

Progress meeting WP2



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SO-FREE Progress meeting 14.03.2024 in Dresden

Progress meeting WP2

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SO-FREE Progress meeting 14.03.24

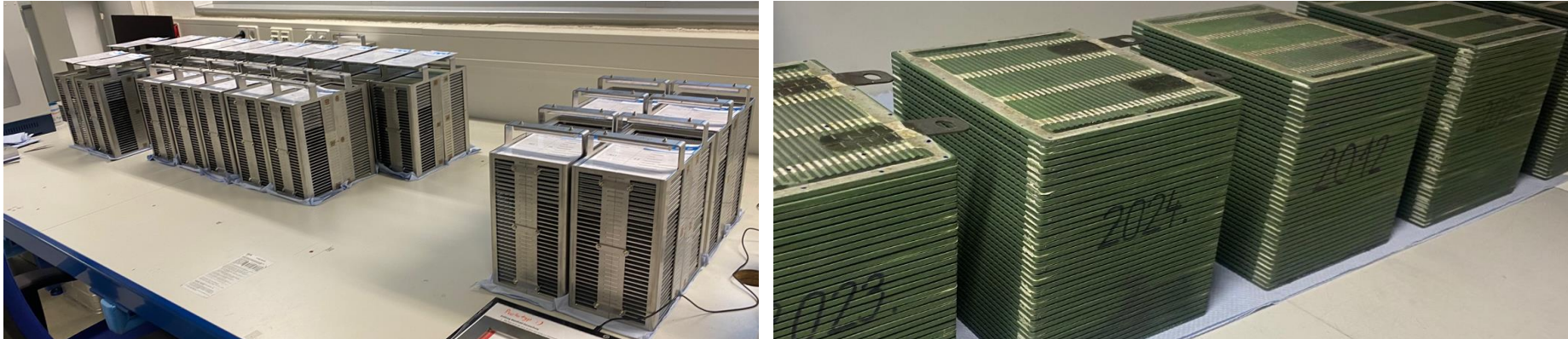
Overview WP2 - Objectives

Work package (WP) number	2			Start date or starting event:				M1	
WP title	System-ready stacks								
Participant nr.	1	2	3	4	5	6	7	8	9
Participant short name	ENEA	AVL	ELC	IKTS	ICI	IEN	KIWA	PGE	USGM
Person-months per participant	18	4	17	20.5	4	22	0.5	0	0

- Alignment of experimental set-ups and supply of **short stacks** for performance map
- **Benchmark different stack types** (ESC vs. ASC) and establish performance maps on stack level for system simulation and efficiency calculations
- Generate a **stack module** design for reliable system integration with **standardized interface**, assuring reliable electrical stack connections with low parasitic losses in the module, good tightness of gas interfaces and high voltage insulation in the stack module
- **Delivery** of finalized **stack modules** for system integration in WP3

