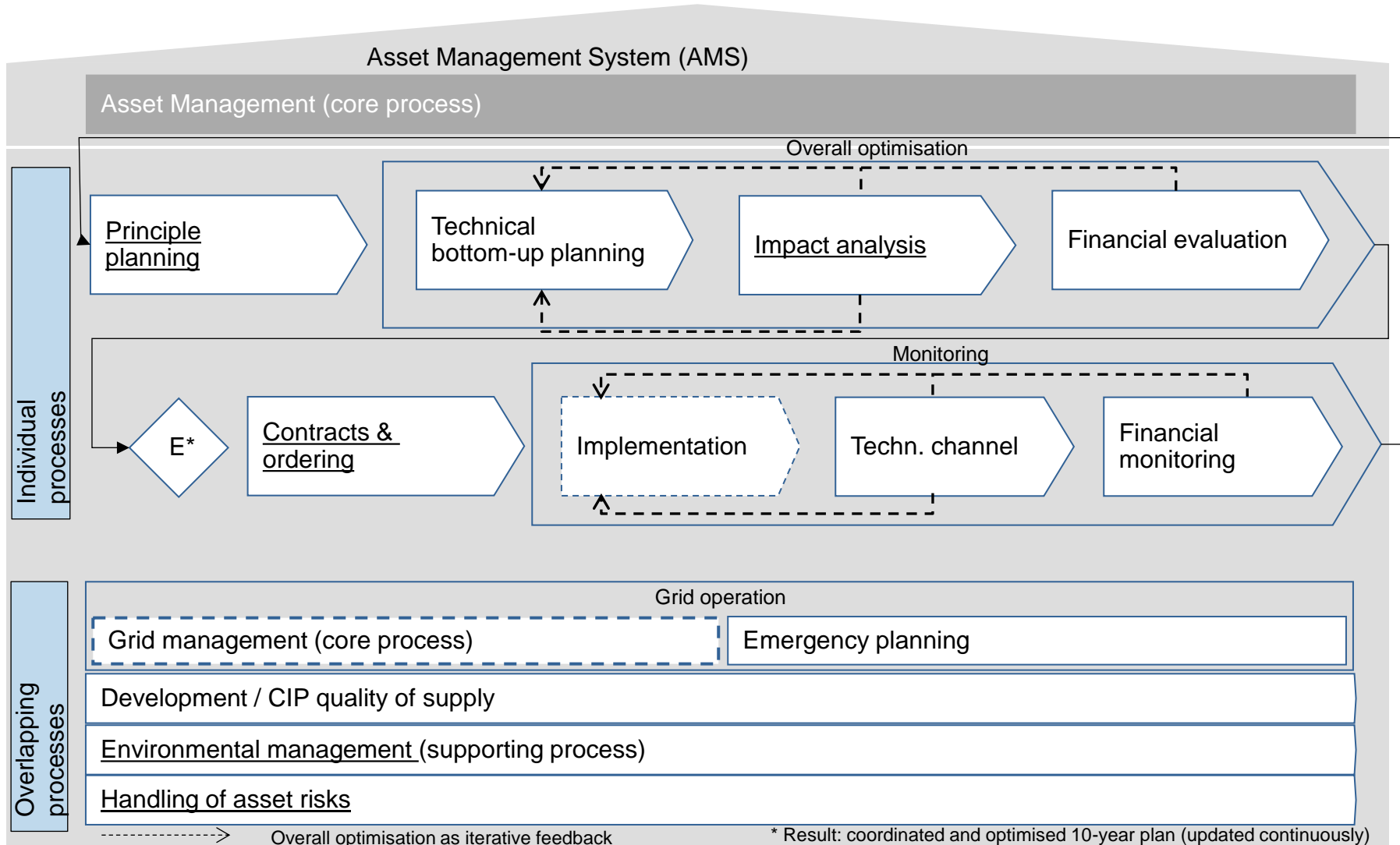
assignment to



- Class 1: no need for action (> 15 years, open)
- Class 2: no need for action (> 10 years, open)
- Class 3: long-term (5 to 10 years)
- Class 4: medium-term (2 to 5 years)
- Class 5: in the following fiscal year to be budgeted (2 years)
- Class 6: in the currently on-going fiscal year

