



THE 20TH INTERNATIONAL OPERATIONS & MAINTENANCE
CONFERENCE IN THE ARAB COUNTRIES

PRACTICAL EXPERIENCE FROM IMPLEMENTATION OF ASSET MANAGEMENT SYSTEM IN HSE GROUP

Andrej Androjna, Slovenia

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20 YEARS



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Introduction

The case of AMS implementation in accordance with ISO 55001 in the largest Slovenian power generation utility, HSE Group, is presented.

Physical Assets of production infrastructure were included in the scope of the AMS.

The project was supported by the AM Consulting team, it was started in 2020 and finished end of 2022 with the formal certifications of companies within the HSE Group.

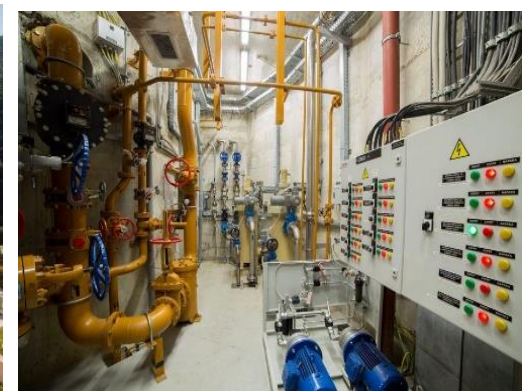
International standards (ISO, IEC, EN, ASTM, etc.), as well as guidelines (GFMAM, IAM, CIGRE, etc.) were used wherever feasible.



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About the HSE Group

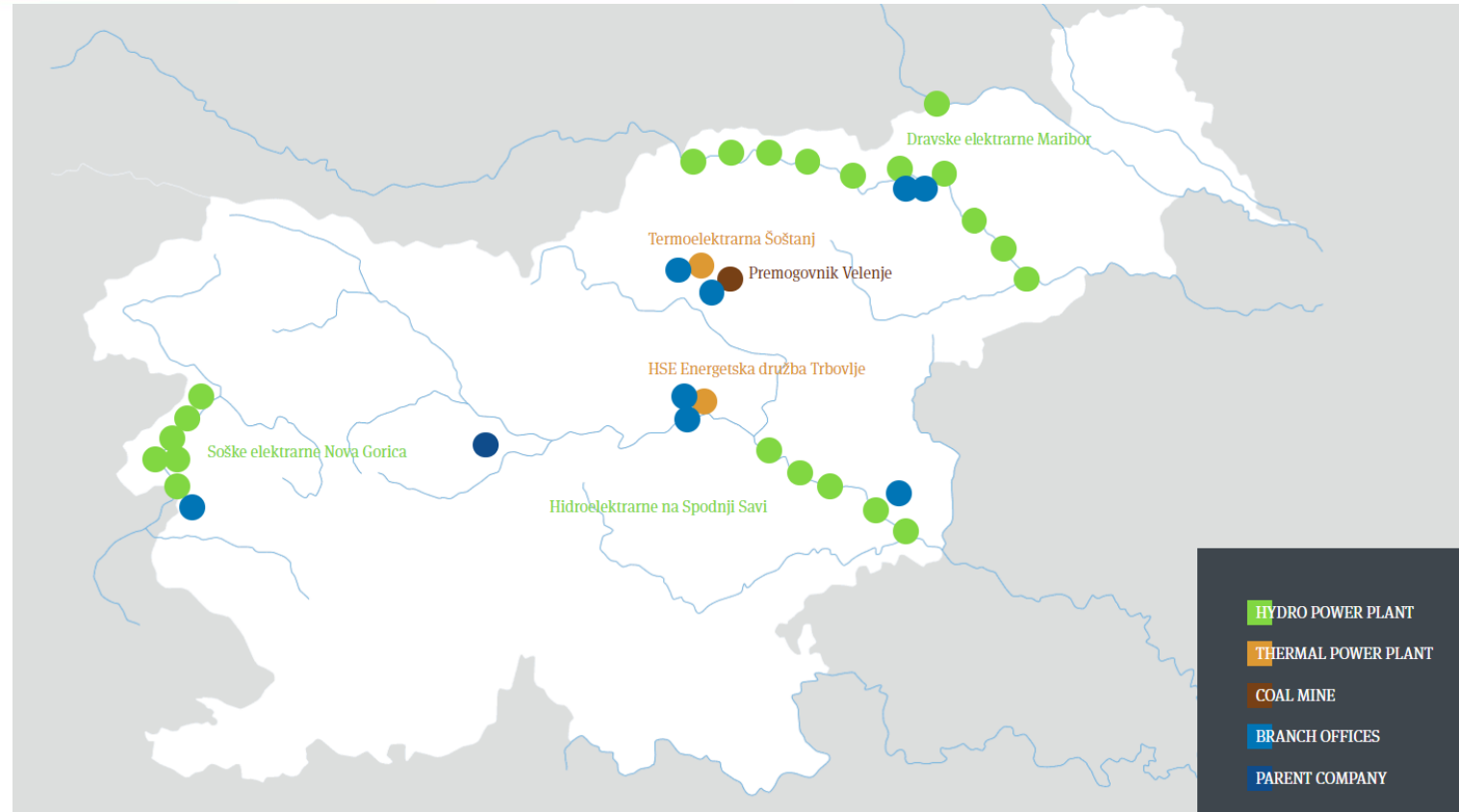
- Largest electricity producer in Slovenia (68%),
- 85% share of renewable sources in the production structure.



About the HSE Group

As of 2021:

- Approx. **2 GW** installed power,
- Annual production **7,5 TWh**,
- **56%** hydro, **44%** thermal,
- Key pillar of **supply reliability**.