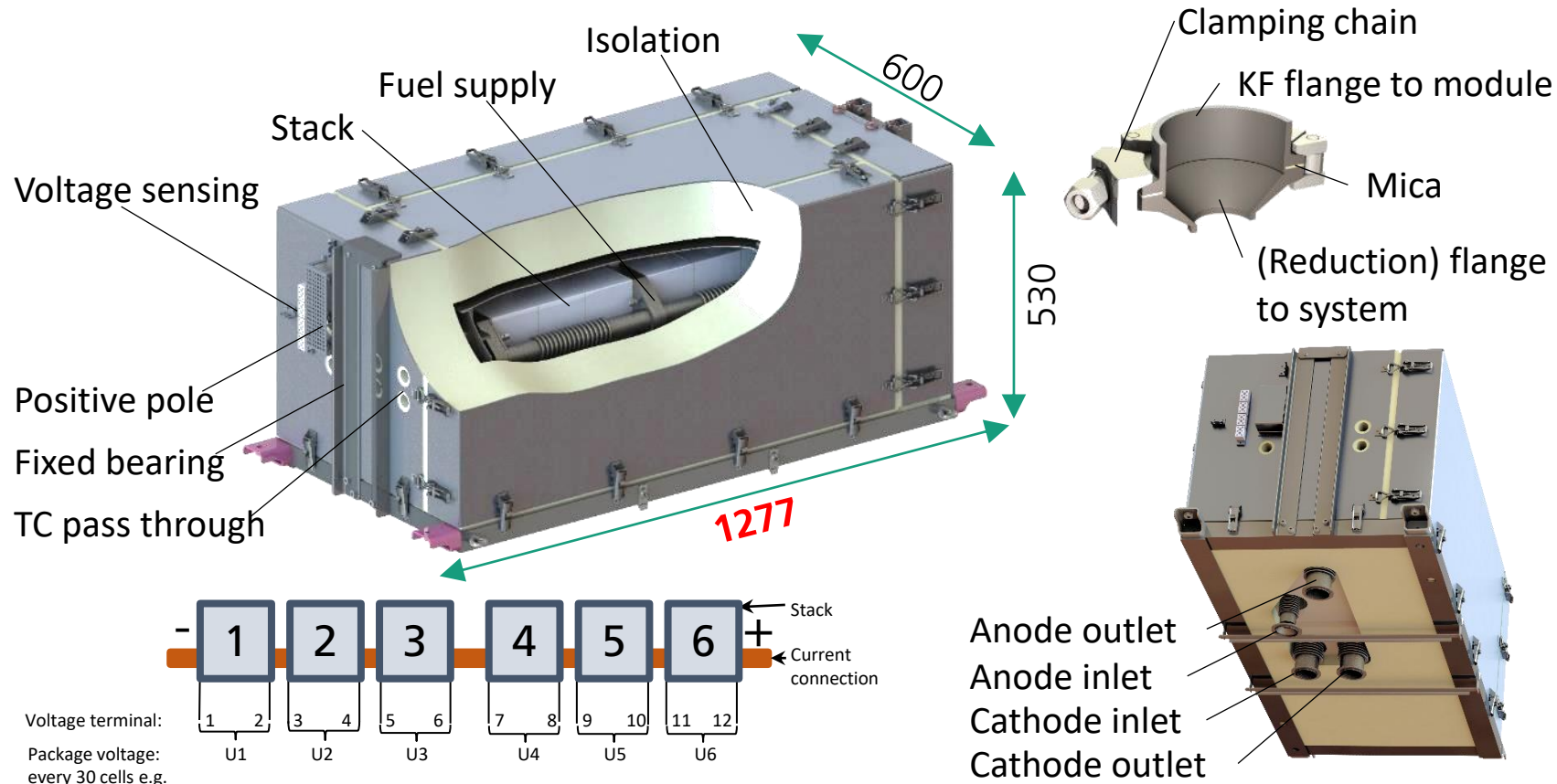
Task 2.5: Assembly, initialization and delivery of IKTS stack modules for system integration

- Existing lab manufacturing at IKTS Dresden for all existing projects



→ Stacks for stack module ready for stack module integration

Task 2.5: Assembly, initialization and delivery of IKTS stack modules for system integration

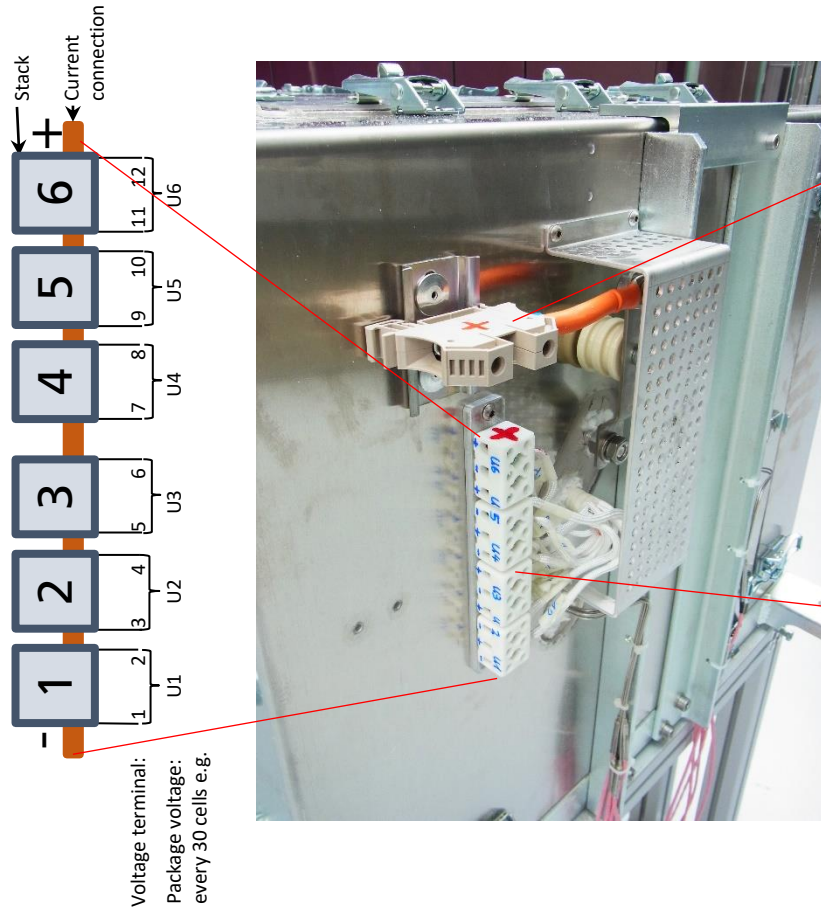


Actually status:

