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SHARE

A roadmap for research in Decommissioning

October 2020

https://share-h2020.eu/
linkedin.share-h2020-project
linkedin/group SHARE Road map for Decommissioning

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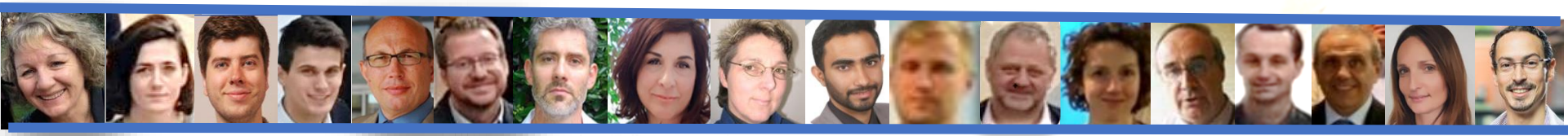
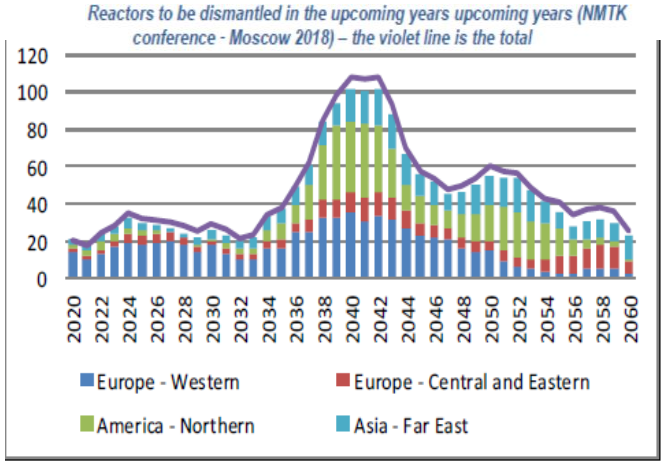
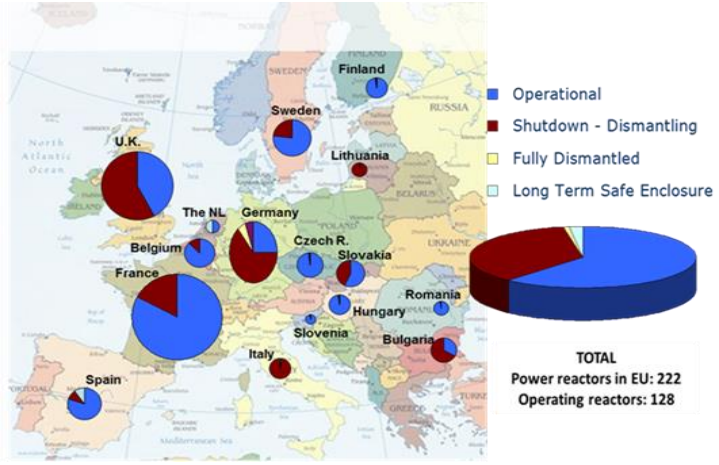
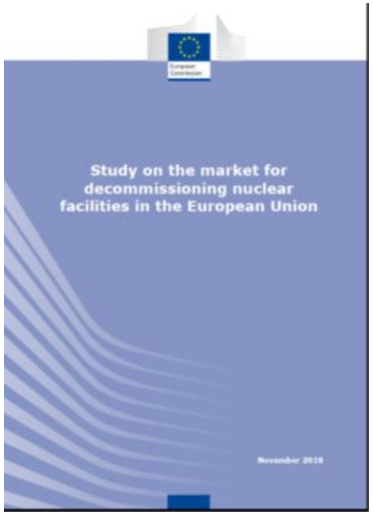