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AM Consulting team



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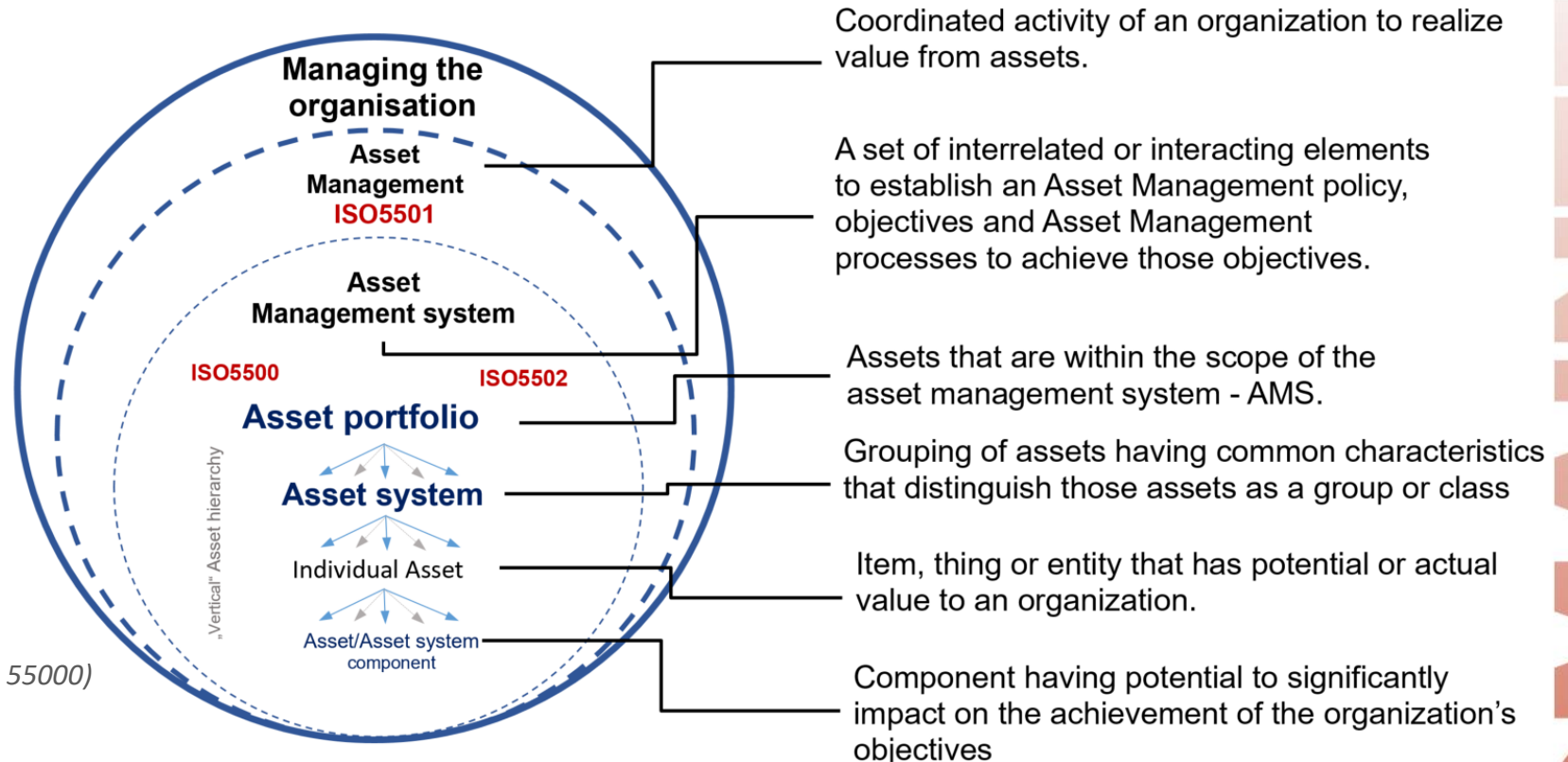
Miha Osredkar

Members of:

- GFMAM
- EFNMS
- ISEAM
- IAM
- FIDIC-EFCA (BIM)
- CIFE Stanford
- CEN
- CIGRE-CIRED
- BuildingSMART
- SIST
- IIBA
- DVS
- etc.

AM and AMS

The relationship between managing the organization, AM and AMS



(Source: AM Consulting, adapted from ISO 55000)



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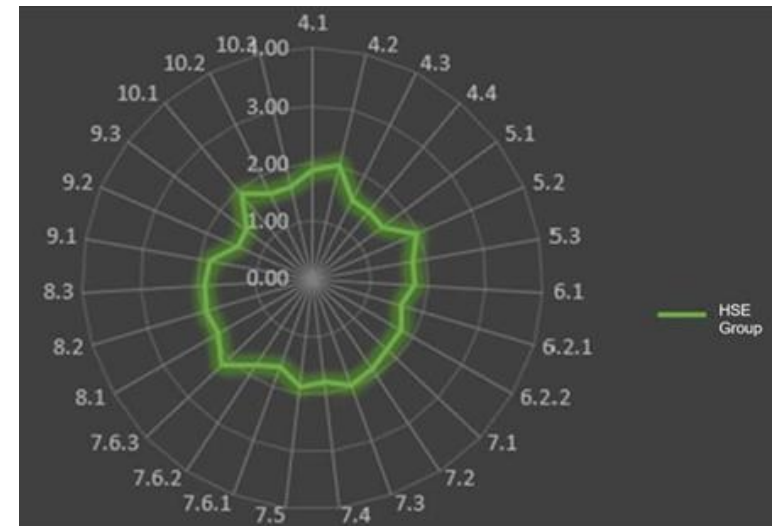
Initial Maturity Assessment

ISO 55001 Maturity Scale

Innocent	Aware	Developing	Competent	Optimising	Excellent	
Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Beyond		
The organisation has not recognised the need for this requirement and/or there is no evidence of commitment to put it in place	The organisation has identified the need for this requirement, and there is evidence of intent to progress it.	The organisation has identified the means of systematically and consistently achieving the requirements, and can demonstrate that these are being progressed with credible and resourced plans in place.	The organisation can demonstrate that it systematically and consistently achieves relevant requirements set out in ISO 55001.	The organisation can demonstrate that it is systematically and consistently optimising its asset management practice, in line with the organisation's objectives and operating context.	The organisation can demonstrate that it employs the leading practices, and achieves maximum value from the management of its assets, in line with the organisation's objectives and operating context.	