- Assembly
- Commissioning June 2024
- Ready for shipment July 2024
- Gen2 or refurbishment of Gen1 in October 2024

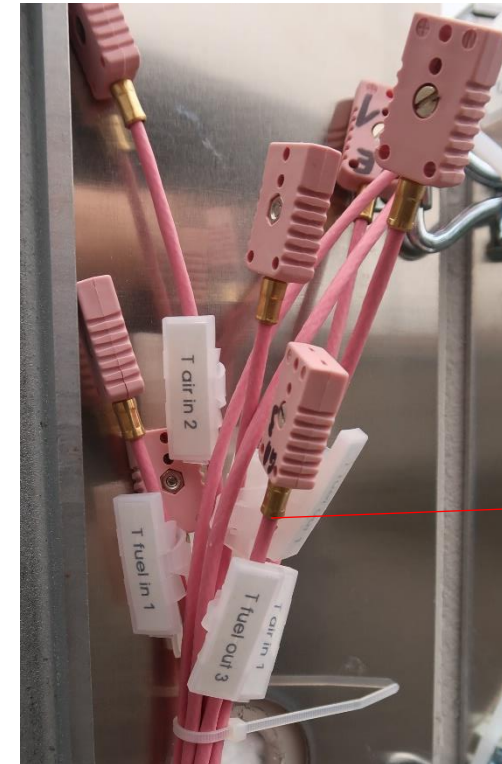

Task 2.5: Assembly, initialization and delivery of IKTS stack modules for system integration

Sensing and power connection



Power connection via terminal blocks

Luster terminal interface for voltage (package) sensing

Labeled socket Type N thermocouples for long-term stable operation

Task 2.5: Assembly, initialization and delivery of IKTS stack modules for system integration

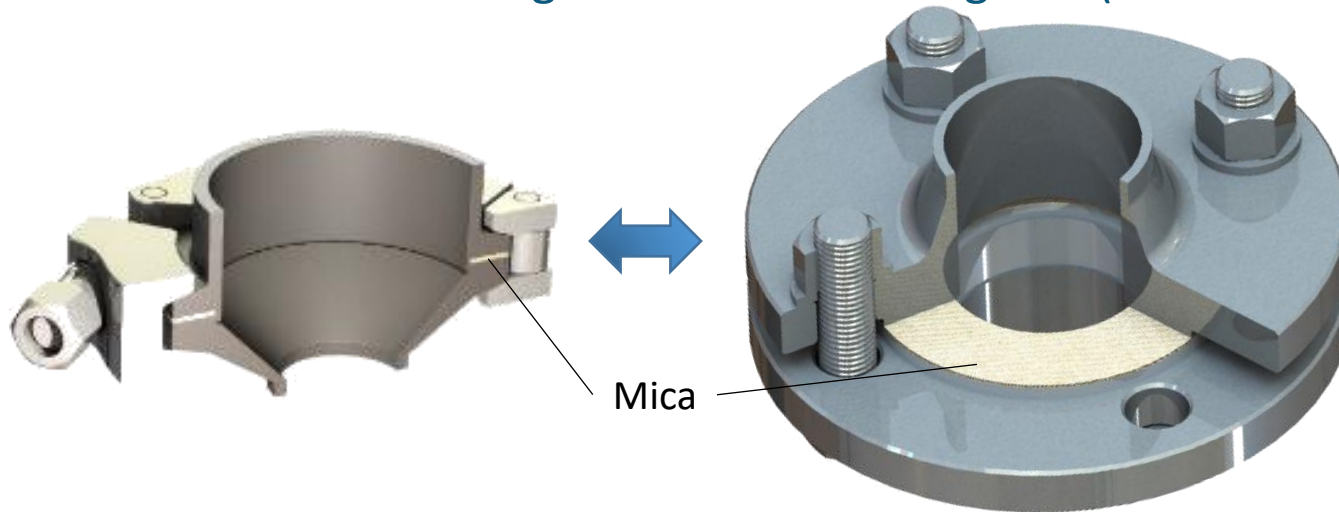
Assembly of air box and base plate



Task 2.5: Assembly, initialization and delivery of IKTS stack modules for system integration

Standardization issue (not for existing stack module)

- Flanges are not technical tight → Certified lab for tests necessary (new standards)
- Change to DIN flanges in future
- Task force “HT-flanges” for summarizing info (next months)



KF flange

DIN flange

	KF flange	DIN flange
Pros	Compact solution Easy to assemble/ mount	Better sealing under higher pressure
Cons	Less sealing under higher pressure	Needs more space More difficult to assemble and align

Task 2.5: Assembly, initialization and delivery of IKTS stack modules for system integration

Standardization issue (not for existing stack module)

- Stephen McPhail → Paul McLaughlin @KIWA:

I have been looking at flanges recently, and I thought it was worth drawing your attention to the EN 1591 series of standards. These are the standards that allow calculations to be made regarding torque settings for making up joints, and include EN 1591-4 which is about the competency of technicians and engineers to make up flanged joints. As this was a subject of concern at the SO-FREE meeting, it might be worth looking at? Perhaps specifying that flanged joints between electrolyser stacks and balance of plant should only be made by bolting technicians whose competency has been certified and maintained in accordance with EN 1591-4 would be sufficient for the project. A quick search shows that there are various organisations across European countries that offer such training and certification.

