EU-H2020- SHARE-Decommissioning
On-line Workshop, December 1-3, 2020

Group B
Session 2: Project Management and Costing

Session will start at 13:50, CET

Fanny FERT - CEA

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement nº 847626.

Group B
Session 2: Project Management and Costing

Agenda

Dec. 1st	**9:00 CET- 13:40: Plenary session (see general program) and switch to breakout sessions**		
Dec. 1st	**International initiatives**		
	13:50	2A	Presentation of IAEA DACCORD (+ CERREX + ISDC, etc.) by Patrick 0'Sullivan, IAEA *(10min)*
	14:00	2B	Presentation of NEA activities relating to costing of decommissioning and legacy management by Simon Caroll, VATTENFALL *(10min)*
	14:10	2C	Presentation of EU-H2020 Project PLEIADES by Caroline CHABAL, CEA *(10min)*
	14:20	2D	Presentation of first achievements from SHARE in this area + introduction to post it session, by Fanny Fert, CEA
	14:40- 16:50 - Post it session by sub-thematic area		
	Link MURAL 25	25	Methodologies and guidance for cost estimation
	Link MURAL 28	28	Methods and tools for sensitivity and uncertainty analysis in cost estimation
	Link MURAL 26	26	Software for cost estimation

Group B
Session 2: Project Management and Costing

Agenda

Dec. 2nd	**9:00- 12:00 - Post it session by sub-thematic area**		
	Link MURAL 19	19	Methodologies and software tools for comparison of alternative decommissioning strategies
	Link MURAL 21	21	Tools for data collection in the field (e.g. for work monitoring)
	Link MURAL 22	22	Digital transformation in decommissioning (big data, business intelligence)
	Link MURAL 27	27	Development of mechanisms for cost benchmarking
	12h00- 13-00 Lunch Break		
	13:00- 15:00 - Post it session by sub-thematic area		
	Link MURAL 24	24	Methods and tools for communication (public)
	Link MURAL 20	20	Methodologies and software tools for project management and performance monitoring
	Link MURAL 23	23	Supply chain management for Decommissioning

IAEA
International Atomic Energy Agency
Atoms for Peace and Development

IAEA DACCORD PROJECT

Patrick O'Sullivan

International Atomic Energy Agency

1 December 2020

Horizon 2020 SHARE-Decommissioning Workshop
1-3 December 2020 *[Virtual]*

IAEA DACCORD Project

Plan of Presentation

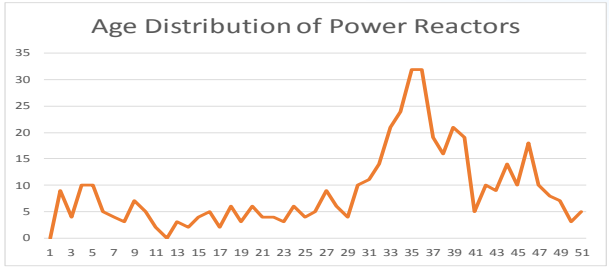
- Global Status of Nuclear Decommissioning
- International Structure for Decommissioning Costing (ISDC)
- DACCORD Project Main Results

Global Status of Nuclear Facilities

[Sources: IAEA 10-2020 : PRIS, Research Reactor, and INFCIS databases]

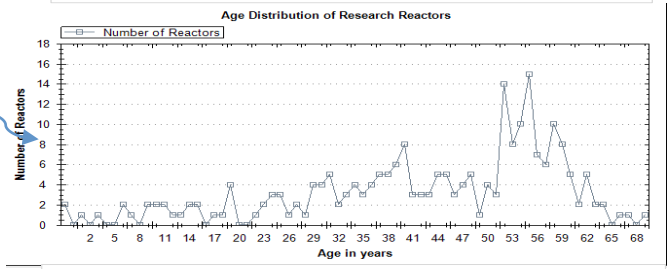
Power Reactors

In construction	54
in operation	442
Permanent Shutdown, in decommissioning / Decommissioned	172/18
	677



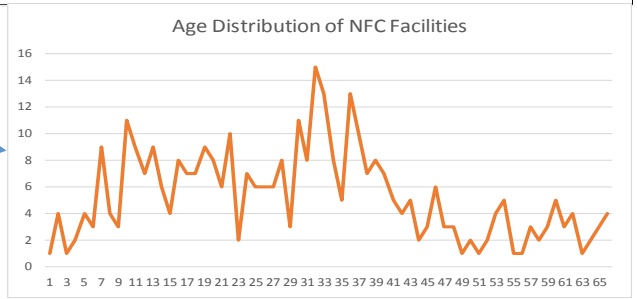
Research Reactors & critical assemblies

In construction	11
in operation	220
Long-term / temporary Shutdown	28
Permanent Shutdown, in decommissioning / Decommissioned	125/444
	828



Nuclear Fuel Cycle Facilities

In construction/commissioning	23/4
in operation	334
Long-term / temporary Shutdown	27
Permanent Shutdown, in decommissioning / Decommissioned	158/131
	704



Small industrial facilities using radioactive material: several '000s

ISDC – Hierarchical Structure *[Courtesy of Vladimir Daniska]*

- Numbered matrix of typical decommissioning activities and cost categories
- Levels 1 and 2 are aggregating levels
- Level 3 is the reference level
- Open for any additional user's defined numbering down to level 3

Level 1 — **Principal activities**

Level 2 — **Activity groups**

Level 3 — **Cost items** (typical decommissioning activities) with detailed definitions and examples (the "4th level")

- 01 Pre-decommissioning actions
- 02 Facility shutdown activities
- 03 Additional activities for safe enclosure or entombment
- 04 Dismantling activities within the controlled area
- 05 Waste processing, storage and disposal
- 06 Site infrastructure and operation
- 07 Conventional dismantling and demolition and site restoration
- 08 Project management, engineering and support
- 09 Research and development
- 10 Fuel and nuclear material
- 11 Miscellaneous costs

Cost Categories are defined which are to be allocated at each ISDC level

Total costs	Labour costs	Investment costs	Expenses	Contingency

Cost calculation structure (any type)