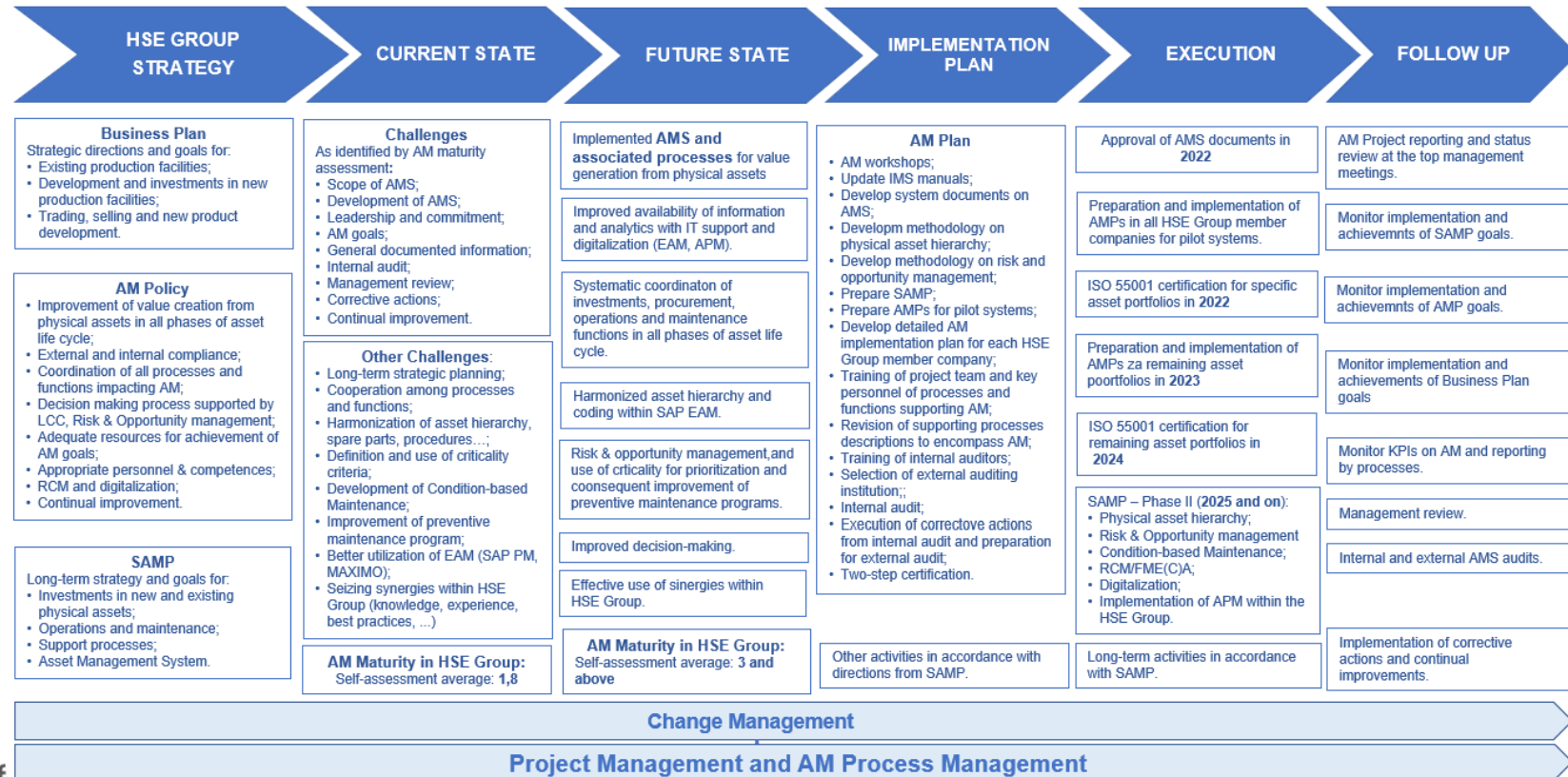
(Source: The IAM, SAM+)