The EN 1591 series as a whole is as below:

EN 1591, *Flanges and their joints*, consists of the following parts:

- [EN 1591-1](#), *Flanges and their joints — Design rules for gasketed circular flange connections — Part 1: Calculation method*
- [EN 1591-2](#), *Flanges and their joints — Design rules for gasketed circular flange connections — Part 2: Gasket parameters*
- [CEN/TS 1591-3](#), *Flanges and their joints — Design rules for gasketed circular flange connections — Part 3: Calculation method for metal to metal contact type flanged joint*
- [EN 1591-4](#), *Flanges and their joints — Part 4: Qualification of personnel competency in the assembly of the bolted connections of critical service pressurized systems (the present document)*
- [CEN/TR 1591-5](#), *Flanges and their joints — Design rules for gasketed circular flange connections — Part 5: Calculation method for full face gasketed joints*

- Can the sealing solve the issues? Contact to Flexitallic (Alessandro Cavalli)

Conclusion

- Support for stack module operation based on draft IOM (12.06.2023) at ICI Caldaie
- Discussion of achieved short stack results
- Final assembly and commissioning of 180 cell MK35x stack module

Next steps - IKTS

- Paper of achieved short stack results together with ENEA
- Assembly of stack module
- Initialization at IKTS
- Update IOM
- Shipment of stack module Gen 1
 - D2.4 to M39 (03/24) (Amendment procedure)
- Flange certification for different versions:
 - Task force “HT-flanges” will summarize state of art
 - Plan for certification
 - Tests of flange connection for validation

Important side note

- SOFC were meant to be the game changer in energy supply
 - CHP Demonstrators in the field, Demonstrators for offgrid and ships
 - Bosch, Convion, Alma Cleanpower, Solydera,...
 - Hard business at this time
- SOEC is a disruptive technology and path the way for SOFC
 - Green H₂+CO production by SOEC
 - Gamechanger for SOFC technology
 - SOFC will profit from price reduction

Important side note

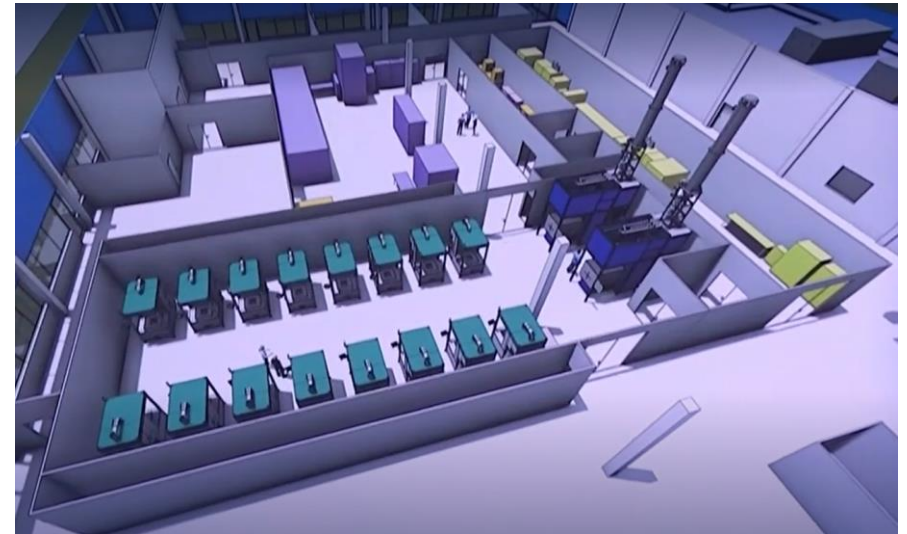
- Strategic partnership with ThyssenKrupp Nucera for SOE-stack module



[13.03.2024 Press release: thyssenkrupp nucera and Fraunhofer IKTS agree on a Strategic Partnership in SOEC Technology - Fraunhofer IKTS](#)

Important side note

- Strategic partnership with ThyssenKrupp Nucera for SOE-stack module
 - Start of pilot line at IKTS Arnstadt →TKN
 - R&D of MK35x stacks and stack module at IKTS
 - Increase capacity at TKN
 - Commercial available MK35x stacks
 - Price reduction by mass production