DECOMMISSIONING= SIZEABLE MARKET EXPANDING OVER THE YEARS

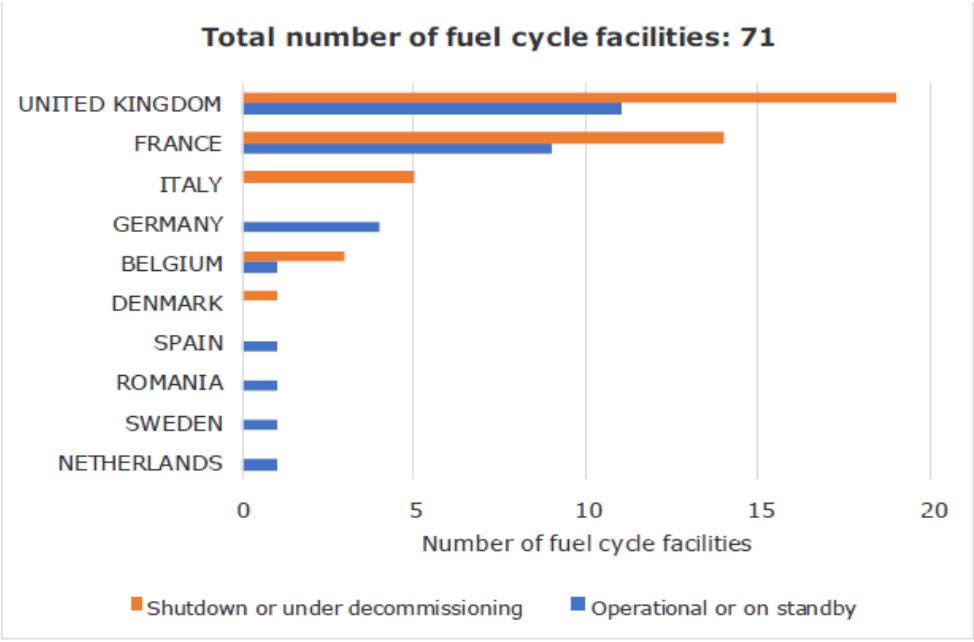
Demonstration at industrial scale is essential for the credibility of the nuclear energy option







- Huge experience but few NPPs fully dismantled in Europe (94 NPPs on permanent shutdown)
- No serial effect for Research and fuel cycle facilities, including legacy waste:
  - ✓ Wide diversity of waste such as “exotic” or highly contaminated, with no ROUTE
  - ✓ Lack of documentation
  - ✓ Need for specific technologies and processes
  - ✓ Exposed to risks such as unexpected delays, cost overruns and technical difficulties.



CHALLENGES AND ECONOMICAL STAKES IN DECOMMISSIONING

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A certain level of industrial maturity for Decommissioning of rather 'standard' nuclear installations relying mostly upon proven processes and technologies e.g. for PWR)

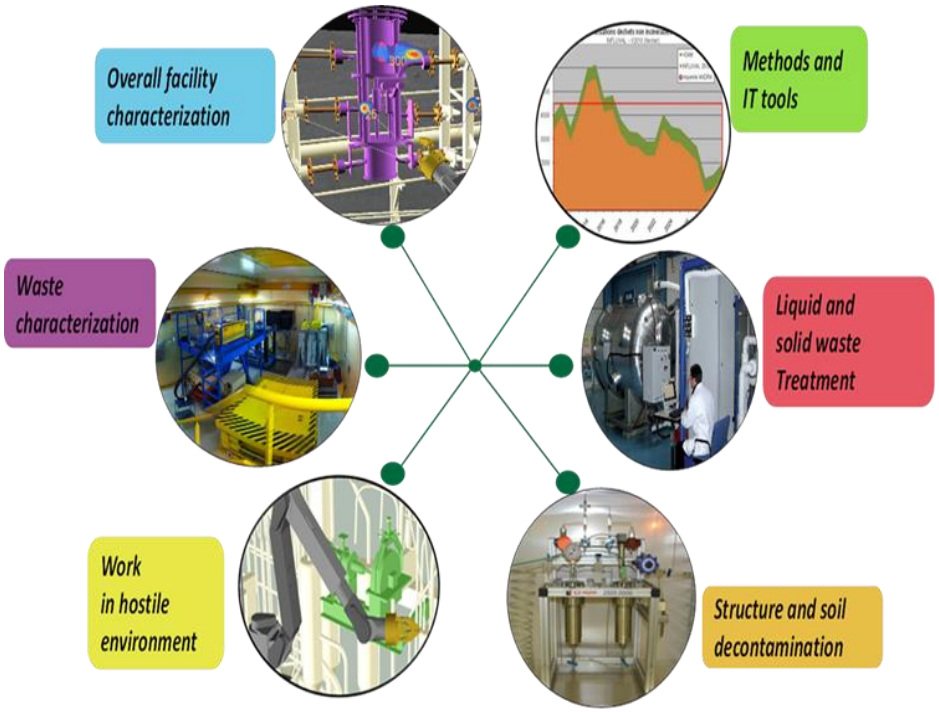
➡ **Need to build on these : methodology and even standardization wherever**
+ few possibilities of optimization/ cost reduction (digital tools, laser cutting, waste routes, etc)