Initial AM maturity self-assessment results, averaged across the HSE Group



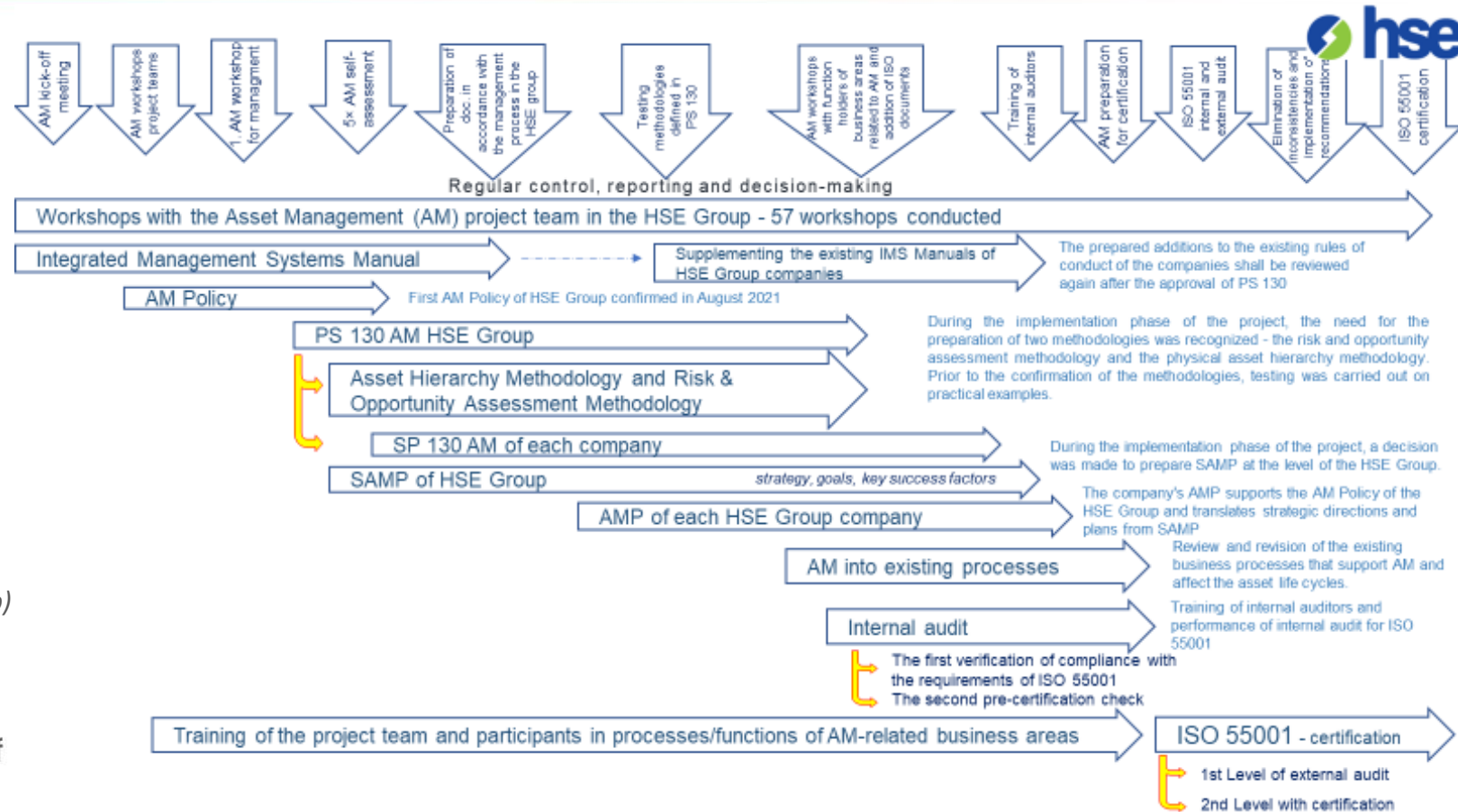
(Source: HSE Group)

Strategic Implementation Framework



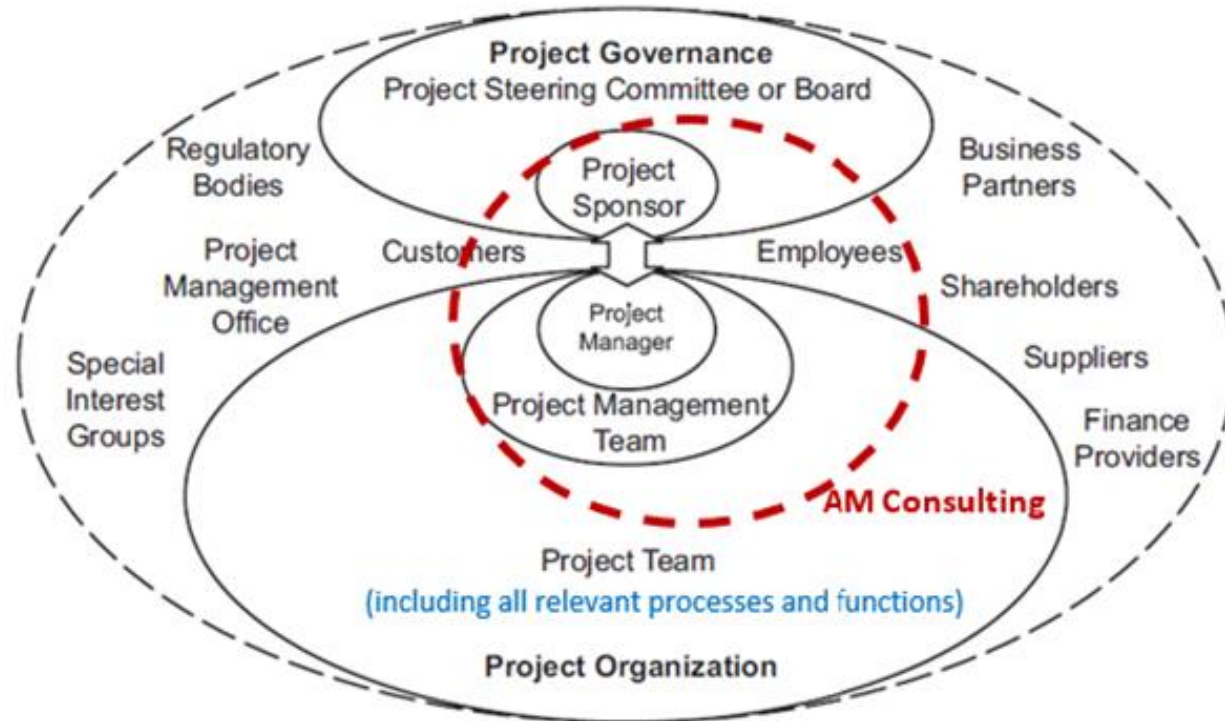
(Source: HSE Group)

Project Roadmap



(Source: HSE Group)