[13.03.2024 Press release: thyssenkrupp nucera and Fraunhofer IKTS agree on a Strategic Partnership in SOEC Technology - Fraunhofer IKTS](#)

Progress meeting M36 WT2.6

Valtteri Vedensola
Matti Noponen

Elcogen Oy

Overview WT2.6 - Objectives

- Assembly, initialization and **delivery of Elcogen stack modules for system integration**
- Leader: ELC
- Partners: AVL, ICI

- Elcogen E3000 **stack manufacturing & adapting the stacks to the standardized stack module design**

- Extracting drawings from CAD, **procurement of parts and manufacturing of components for stack module**

- Integration of stacks in the module, **assembly of stack modules for system integration**
- Commissioning tests of stack modules before delivery for system integration

- **Delivery** of Generation 1 ELC stack module (M39, March 2024 per 2nd amendment)
- **Delivery** of Generation 2 ELC stack module (M43, July 2024 per 2nd amendment)

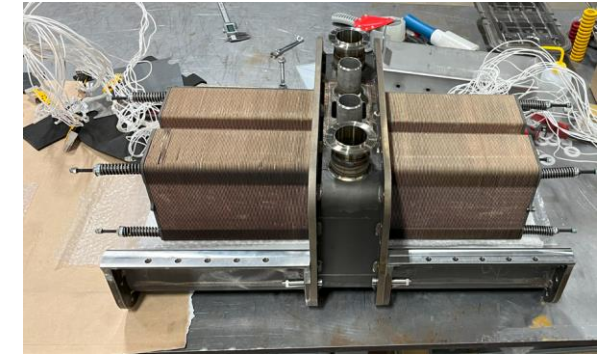
Results summary

- **2 sets of 2x1 stack module parts have been received** and inspected at Elcogen
 - Stack module (excl. thermal insulation and covers) have been test assembled
- **Module supports, pipes and pipe supports designs done**, parts ordered, to be received during March 24.
- **Thermal insulation + baseplate detailed design frozen**
 - Calculations & Strength simulation of baseplate for lifting done
 - Two thermal insulation + module housing concepts ready, quotations received, order to be placed this week
- **1st Gen Elcogen module delivery is delayed by 1-2 months**
 - Iteration rounds with thermal insulation and housing with manufacturer took longer than expected

Stack module parts received, inspected, test assembled

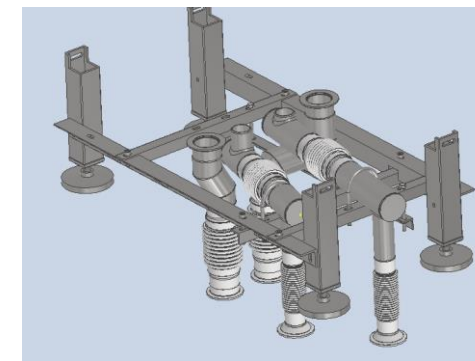
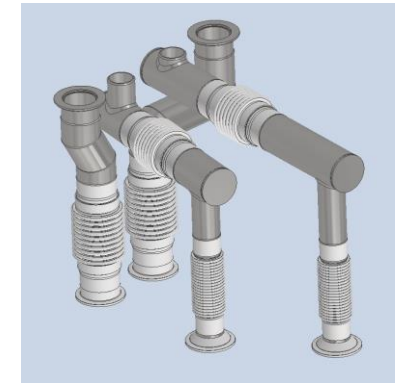
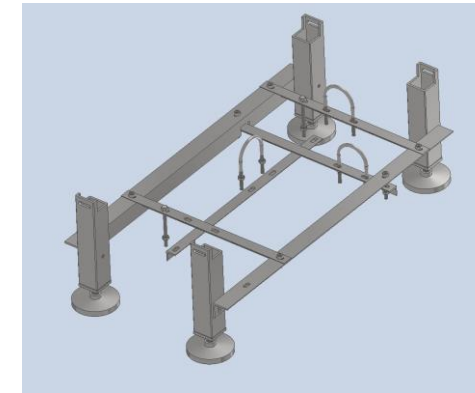