But still a number of technological challenges for the decommissioning industry, eg. graphite reactors, fuel cycle back end facilities or other legacy waste

➡ **Need to accelerate projects in order to decrease fixed costs**
Need for research targeted to the actual needs of end users, in a "waste- led approach"

Also, non-technological issues, e.g need to stimulate young generation on the necessary competences.

➡ **Education and training, Competence maintenance, Project management, Contracting, Dialogue with society, regulators, etc.**



CONTEXT OF « SHARE » PROJECT

Situation in 2016 : need for more impulse

- **On one hand:**
- Increasing difficulties for Individual countries to justify expenditures on new developments that can require more than 10 years to be completed
- Reluctance on sites to use innovative technologies and search for approved technologies to minimize risks
- Industrials need confidence in markets and associated business plans before investing in industrialization.

- **On the other hand**
- Significant redundancy and duplication in current Research programmes for Decommissioning in different countries
- Already lot of cooperation (IAEA, NEA, etc.) , but…
- … few real projects in common in 2016

More impulse needed to develop and to use research and innovation in Decommissioning projects and to promote and organize at international level the co-financing of developments and demonstrators by actors with common objectives

Euratom research and training programme H2020 NFRP-2018-5: CSA "Development of a roadmap for decommissioning research aiming at safety improvement, environmental impact minimisation and cost reduction"

«SHARE »: StakeHolders-based Analysis of Research* for Decommissioning

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- Started June 2019
- End = November 2021

- Consortium = 11 partners /10 countries
- Expert Review Panel= 18 entities / 12 countries
- Wider community: around 250 entities all along the value chain
- Support/ endorsement of IAEA, NEA, Nugenia,

https://share-h2020.eu/
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(*): "Research"= Research and Innovation in technical and non technical fields

POINT OF SITUATION – October 2020

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- Survey among 600 stakeholders during Summer 2020: asked to rank importance and urgency of their needs for Research, aiming at improving Safety, costs and optimizing Waste in Decommissioning
- 230 responses under analysis.
- In parallel, report on best practices and on-going international initiatives under review

<u>8 fields addressed :</u>

1. Safety and radiological protection aspects
2. Project management and costing
3. Human resources management
4. Characterisation during decommissioning
5. Site preparatory activities
6. Dismantling
7. Environmental remediation and site release
8. Management of material and radioactive waste from decommissioning

- Virtual Workshop October, 22-23d: choice of sub-fields to continue with, depending on stakeholders ranking and coordination with other EU initiative, e.g for session October 22th morning, on field « 8 », in coordination with PREDIS, ROUTE, MICADO and CHANCE.