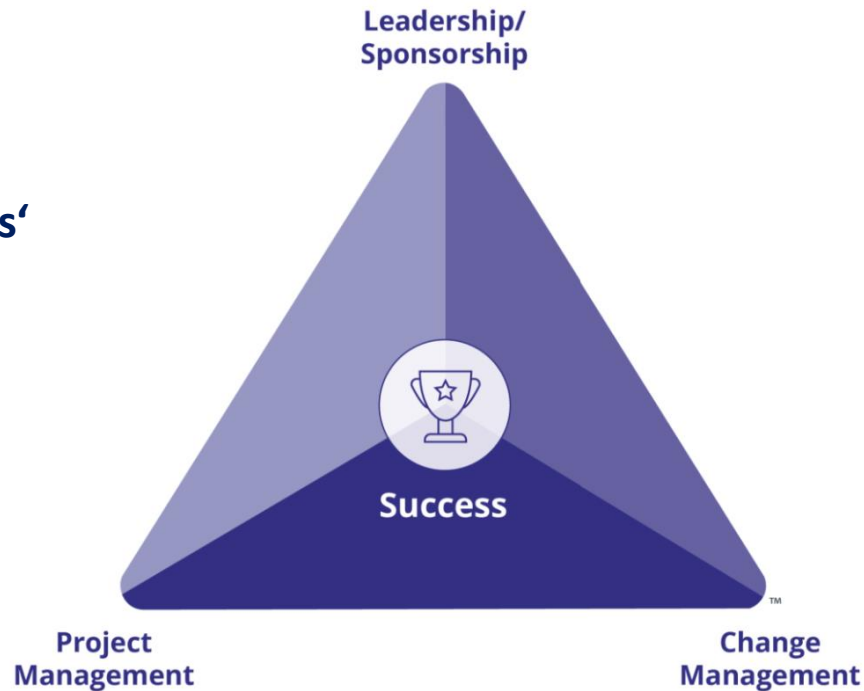
Project Organization



(Source: AM Consulting, adapted from ISO 21502)

Change Management

- Utilization of the Prosci® PCT™ Model,
- Dealing specifically with the employees' side of the change.

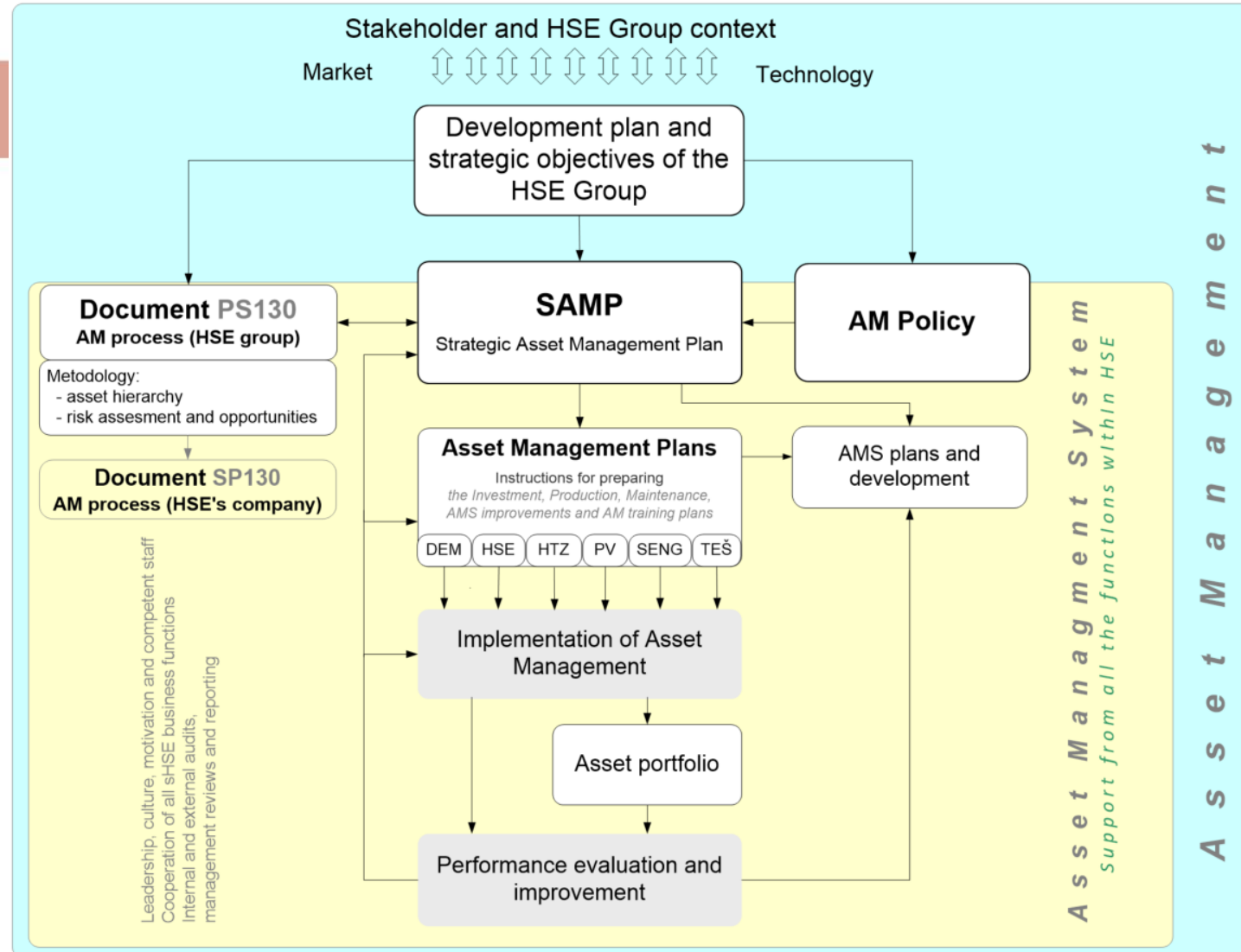


(Source: www.prosci.com)