ISDC - Hierarchical Levels *[Courtesy of Vladimir Daniska]*

04 Dismantling activities within the controlled area

04.0500 Dismantling of main process systems, structures and components

04.0501 Dismantling of reactor internals

- Preparation of the work area for dismantling, extracting and packaging the waste for disposal
- Construction of dams on vessel nozzles or gates to isolate and contain the pool being used for disassembly (if performed underwater)
- Installation of handling devices and protection systems
- Control-rod blades and motors, rod guide tubes, RSA-guide tubes
- Steam dryer
- Feedwater sparger ring
- Core shroud, including fixing
- Fuel channels in channel type reactors
- Monitoring of the disassembly
- Operation of the segmentation tooling
- Maintenance and change-out of support equipment (purification and ventilation filters)
- Accepting and preparation of the disposal containers as well as loading and processing containers for transport
- Removal of handling devices and protection systems

04.0502 Dismantling of reactor vessel and components

- One-piece-removal of reactor
- Reactor pressure vessel top head
- Reactor core top head
- …

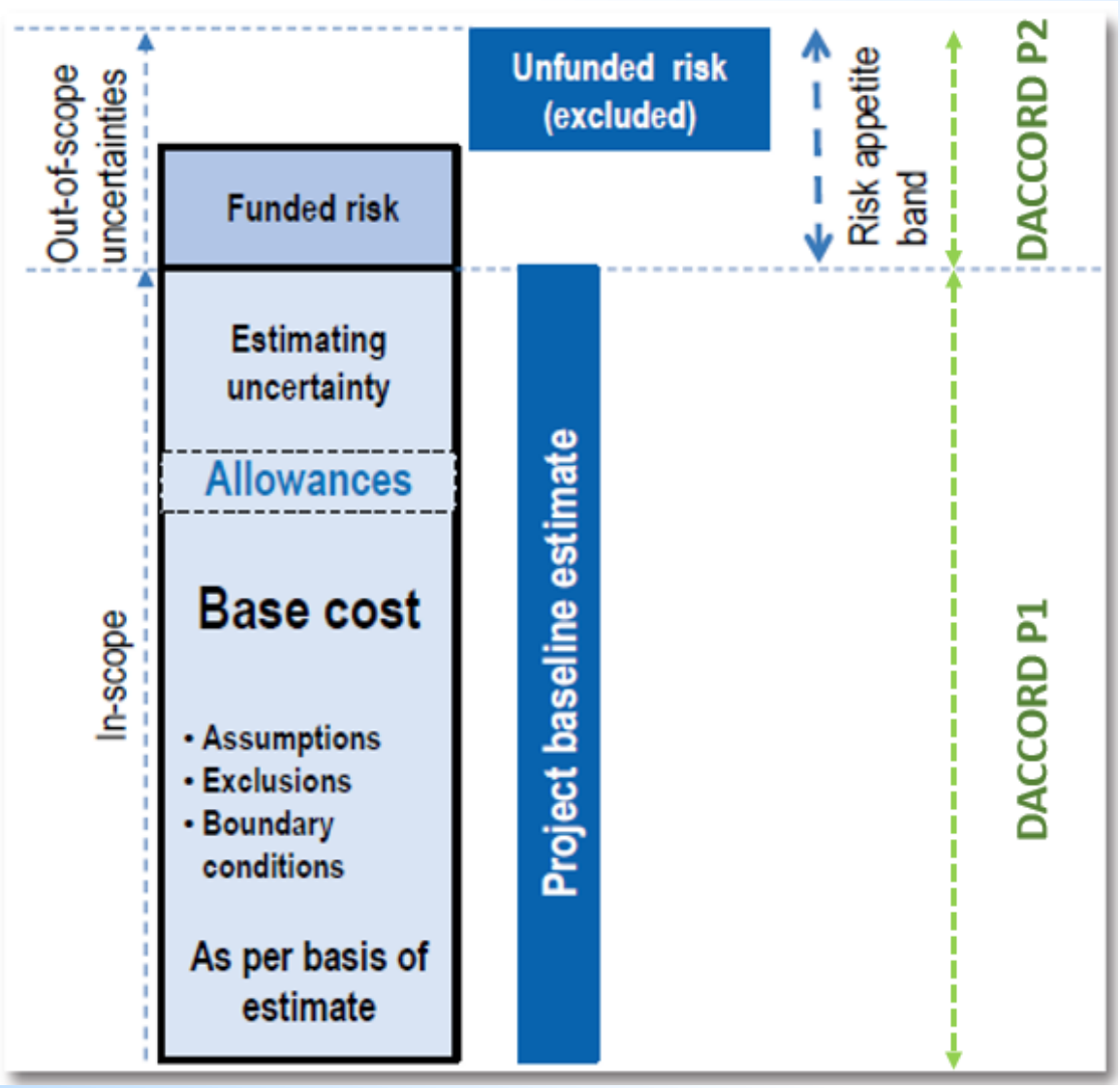
Examples of activities:

- ❑ **Preparatory activities**
- ❑ **Dismantling of components**
- ❑ **Supporting activities**
- ❑ **Finishing activities**

Subject of costing are elementary activities including all relevant cost drivers such as:

- ❑ **staff**
- ❑ **equipment, materials, energy, …**
- ❑ **services**
- ❑ **etc.**