- Module test assemblies done vertically and horizontally



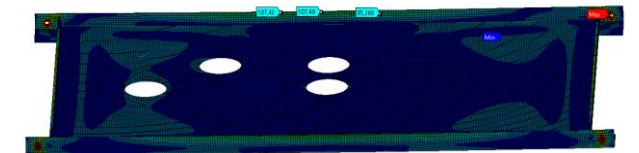
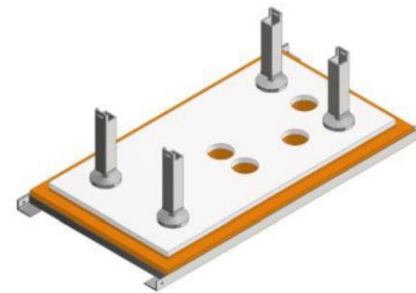
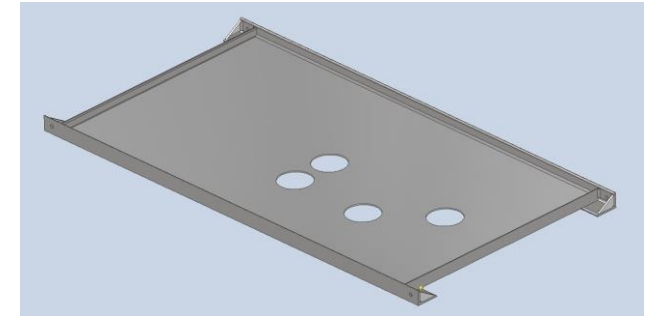
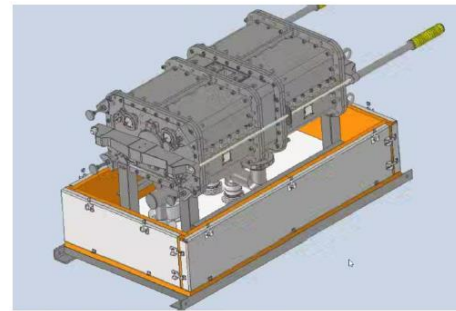
Pipes and pipe/module supports

- Detailed designs done
- Single parts received
- Welding ongoing and ready during March



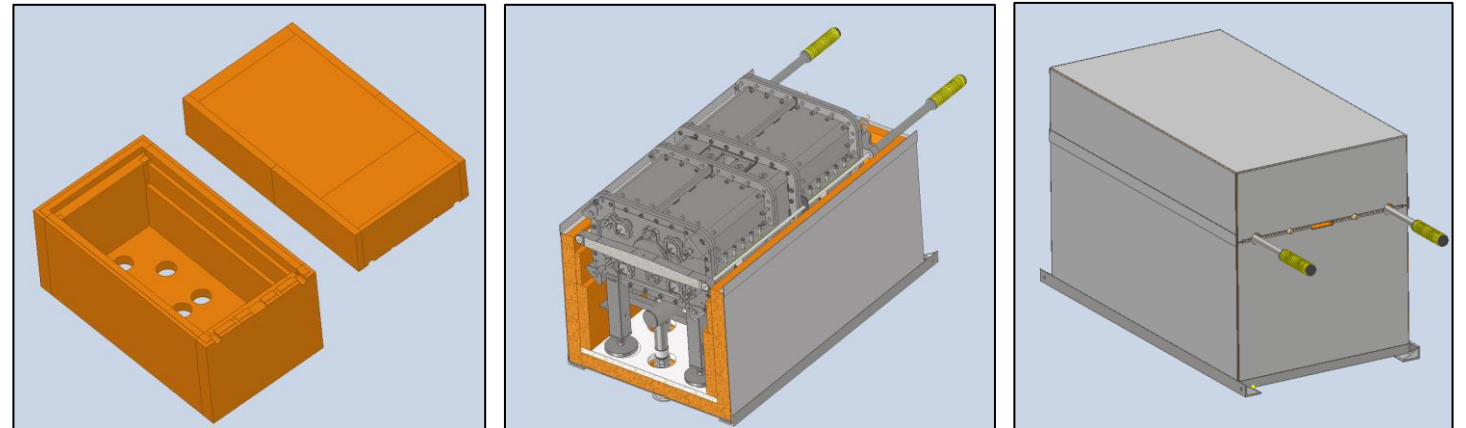
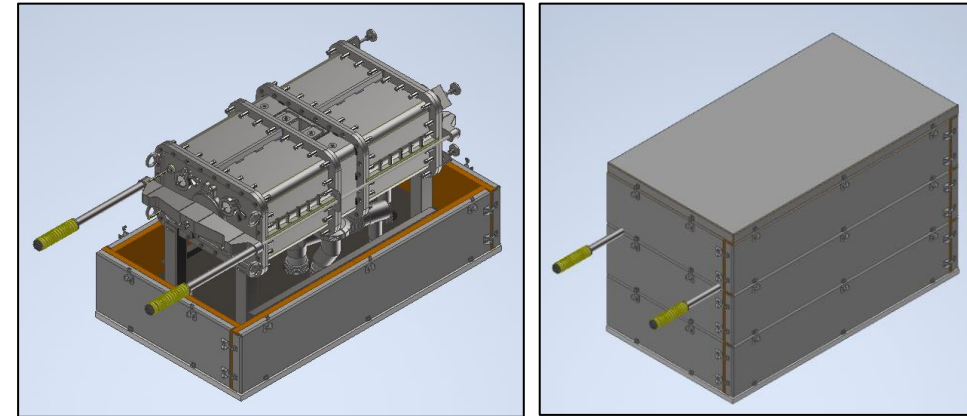
Baseplate