Deliverables

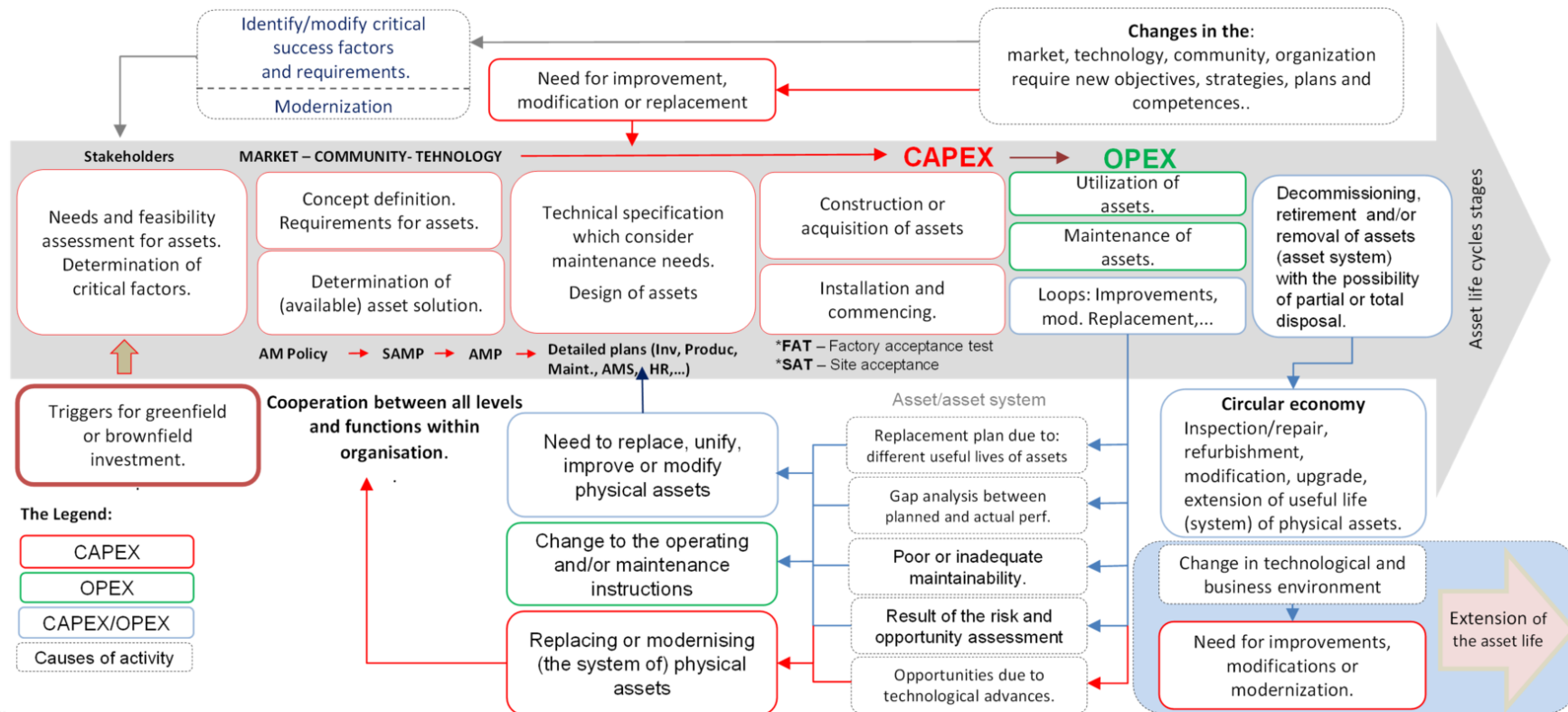
- Documents and activities of AMS in the HSE Group

(Source: HSE Group)



Deliverables

- **Training and Workshops (> 60) on different aspects of AM, AMS and Life Cycle Delivery**



(Source: AM Consulting, adapted from EN 17485)

The Legend:

- CAPEX
- OPEX
- CAPEX/OPEX
- Causes of activity

Deliverables (Cont'd)

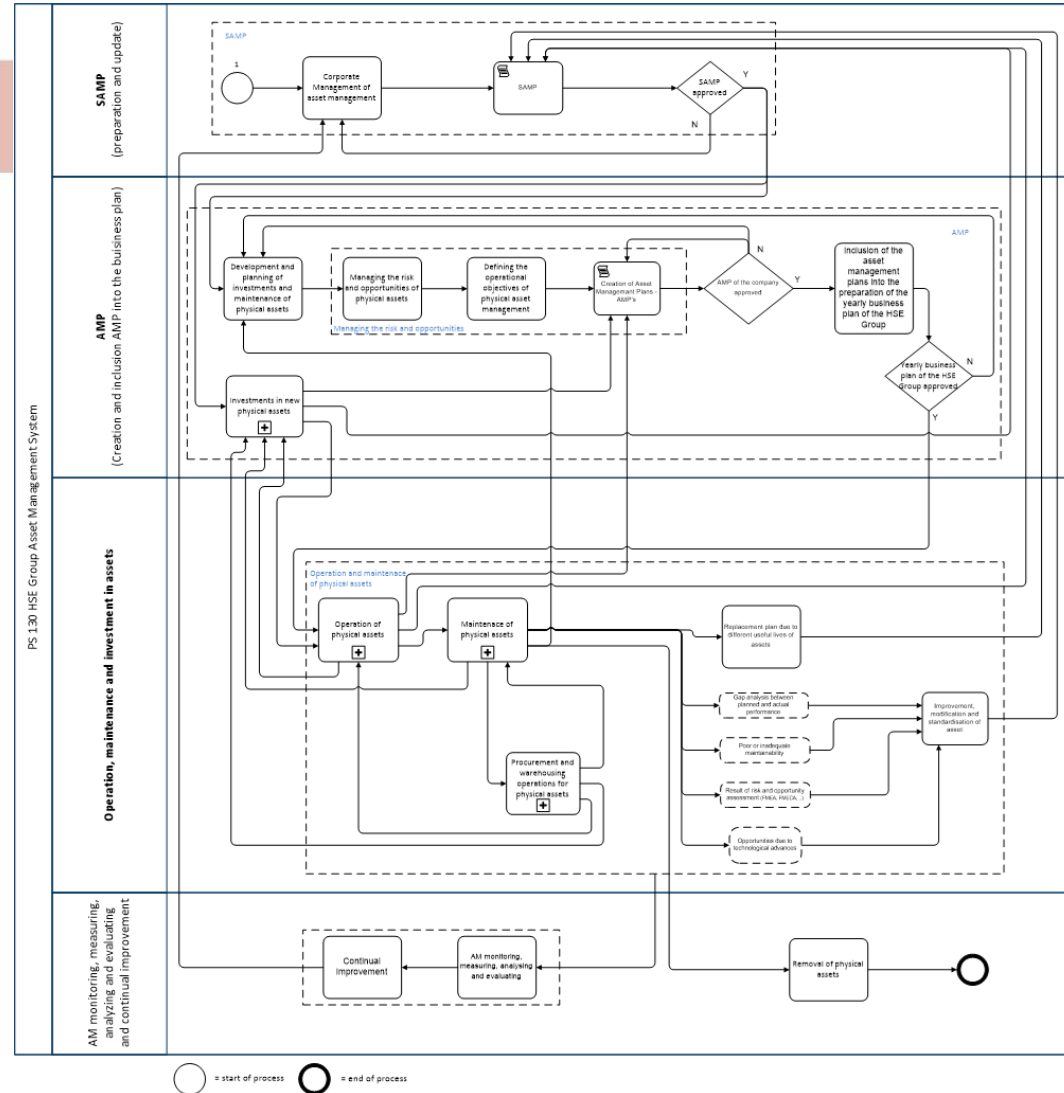
- Asset Management Policy
- Updated Integrated Management Systems (IMS) Manual
- Strategic Asset Management Plan (SAMP)
- ISO 55000 series handbooks
- AM process description - RACI Matrix