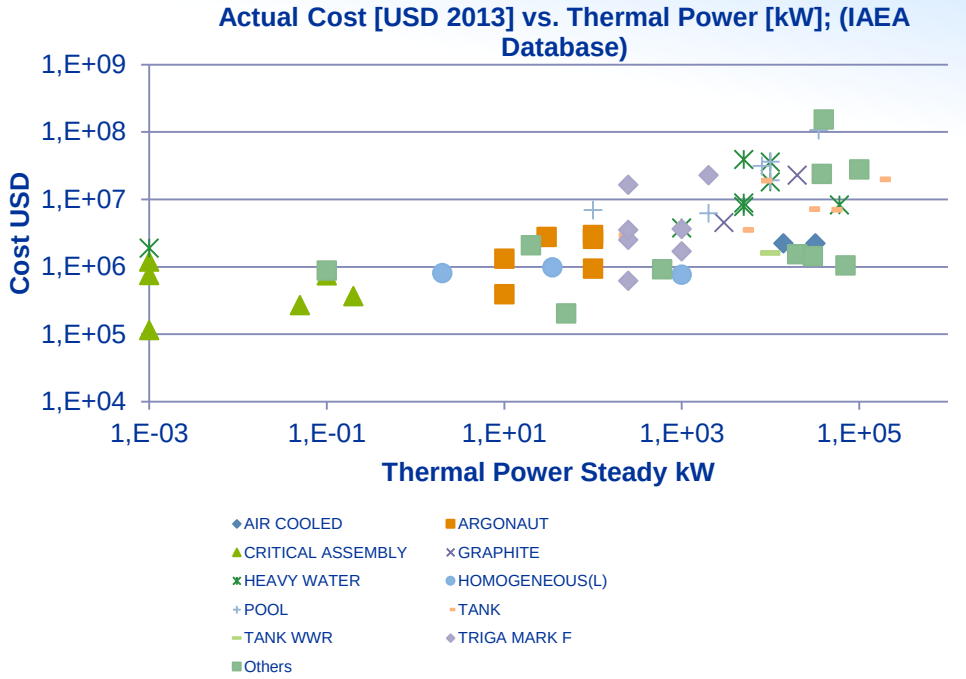
Uncertainties in Decommissioning Cost Estimates

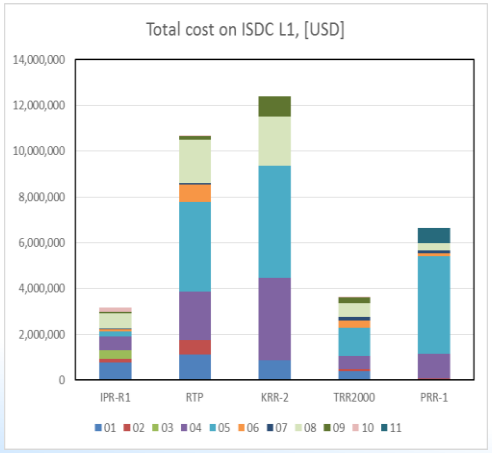


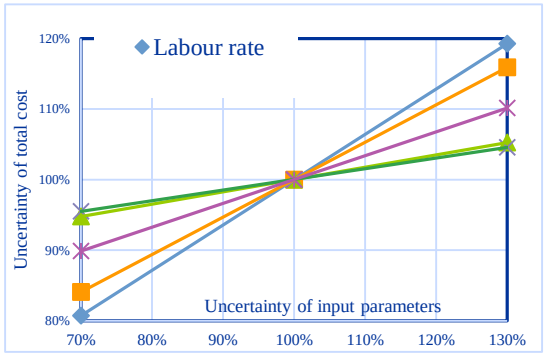
[Source: NEA/IAEA Report on 'Addressing Uncertainties in Cost Estimates for Decommissioning of Nuclear Facilities', NEA Report No. 7344 (2017)]

Collaborative Project: Costing of Research Reactor Decommissioning (DACCORD)

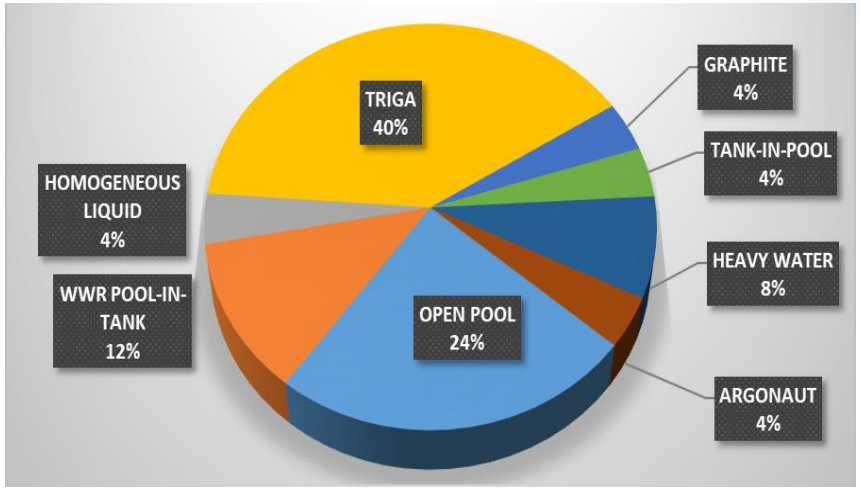
- **Objective**
  - Sharing current good practice on costing of research reactor decommissioning including characterization and addressing uncertainties
- **Timeframe**
  - 2013-2019
  - Final Technical Meeting – 21-25 October, Cadarache *[EVT1804580]*
- **Deliverable**
  - NE Series Report *"Final Report of the DACCORD Collaborative Project" [Early 2021]*
- **Main topics Addressed**
  - Cost estimation for decommissioning
  - Illustrative costing cases
  - Uncertainty analysis
  - Impacts of planning and characterization on decommissioning