- Baseplate for lifting the module
- Strength calculations and simulations for baseplate done
- Baseplate ordered together with sheet metal covers



Thermal insulation and housing

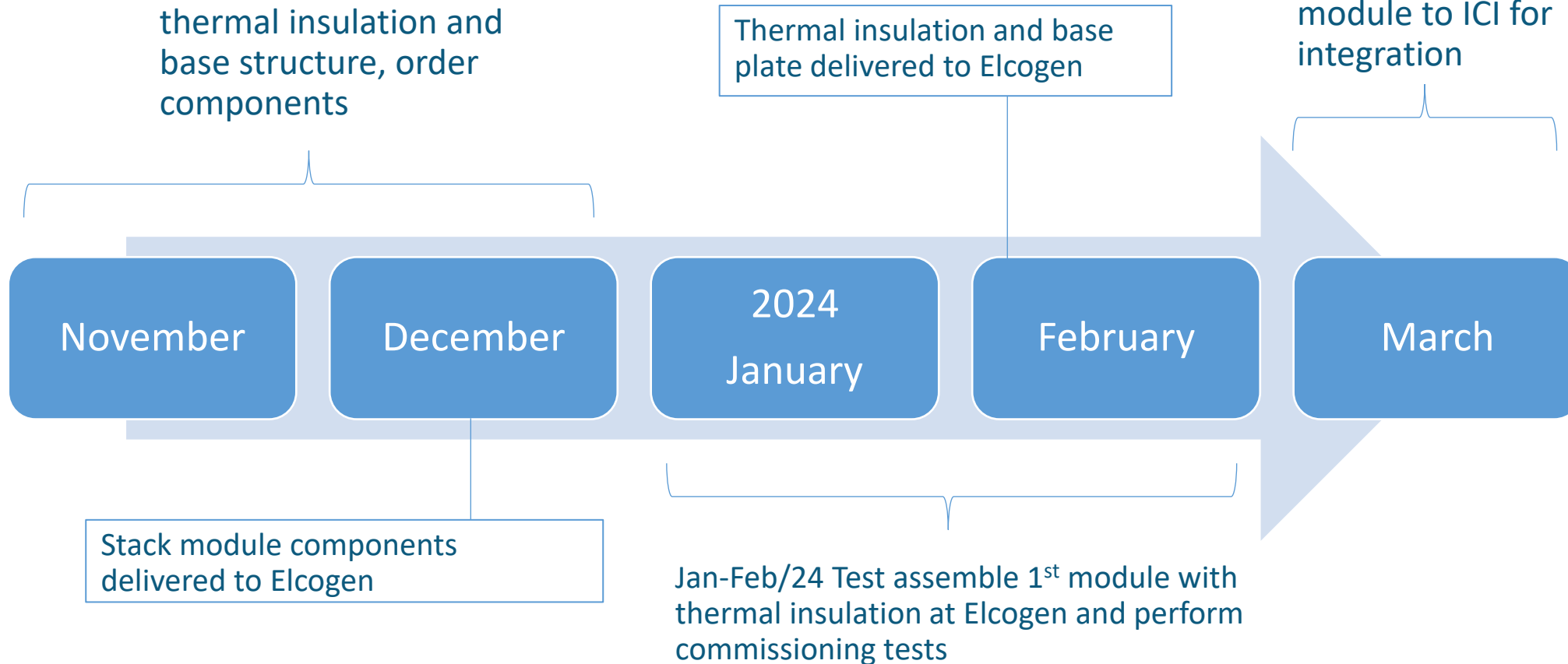
- Concepts and iteration rounds done with the manufacturer
- Two best concepts have been chosen and further detailed
- Quotation received, order during this week



Schedule (from M30 meeting)