(Source: HSE Group)

	Activity and/or process	Responsible									
		HSE top management	CEO of key function	HSE management representative for AMS	HSE Group AM process owner	Owners of other HSE Group processes	Management of the HSE Group company	Managers / heads of individual areas of HSE Group companies	HSE Group company management representative for AMS	AM process owner at HSE Group company	Other process owners at the company
1.	Corporate Management of AM, SAMP development	V	I		SI	SI	SV*	SI**		SI*	SI*
2.	Development and planning of investments and maintenance of physical assets		V		SI	I	V*	SV*		SI*	I*
3.	Managing the risks and opportunities of physical assets			SI	V, SI	I			SI*	V*, SI*	I*
4.	Defining the operational objectives of physical asset management		V	SI	SI	I	V*	SV*	SI*	SI*	I*
5.	Creation of Asset Management Plans – AMP's		V		SI	I	V*	SV*		SI*	I*
6.	Inclusion of the asset management plans into the preparation of the yearly business plan of the HSE Group	V	SV SI		SI	I	V*	SV* SI*		SI*	I*
7.	Operation, maintenance and investment in physical assets		V		SI	I	V*	SV*		SI*	I*
8.	Procurement and warehousing operations for physical assets		V		SI	I	V*	SV*		SI*	I*
9.	Removal of physical assets		V		SI	I	V*	SV*		SI*	I*
10.	AM monitoring, measuring, analysing and evaluating and continual improvement		V	SV	SV	I		V*	SV*	SV*	I*

Deliverables (Cont'd)

- AM process description - Process Flow Diagram



(Source: HSE Group)



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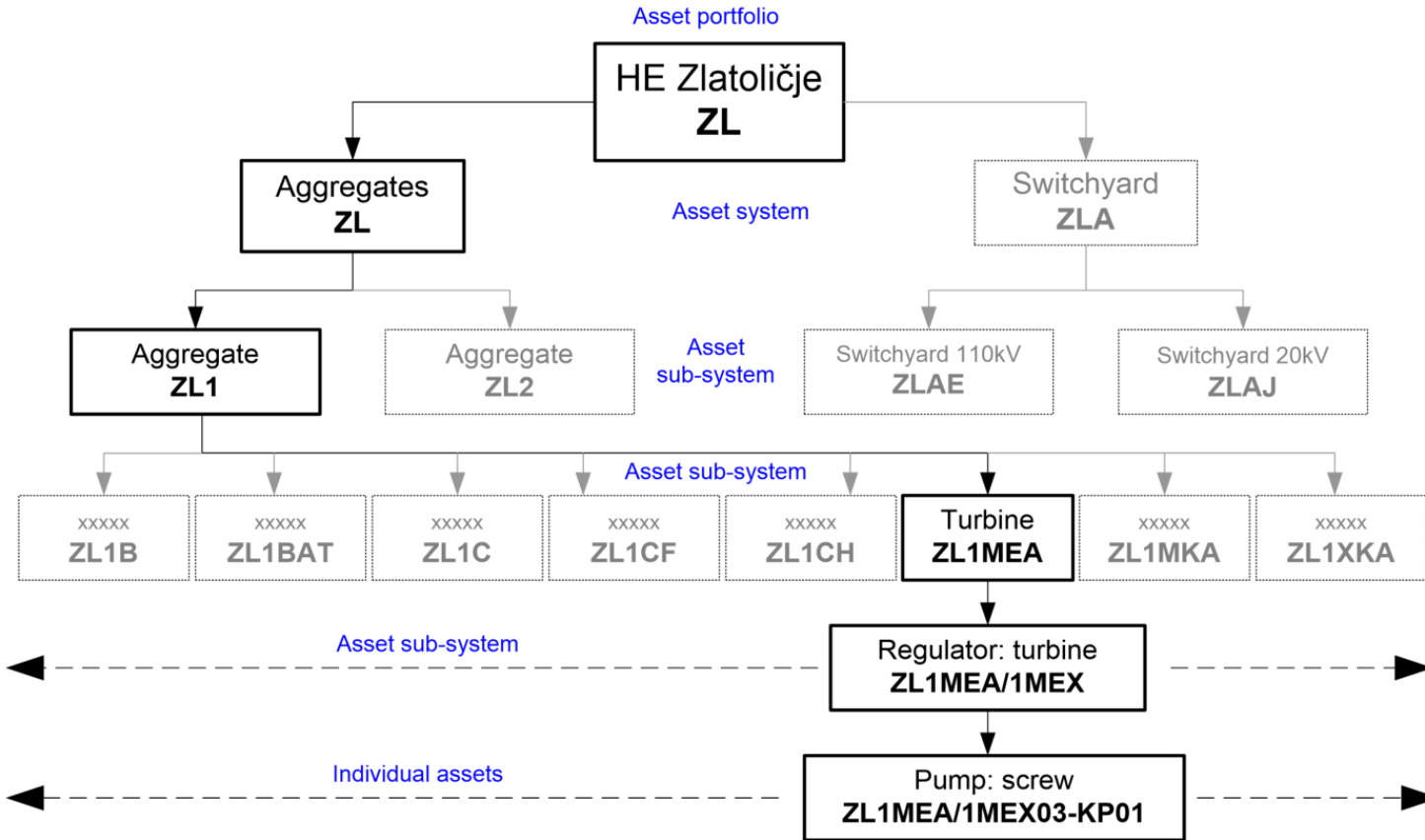
Deliverables (Cont'd)