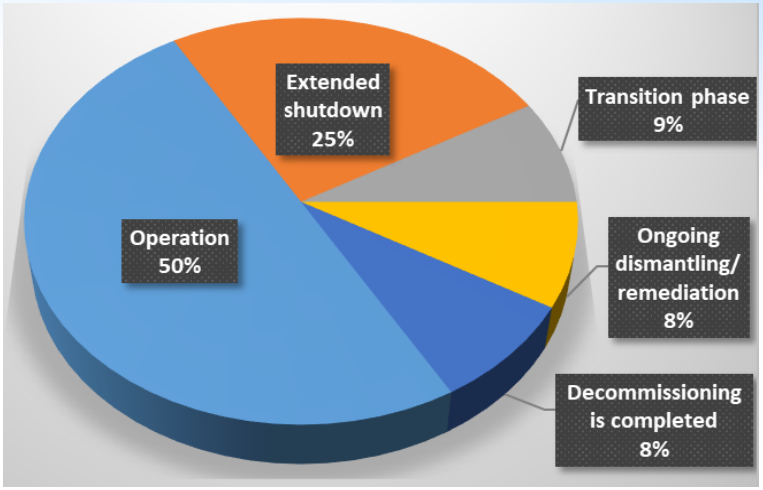




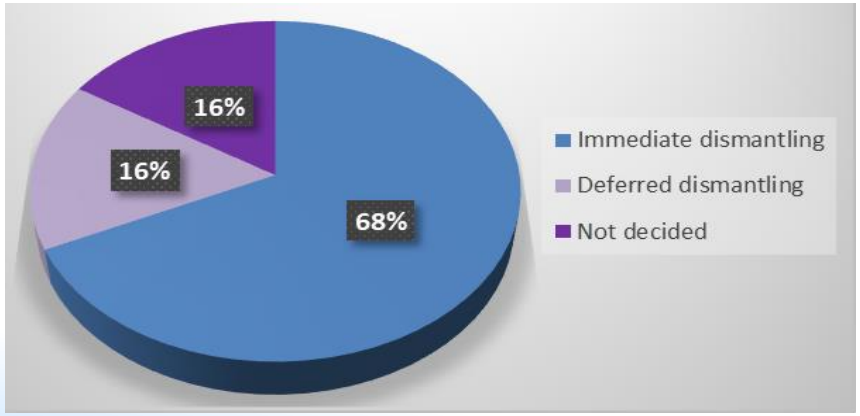
DACCORD Phase 2: Decommissioning Strategies



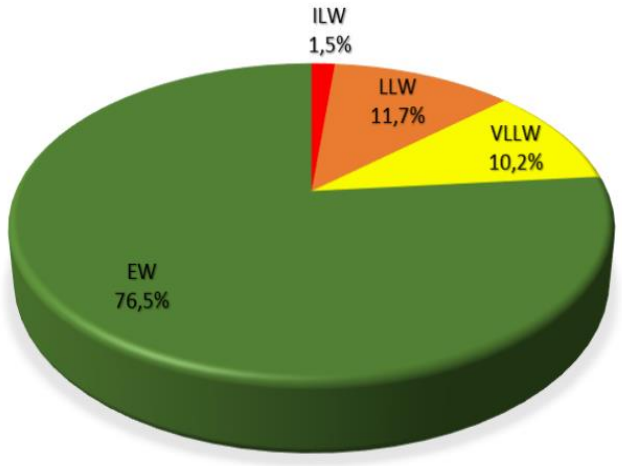
Research reactor types analyzed in Phase 2



Current status of participating reactors

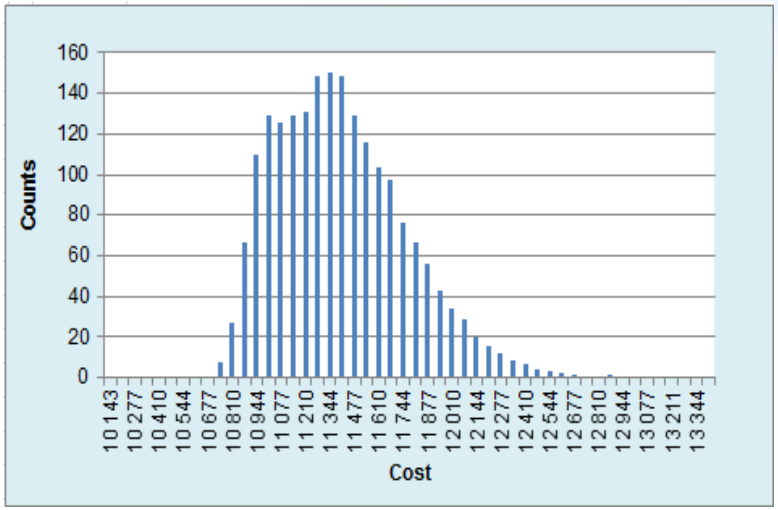


Decommissioning strategy



Average waste generated (participating reactors)

In-scope Cost Assessment (Illustrative)



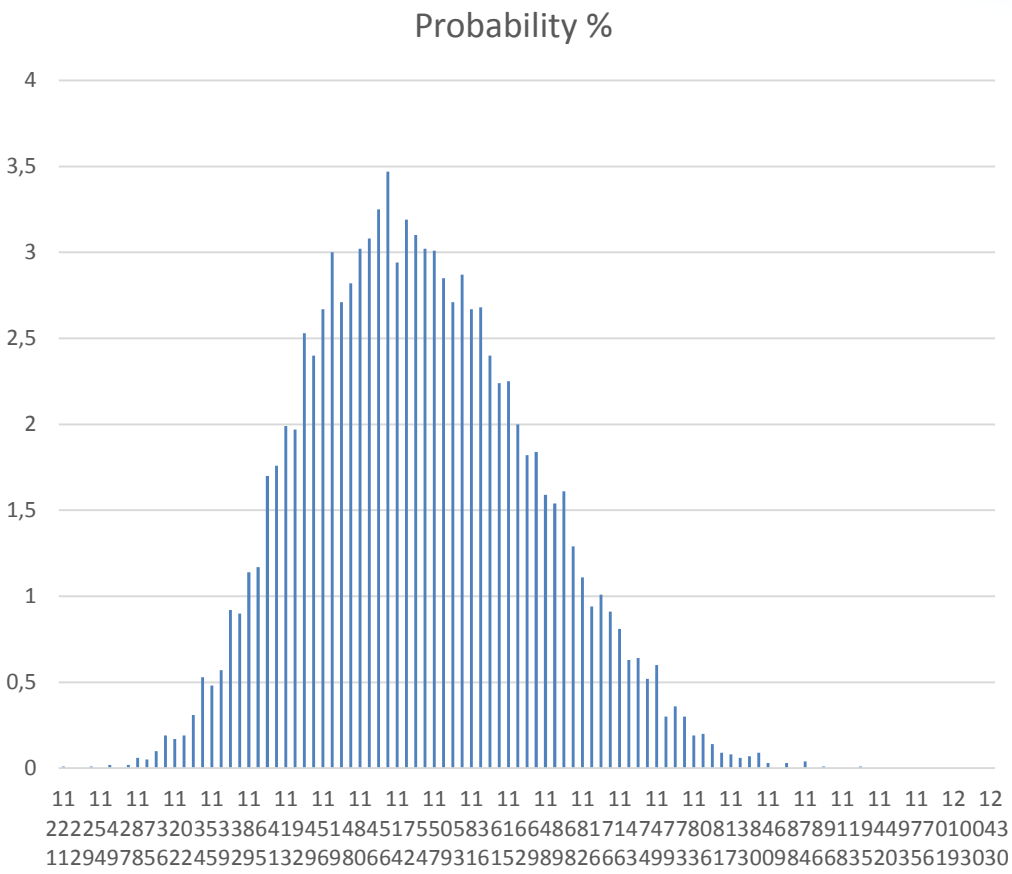
Probabilistically and deterministically calculated total cost for JSI TRIGA (Slovenia)