Report to DSO

Process House for the Asset Management (AM) at "Stromnetz Hamburg GmbH"



		Finance	Quality	Environment	Image	Safety	Legal compliance										
		Unternehmenswerte						unmöglich	scheinbar	möglich	wahrscheinlich	regelmäßig	jährlich	monatlich	täglich	dauerhaft	
		Finanzen	Qualität		Umwelt	Image	Sicherheit	Gesetzeskonformität	nur von gehört	schon einmal passiert in Branche	schon mehrmals passiert in Branche	schon einmal passiert in DSO	schon mehrmals passiert in DSO	ein bis einige Male in DSO	einige Male in DSO	einige Male in DSO	einige Male in DSO
		Schadensbehebung, Wiedervereinigung, NNE	Berlin	Hamburg	Umwelt- und Klimaschutz	Sicherheitsbereiche	Rechtsangelegenheiten	<0,0001/a	>0,0001/a	>0,001/a	>0,01/a	>0,1/a	>1/a	>10/a	>100/a	>1000/a	
very small	sehr klein	V	V	V	V	V	V	V	V	V	V	V	V	N	M	H	
	klein	V	V	V	V	V	V	V	V	V	V	V	N	M	H	SH	
	mäßig	V	V	V	V	V	V	V	V	V	N	M	H	H	SH	U	
	erheblich	V	V	V	V	V	V	V	V	N	M	H	H	SH	U	U	
	ernsthaft	V	V	V	V	V	V	V	V	N	M	H	H	SH	U	U	
	katastrophal	V	V	V	V	V	V	V	V	N	M	H	H	SH	U	U	
	sehr klein	V	V	V	V	V	V	V	V	V	V	V	V	N	M	H	
	klein	V	V	V	V	V	V	V	V	V	V	V	V	N	M	H	

The Risk matrix

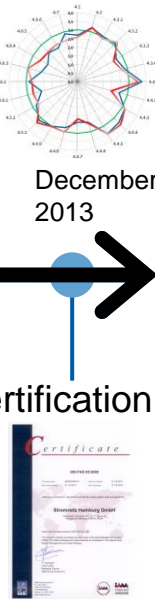
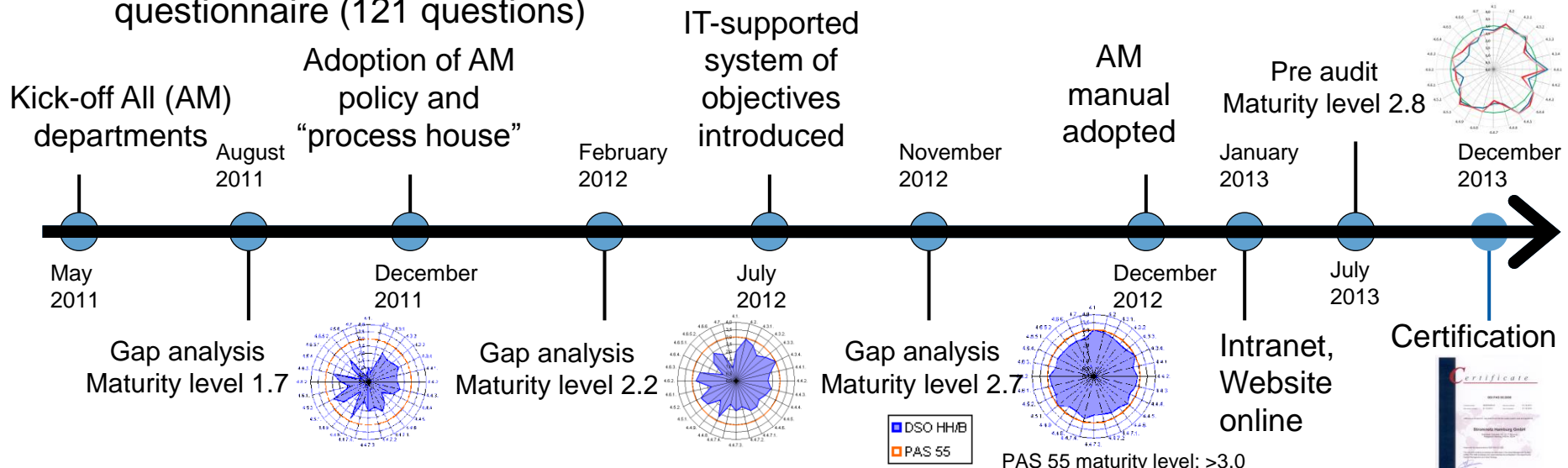
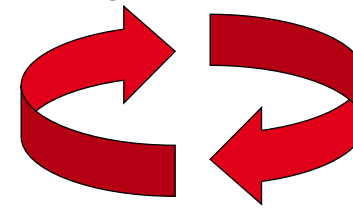
- represents the set of business values
- refers to business objectives
- links loss and probability of occurrence
- Identifies risk classes from negligible to unacceptable (definition by asset owner)
- simplifies the handling: each field includes a story and a price tag