NEXT STEPS

- Virtual Workshop December 1-3d, open to Stakeholders for inputs: presentation of results / survey and existing situation / beginning of gap analysis
- Gap analysis, SRA and Roadmap in 2021
- 2 other worshops of the project in 2021; hopefully face to face …

2021	2-3/02	Italy	Roma	Nugenia forum
	8-12/03	USA	Phoenix	Waste Management
	17-19/03	Germany	Dresden	KONTEC 2021
	23-25/03	Norway	Halden	Digidecom
	18-21/05	China	Beijing	NEA-China Forum on Decom. & RWMC
	7-9 / 06	France	Avignon	DEM 2021
	06	France	Marcoule	NEA CPD meeting
	06	France	Marcoule	IDN meeting
	30/09-10	France	Cadarache	Congress of ATSR

www.ife.no/digidecom-elinder-2020
www.ife.no/digidecom2021

SFEN
www.sfen-dem2021

DEM 2021,
June 07-09, 2021
Palais des Papes - Avignon, France

Call for abstracts !

Thanks for your attention

Hope to see you tomorrow morning!

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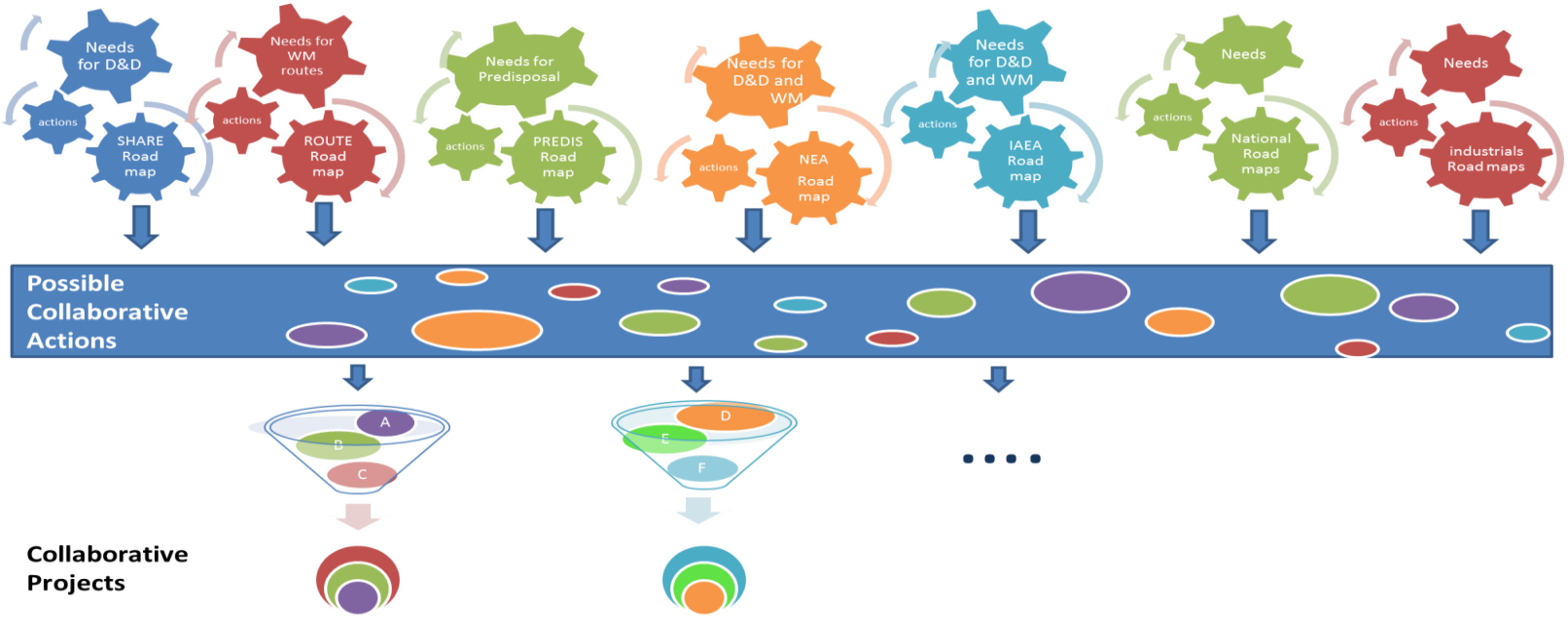