ISDC No.	ISDC Name	Costs before Contingency [EUR]	Deterministic Contingency [EUR]	Costs with Contingency [EUR]
01	Pre-decommissioning actions	231 577	33 081	264 658
02	Facility shutdown activities	38 462	7 369	45 831
03	Additional activities for safe enclosure or entombment	0	0	0
04	Dismantling activities within the controlled area	2 176 006	480 891	2 656 897
05	Waste processing, storage and disposal	1 574 282	276 430	1 850 712
06	Site infrastructure and operation	2 028 462	202 846	2 231 308
07	Conventional dismantling and demolition and site restoration	0	0	0
08	Project management, engineering and support	5 250 000	525 000	5 775 000
09	Research and development	131 538	13 154	144 692
10	Fuel and nuclear material	0	0	0
11	Miscellaneous expenditures	150 000	15 000	165 000
	Total	11 580 327	1 553 771	13 134 098

Out-of-scope Cost Assessment (Illustrative)

Out of scope risks

- Discovery of asbestos
- Unanticipated low level waste (LLW) waste identified during implementation of decommissioning
- External pressure from stakeholders to demolish the buildings
- Unexpected contamination of concrete due to unknown leakage
- Change of the strategy – contractor will be involved instead of own staff



IAEA 60 Years
Atoms for Peace and Development

Thank you!

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www.iaea.org/nuclearenergy

NEA activities relating to costing of decommissioning & legacy management

Niklas BERGH & Simon CARROLL

EU-H2020- SHARE-Decommissioning

Virtual Workshop, 1-3 December 2020

Key Milestones at the NEA in Decommissioning

1978

First decommissioning programme in the NEA

1985

NEA Co-operative Programme for the Exchange of Scientific and Technical Information Concerning Nuclear Installation Decommissioning Projects (CPD)

2001 - 2018

Working Party on Decommissioning and Dismantling (WPDD)

Decommissioning Cost Estimation Group (DCEG) (2008-2018)

2018

Committee on Decommissioning of Nuclear Installations and Legacy Management (CDLM)

2020

Expert Group on Costing For Decommissioning of Nuclear Installations & Legacy Management (EGCDL)

Extensive work decommissioning costing, including:

- An international structure for presenting NPP decommissioning costs - **ISDC** 2012 (joint report of NEA, EC & IAEA)
- Preparing and reviewing decommissioning cost estimates (‘*Practice*’, 2015; ‘*Peer Reviews*’, 2014)
- **Uncertainties** in decommissioning costing, 2017 (joint report with IAEA)
- NPP decommissioning **cost benchmarking**, 2019
- Costs of NPP decommissioning (**COSTDEC**) 2016
- Workshops and presentations relating to these

- *Links to these reports are included at the end of this presentation*

The CDLM and costing

- The CDLM was established in 2018 as a Standing Technical Committee of the NEA.
- As noted in the CDLM Mandate, one of the objectives of the committee is to:

> *"**further develop approaches for the estimation of decommissioning project costs** by improving understanding of the risks associated with financial consequences in regards to cost estimating and financing; and decommissioning planning for uncertainties, with an overall aim to assist member organisations to develop robust and efficient project management throughout the decommissioning process;…"*

CDLM has created an Expert Group on Costing (EGCDL)

The EGCDL will, for example:

- **foster exchange of information** and experience between its members on issues concerned with cost estimation;
- **describe good practices** in the field of cost estimation for decommissioning and legacy management projects, including understanding of the risks …
- **advise the parent body** on major and emerging issues in the area of cost estimation for decommissioning and legacy management, and provide appraisals of the state of the art;
- **define, conduct and oversee studies** aimed at improving the transparency and reproducibility of cost estimates…

Starting work at the EGCDL

- The EGCDL has its initial ‘kick-off’ meeting in September 2020.
- A Programme of Work is under development for 2021-2022
- A Chairpersonship and Bureau Members has been appointed

EGCDL Bureau	Organisation & Country
Milena KOSTOVA *(Chair)*	CNSC, Canada
Alec KIMBER	ANSTO, Australia
Niklas BERGH	Westinghouse, Sweden
Paolo GUI	SOGIN, Italy
Karl SANDERSON	NDA, UK