The risk matrix builds the basis for decision making within the AM.

Implementation in the distribution grid of Hamburg Steps:

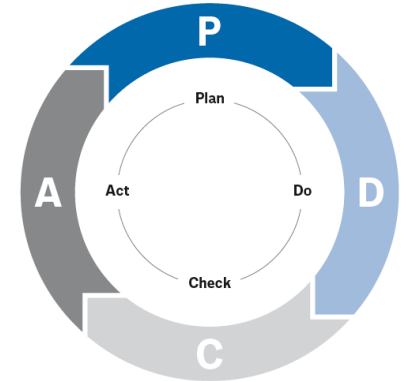
- Participants in AM: all managers, dept. heads and one employee from each department.
- Organisation of various workshops: kick-off, development of policy and processes, etc. → ensure buy-in by everyone.
- Self-audit based on an official IAM questionnaire (121 questions)

1. Gap analysis with all participants → overview of gaps
2. Roadmap towards closing the gaps
3. Cooperative effort of closing gaps in different work groups



Core challenges

- Definition and adoption of AM principles
- Consistent top-down / bottom-up planning
- Securing of PDCA circles
- Installation of a consistent KPI system
- Documentation of all AM processes
- Embedding AM processes in an AM process house
- Internal communication/ensure transparency



Individual topics to be implemented

- In the scope of the gap analysis, a multitude of individual topics have emerged that were tackled on a step-by-step basis such as:
 - development of a risk management system
 - role models/task descriptions
 - enhancement of existing tools



Outlook towards the ISO 55000 and Conclusion

ISO 55000 was released January 2014 with three parts analogous to other ISO codes (9000, 14000, 18000, etc.)

- ISO 55000 gives an overview, principles and terminology,
- ISO 55001 defines the requirements,
- ISO 55002 is a guideline for application

To ease the implementation ISO 55001 renders the same structure as the other codes:

4 Context of the organization

5 Leadership

6 Planning

7 Support

8 Operation

9 Performance evaluation

10 Improvement

generic

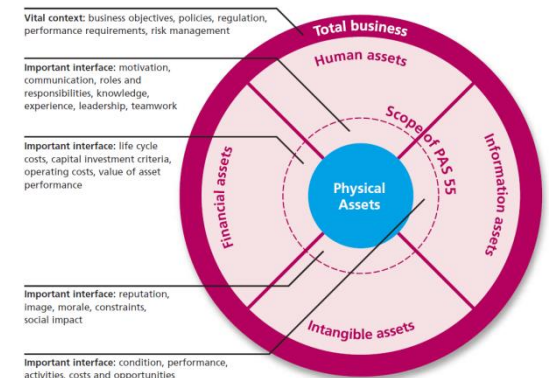
2.3 Assets

An asset is an item, thing or entity that has potential or actual value to an organization. The value will vary between different organizations and their stakeholders, and can be tangible or intangible, financial or non-financial. Source: ISO55000

ISO 55000 amends the term asset from physical assets to all items having value to an organization.