- **AM process description** - Integration of Functions and Processes
 - **Recommendations on AM-related upgrade of existing processes**
 - **Guidelines on Maintenance Requirements for investments and hand-overs**
- ✓ Corporate governance,
 - ✓ Investments,
 - ✓ Operations,
 - ✓ Maintenance,
 - ✓ Risk management,
 - ✓ Controlling,
 - ✓ Procurement and warehousing,
 - ✓ Human resources,
 - ✓ Finance and accounting,
 - ✓ IT.

(Source: HSE Group)

Deliverables (Cont'd)

- Guidelines on Asset Hierarchy



(Source: HSE Group)

Deliverables (Cont'd)

- Methodology on Risk & Opportunity Assessment
- Guidelines on Asset Group PM tasks, criticality based
- Specific Maintenance Guidelines

(Source: HSE Group)

	MAINTENANCE PROGRAM (320)	Rev.: 2
	PR PA-320-1-2 Asset group PM tasks - TRANSFORMERS	

HSE - Preventive maintenance tasks		Criticality based (RAM) task execution period			
Task	Comment	Critical	Important	Less important	Non-critical
1. ROUTINE INSPECTIONS (daily, weekly, monthly)					
Oil level inspection	oil TR only	1W	1W	1M	1M
Cooling system inspection		1W	1W	1M	1M
Air dryer inspection	oil TR only	1W	1M	1M	1M
Oil sump inspection	oil TR only	1W	1M or as needed	1M or as needed	1M or as needed
Inspection of fire extinguishing CO2 bottles		1W	1W	1M	1M
Inspection of water quantity in fire extinguishing tank		1W	1W	1M	1M
Thermometer inspection		1W	1W	1M	1M
2. TRANSFORMER OIL ANALYSES					
Gas chromatography oil analysis (GC)		1Y	2Y	6Y	6Y
Liquid chromatography oil analysis (LC)		1Y	2Y	6Y	6Y
Physical and chemical oil analysis, infrared spectroscopy (C + IR)	1 x 6 yrs for TR up to 12 yrs, 1 x 3 yrs for TR older than 12 yrs	1Y	4Y	6Y	6Y
Prebojna napetost olja in voda v olju (Pn + v)		1Y	2Y	6Y	6Y
3. ELECTRICAL MEASUREMENTS					
Isolation resistance		1Y	5Y	6Y	8Y
Magnetizing currents	*as needed, based on the GC/LC analyses results.	4Y	5Y	6Y	8Y
Resistance measurement at all stages	*as needed, based on the GC/LC analyses results.	4Y	5Y	6Y	8Y



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Deliverables (Cont'd)

- **Asset Management Plan (AMP) Preparation Procedure, including harmonized plans on:**
 - ✓ Investments in new physical assets,
 - ✓ Investments in existing physical assets,
 - ✓ Operations,
 - ✓ Maintenance,
 - ✓ AMS improvements, and
 - ✓ Human resources.

- **Subordinated documents within HSE Group's companies**



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Certification

- Internal audits
- 1st level external audit
- 2nd level external audit with certification

Note: management system audits were integrated wherever possible.

(Source: HSE Group)





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Lessons Learned - Achievements

- Very active project management team with regular communication,
- Clear ownership of the project,
- Excellent cooperation with external consultants,
- Improved alignment of functions and processes,
- AMS aligned with current maturity,
- Support of top management where necessary,
- Risk and opportunity introduced to asset system and individual asset levels,
- Implementation of AMS as a learning process,
- Utilization of existing documents and standards as much as possible.



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Lessons Learned - Challenges

- Very ambitious initial time goals,
- Availability of managers during the project,
- Implementation of AMS in several companies of the HSE Group simultaneously,
- Some practices in different processes / functions were not easy to align,
- Change management methods were underutilized,
- The decision-making practices not as harmonized as expected.



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Lessons Learned – Future Opportunities

- Further alignment of relevant processes, especially investments and maintenance.
- Introduction of more in-depth methods focusing on risks and reliability for critical and important assets, such as RCM and/or FMECA.
- Further development of condition-based maintenance, together with asset health monitoring.
- Upgrade the work ordering process with better utilization of SAP EAM and APM.
- Improve the integration of asset information from different IT systems or their modules.
- Further optimize plant outages in the context of AM using modern approaches.
- Continuous improvement of AM maturity in order to generate more value from the assets at levels > 3.



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