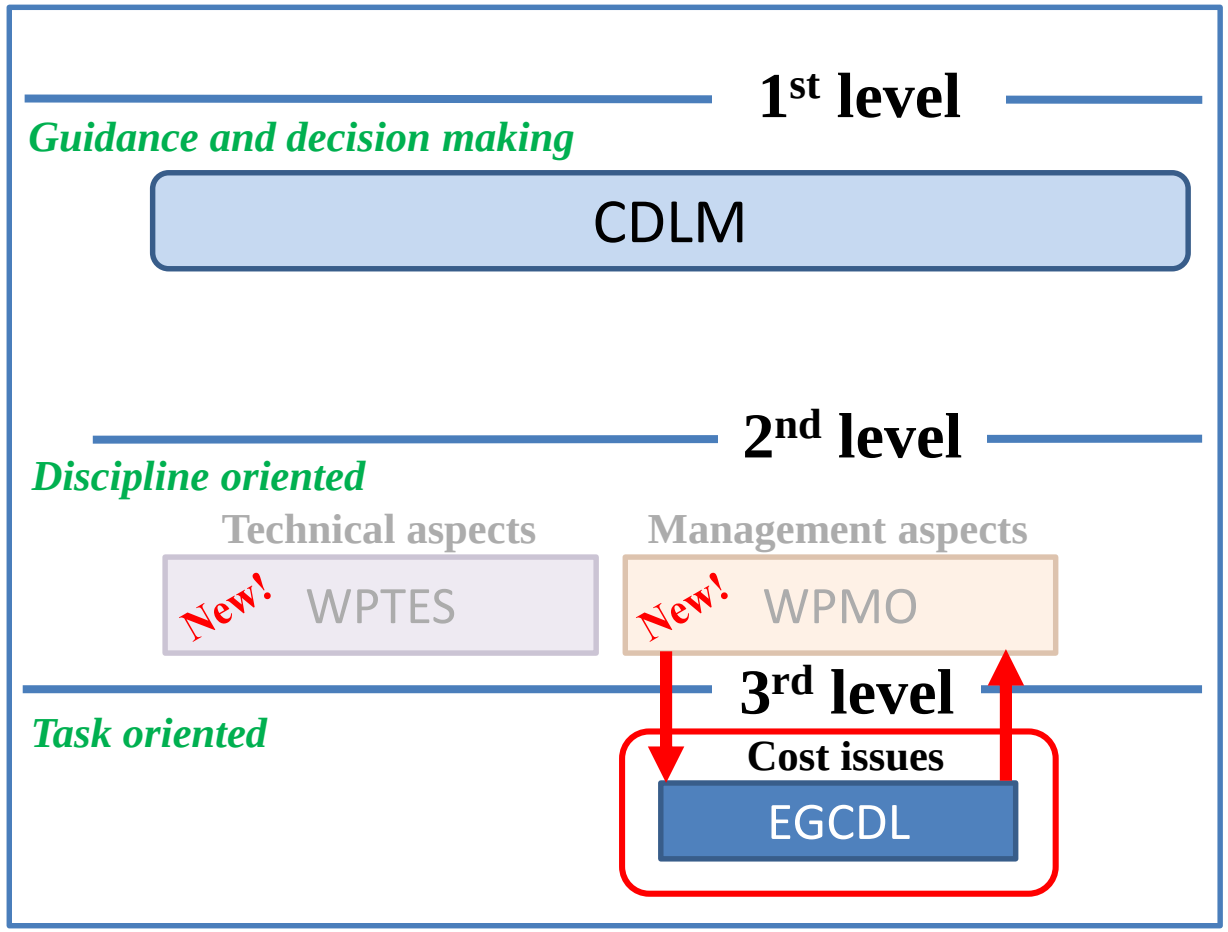
EGCDL is developing its Programme of Work for 2021-2022

- Several themes identified as possible priority areas

Topic	*Examples of considerations for potential development into specific activities & ToR for work*
Further development of benchmarking work & analysis of data	• Stepwise building on previous work • Identification of necessary data & relevant metrics • Practical considerations in data sharing & comparisons • Identification of cost drivers & risk factors
Review & update of existing guidance	• Integrate & update ISDC & uncertainties • Broaden applicability to address legacy management • Extend range of facilities and situations covered
Cost information as a tool for communication with stakeholders and decision makers	• Validation & 3rd party review of estimates • Guidelines on presenting cost information

Relationship between CDLM and EGCDL

- The EGCDL is a task-oriented expert group, providing specialised inputs into the work of CDLM
- The EGCDL will report to a new Working Party which has a portfolio of work related management and organisational aspects of decommissioning and legacy management (WPMO)
- The WPMO is expected to start work in 2021



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Martin BRANDAUER, NEA, martin.brandauer@oecd-nea.org

THANK YOU.

Selected reports

Decommissioning Cost Estimation Group (DCEG)	**International Structure for Decommissioning Costing (ISDC) of Nuclear Installations, 2012** ***(with IAEA & EC)*** http://www.oecd-nea.org/rwm/reports/2012/ISDC-nuclear-installations.pdf
	Guide for **International Peer Reviews** of Decommissioning Cost Studies for Nuclear Facilities, 2014 https://www.oecd-nea.org/upload/docs/application/pdf/2019-12/7190-guide-peer-reviews.pdf
	The **Practice of Cost Estimation** for Decommissioning of Nuclear Facilities, 2015 http://www.oecd-nea.org/rwm/pubs/2015/7237-practice-cost-estimation.pdf
	Addressing Uncertainties in Cost Estimates for Decommissioning Nuclear Facilities, 2017 ***(with IAEA)*** https://www.oecd-nea.org/rwm/pubs/2017/7344-uncertainties-decom-cost.pdf
	Cost Benchmarking for Nuclear Power Plant Decommissioning, 2019 http://www.oecd-nea.org/rwm/pubs/2019/7460-cost-benchmark-decom.pdf
Ad Hoc Expert Group on Costs of Decommissioning (COSTDEC)	**Costs of Decommissioning Nuclear Power Plants, 2016** http://www.oecd-nea.org/ndd/pubs/2016/7201-costs-decom-npp.pdf