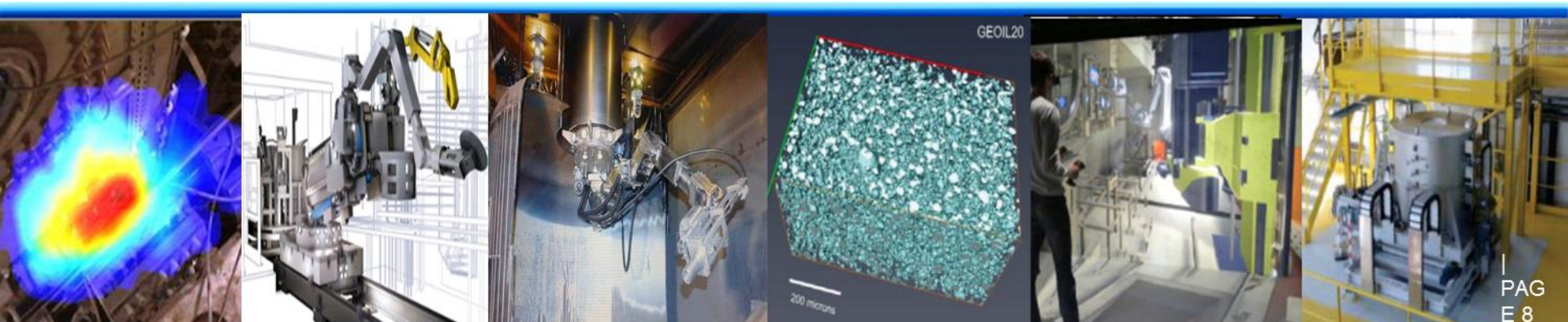

Distribution of work / review Task 3.1 1/2

Questionnaire Topic Area	TOPIC AREA LEADER	SUB-TOPIC LEADER	Q	D3.1 §	Sub-topic
Safety and Radiological Protection aspects	IFE	JRC	10	1.1	International harmonization of safety standards and safety approaches for Decommissioning
		LEI		1.2	Development for National regulatory guidance for Decommissioning
			11	1.2.1	- Preparatory activities
			12	1.2.2	- Dismantling
			13	1.2.3	- Clearance of structures and materials
			14	1.2.4	- Final site release
		SOGIN	15	1.3	Methods and tools nuclear safety
		SOGIN	16	1.4	Methods and tools for conventional industrial safety
		CEA/CEPN	17	1.5	Development of radiological protection approaches and guidance for Decommissioning
Project Management and costing	CEA	LEI	19	2.1	Methodologies and software tools for comparison of alternative decommissioning strategies
		LEI	20	2.2	Methodologies and software tools for project management and performance monitoring
		VTT	21	2.3	Tools for data collection in the field (e.g. for work monitoring)
		IFE	22	2.4	Digital transformation in decommissioning (big data, business intelligence)
		VTT	23	2.5	Supply chain management for Decommissioning
		IFE	24	2.6	Methods and tools for communication (public)
		SOGIN	25	2.7	Methodologies and guidance for cost estimation
		LEI	26	2.8	Software for cost estimation
		SOGIN	27	2.9	Development of mechanisms for cost benchmarking
		SOGIN	28	2.10	Methods and tools for sensitivity and uncertainty analysis in cost estimation
Human resources management	IFE	IFE	30	3.1	Organisation models (staff and resources)
		IFE	31	3.2	Methods and software tools for knowledge management (e.g. competence preservation)
		IFE	32	3.3	General education for decommissioning
		IFE	33	3.4	Methodologies and tools for task specific training
Characterisation during decom.	JRC	CEA	35	4.1	Methodology for historical site assessment
		CEA	36	4.2	Inventory assessment (Radiological and non-radiological)
		NNL		4.3	Characterisation of activated components and areas
			37	4.3.1	- Metal
			38	4.3.2	- Concrete
			39	4.3.3	- Graphite
		ENRESA	40	4.4	Technologies for hard to access areas (high walls, embedded components, harsh environment…)
		CEA	41	4.5	Development of modelling and simulation software for characterisation of irradiated components
		CEA	42	4.6	Standards for statistical sampling
		CEA	43	4.7	Geostatistical software applications
		JRC	44	4.8	Sample analysis technologies
		CEA	45	4.9	Alpha and beta non-destructive measurements
Site preparatory activities	SOGIN	LEI	47	5.1	Adaption of auxiliary systems for decommissioning (ventilation, electrical, monitoring, etc.)
		SOGIN	48	5.2	Preparation of infrastructures and buildings for decommissioning (storages, capabilities for material sorting and treatment…)
		NNL	49	5.3	Systems decontamination (internal)