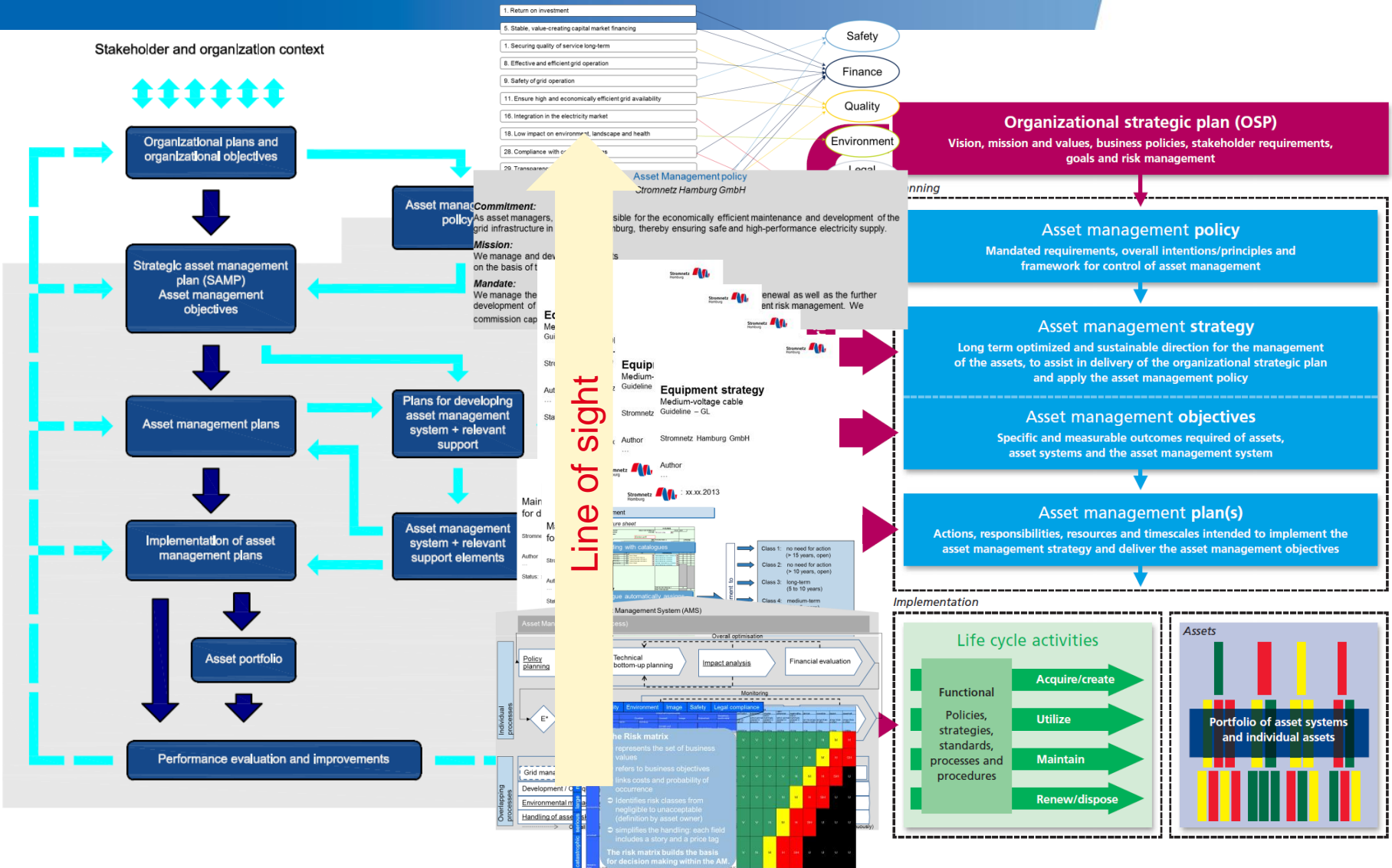


Figure 2 – Focus and business context of this PAS in relation to the other categories of assets



Source: PAS 55 1-2008

ISO 55000 versus PAS 55



Thank you very much for your attention!



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