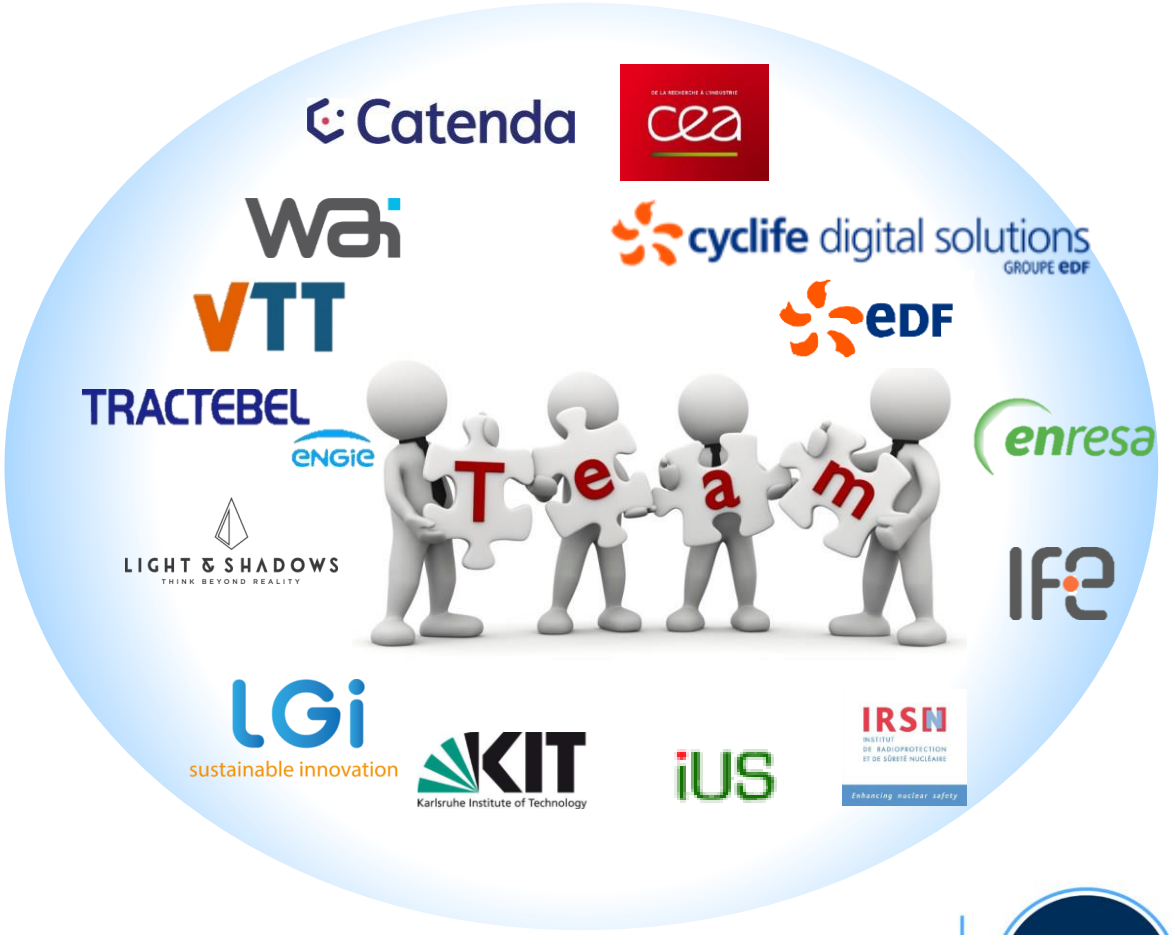
PLEIADES a Smarter Plant Decommisioning

Caroline CHABAL (CEA, project leader)

PLEIADES
Smarter Plant Decommissioning

PLEIADES: introduction

- PLatform based on Emerging and Interoperable Applications for Enhanced Decommissioning PRocessES
- Call for projects: H2020 NFRP-2019-09 – "Fostering innovation in decommissioning of nuclear facilities"
- Duration: 3 years (1/10/2020-30/09/2023)
- Consortium: 14 partners
  - 7 countries: FR (6), DE (2), NO (2), ES (1), FI (1), BE (1), SK (1)
  - Academic (1), TSO (1), research organisations (3), industrial companies (4), SMEs (5)

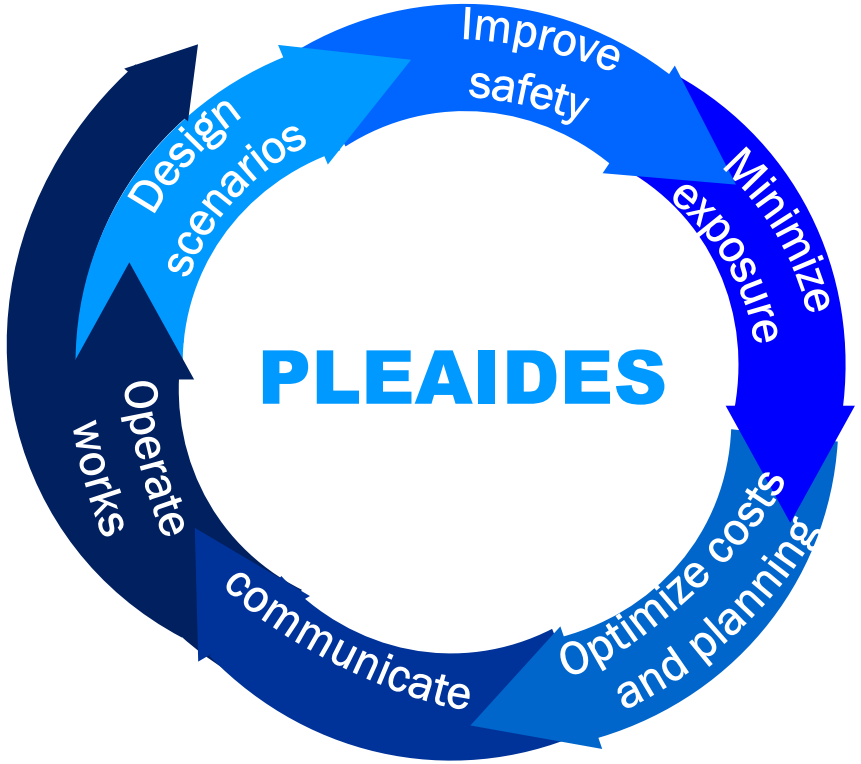


European Commission

PLEIADES: Objectives

✓ Develop an innovative platform based on a BIM approach

→ define a BIM approach to **design scenario**, **improve safety**, **minimize radiation exposure**, **optimize costs and planning**, **communicate**



European Commission

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→ define a BIM approach to **design scenario**, **improve safety**, **minimize radiation exposure**, **optimize costs and planning**, **communicate**

→ based on a “multi-dimensional modelling”, including **3D model**, **time**, **dose**, **feasibility studies**, **waste** and **costs**