Distribution of work / review task 3.1 2/2

Dismantling	**KIT**	SOGIN	**51**	**6.1**	Segmentation of large irradiated metallic components (reactor vessel internals, etc.)
		KIT	**52**	**6.2**	Handling, segregation and loading of segmented elements and secondary waste
		NNL	**53**	**6.3**	In situ Radioactive Waste characterization and segregation
		LEI	**54**	**6.4**	Segmentation of large surface-contaminated components
		LEI	**55**	**6.5**	Dismantling of surface-contaminated piping and small components
		KIT	**56**	**6.6**	Segmentation of interior concrete structures (e.g., bioshield)
		KIT	**57**	**6.7**	In situ decontamination of building surface (concrete)
		KIT	**58**	**6.8**	Management (characterization, decontamination, removal) of radiological embedded elements
		KIT	**59**	**6.9**	Demolition of large, reinforced concrete structures
		KIT	**60**	**6.10**	Robots and remote controlled tools for dismantling
Environmental remediation and Site Release	**SOGIN**	SCK-CEN	**62**	**7.1**	Clearance of surfaces and structures (interiors and exteriors)
		NNL	**63**	**7.2**	Characterisation methods and technologies to identify subsurface contamination
		NNL	**64**	**7.3**	Modelling and statistical tools to analyse contaminant transport in subsurface soil and groundwater
		CEA	**65**	**7.4**	Soil remediation technologies (washing, bioremediation, contamination fixing)
		SOGIN	**66**	**7.5**	Remediation of contaminated groundwater (radiological)
		SOGIN	**67**	**7.6**	Methodologies and techniques for final release survey of the Site
		SOGIN	**68**	**7.7**	Tools for statistical analysis and management of survey data for site release
Management of material and radioactive waste from decommissioning	**NNL**	ENRESA	**70**	**8.1**	Management routes for materials including radioactive waste streams
		NNL		**8.2**	Radioactive material decontamination
			71	**8.2.1**	- Mechanical
			72	**8.2.2**	- electrochemical
		NNL		**8.3**	Radioactive material treatment processes
			73	**8.3.1**	- metals
			74	**8.3.2**	- concrete
			75	**8.3.3**	- aqueous liquids
			76	**8.3.4**	- non aqueous liquids
			77	**8.3.5**	- organic materials
			78	**8.3.6**	- VLLW
			79	**8.3.7**	- LLW
			80	**8.3.8**	- ILW
		NNL	**81**	**8.4**	Radioactive waste conditioning
		JRC	**82**	**8.5**	Radioactive waste packaging and logistics
		CEA	**83**	**8.6**	Characterization and survey of containerized radioactive waste
		ENRESA		**8.7**	Material clearance
			84	**8.7.1**	- methodology and procedures
			85	**8.7.2**	- instrumentation and logistics
		ENRESA	**86**	**8.8**	Management of hazardous and toxic materials (asbestos, lead in paint, etc.)
		NNL	**87**	**8.9**	Conventional and cleared materials recycling (circular economy)