- Q4/23 Finalize the thermal insulation and base structure, order components

- March/24 Ship the 1st module to ICI for integration

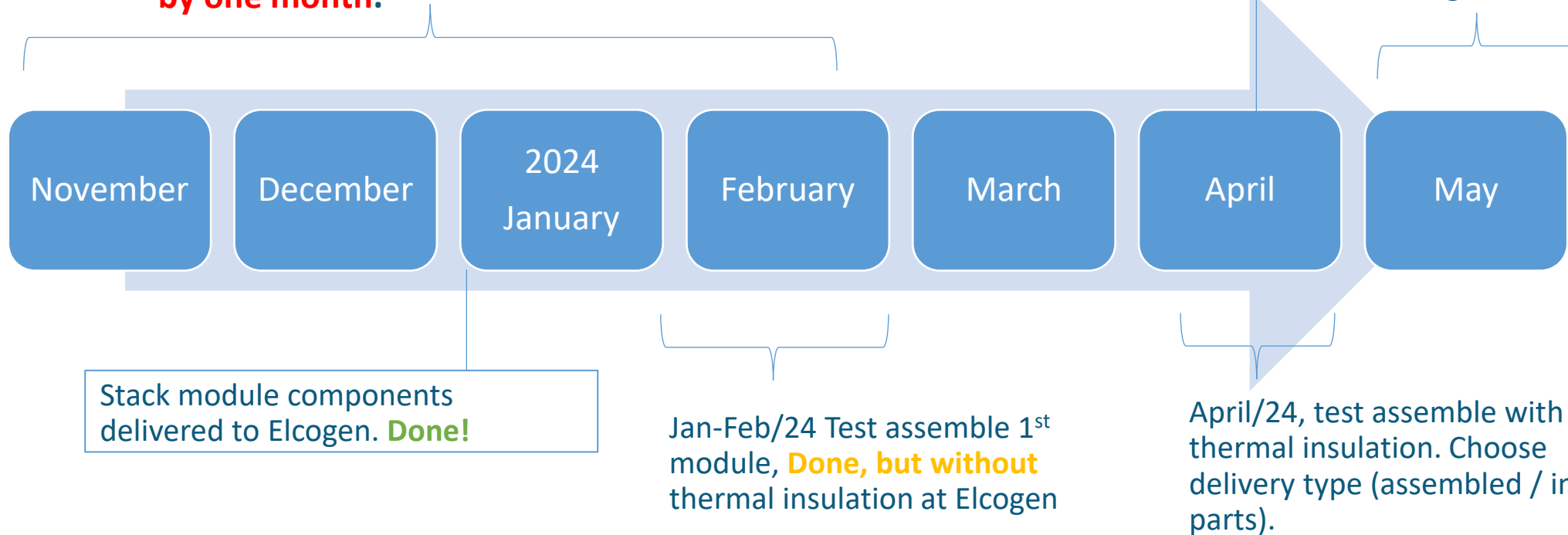


Schedule (updated with delays)

- Q4/23 Finalize the thermal insulation and base structure, order components. **Extended by one month.**

Thermal insulation and base plate delivered to Elcogen. **Delayed by 1,5 months.**

- May 24 Ship the 1st module to ICI for integration



Progress meeting WP2

Francesca Santoni
ENEA

SO-FREE Progress meeting

WP2 System-ready stacks Results

- Task 2.1 Alignment of experimental facilities @ENEA – **Completed ✓**
- Task 2.2 Delivery of Fraunhofer IKTS stacks and performance evaluation @ENEA – **Completed ✓**
- Task 2.3 Delivery of Elcogen cks and performance evaluation @ENEA – **Completed ✓**

Test results (ENEA) already presented in last meeting and reported in the **Del 2.1 and Del 2.2**

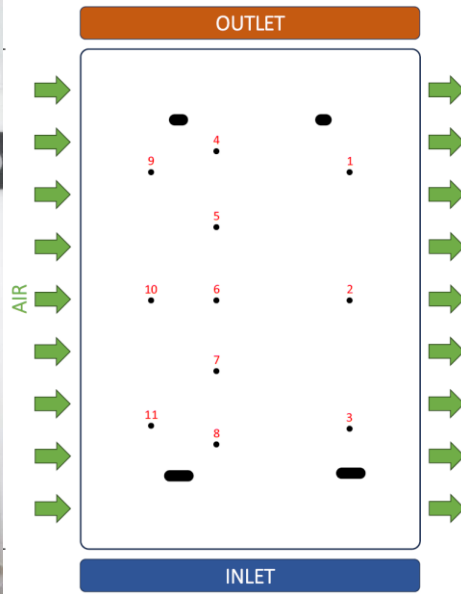


WP2 System-ready stacks (ENEA)

NEXT STEPS

- Multi-sampling test campaign for MK354 stack – by end of the project

The test could start before Easter- Testing only the condition in Full load.



WP2 next steps

- D2.2 Report on short stack characterization tests (M14) → done M28 – ENEA
- D2.4 IKTS stack module Gen 1 evaluated and ready to deliver for system integration
IKTS (delivery to ICI July 2024)
- D2.5 Elcogen stack module Gen 1 evaluated and ready to deliver for system integration
ELC (delivery to ICI July 2024)
- All Gen2 stack modules will have only minor adaptations
- D2.6/2.7 stack module Gen 2 (planned M27) → shifted to **October 2024** (ICI)
- MS8: Delivery of commissioned stacks for system integration Gen2 (M27)
IKTS and ELC means of verification: Deliverables 2.6 and 2.7 → shifted to **October 2024** (ICI)
- Extra deliverable D2.8 for “additional” measurement on MK354 PM & GC measurement

*Thank you for your work performed in WP2
&
Thank you for your attention*