→ **11** emerging software provided by the consortium (TRL 5-7) capable of exchanging data (interoperability).

iDROP (CEA)
DEMplus (CYCLIFE DS)
VRdose (IFE)
Aquila costing (WAI)
RadPIM (IFE)
IMS (IUS)
3DScanPF (KIT)
INTERACT (LS)
ARWorkflow ALVAR (VTT)
LLWAA-DECOM (Tractebel)
DIM (EDF)

European Commission

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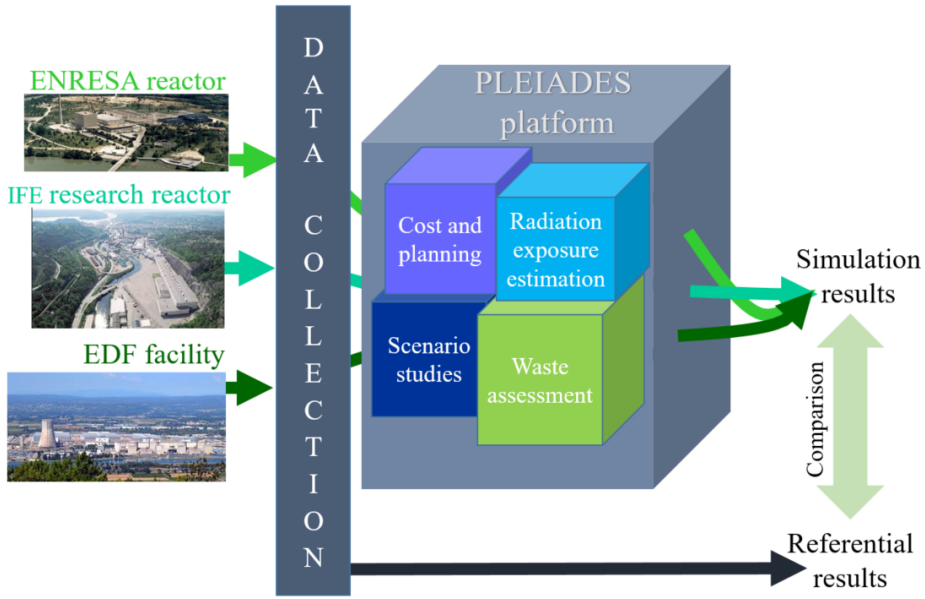
→ implementation on real cases



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→ implementation on real cases

✓ Develop an associated methodology and impose it as a standard

→ establish a standardized process to organize the data collected throughout the project in datasets (codebooks, instructions, naming conventions…)

European Commission

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✓ Develop an associated methodology and impose it as a standard

→ establish a standardized process to organize the data collected throughout the project in datasets (codebooks, instructions, naming conventions…)

✓ Prepare the exploitation of the PLEAIDES platform

s the market potential

a comprehensive exploitation strategy with preliminary business plan

te training for the application in decommissioning

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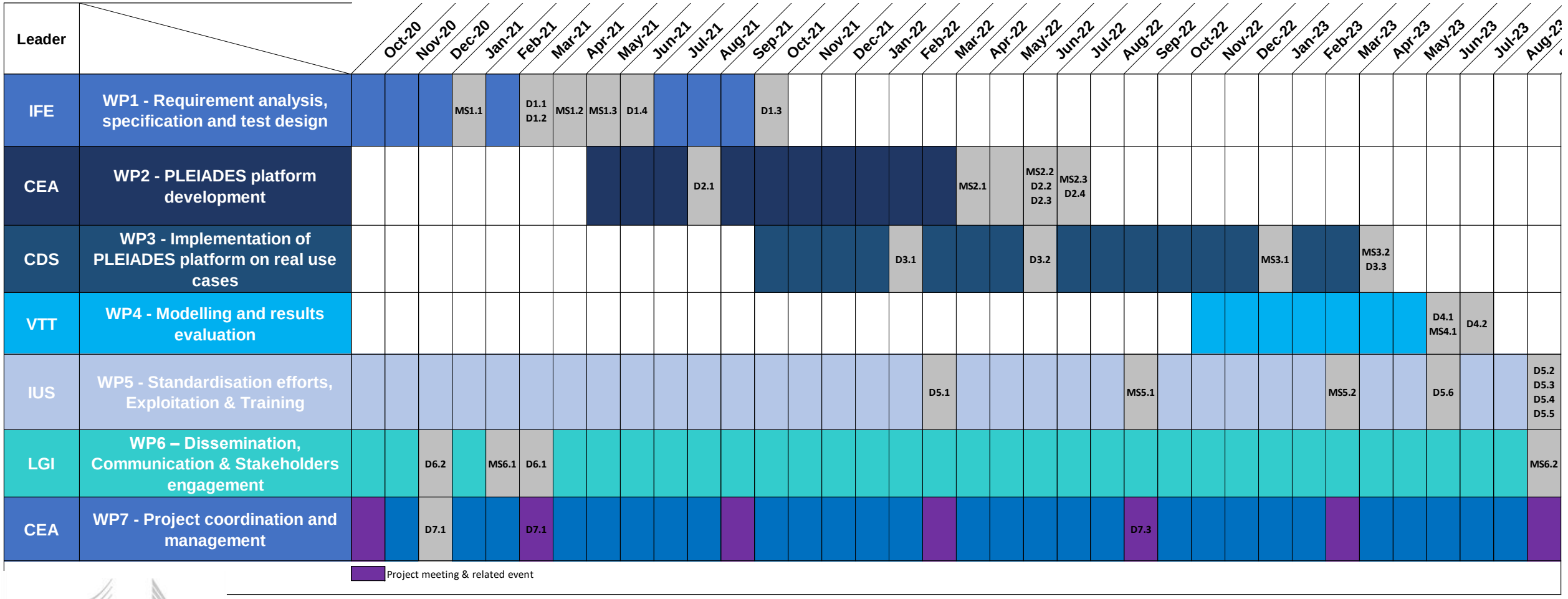
PLEIADES: Planning



Thank you!

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PLEIADES
Smarter Plant Decommissioning