



# University R&D Panel Session

*The 7<sup>th</sup> International Supercritical CO<sub>2</sub> Power Cycles Symposium*  
*San Antonio, Tx*

## *Impact-Driven Research*

David T. Sánchez  
University of Seville



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7<sup>th</sup> Supercritical CO<sub>2</sub> Power Cycle Symposium, San Antonio TX

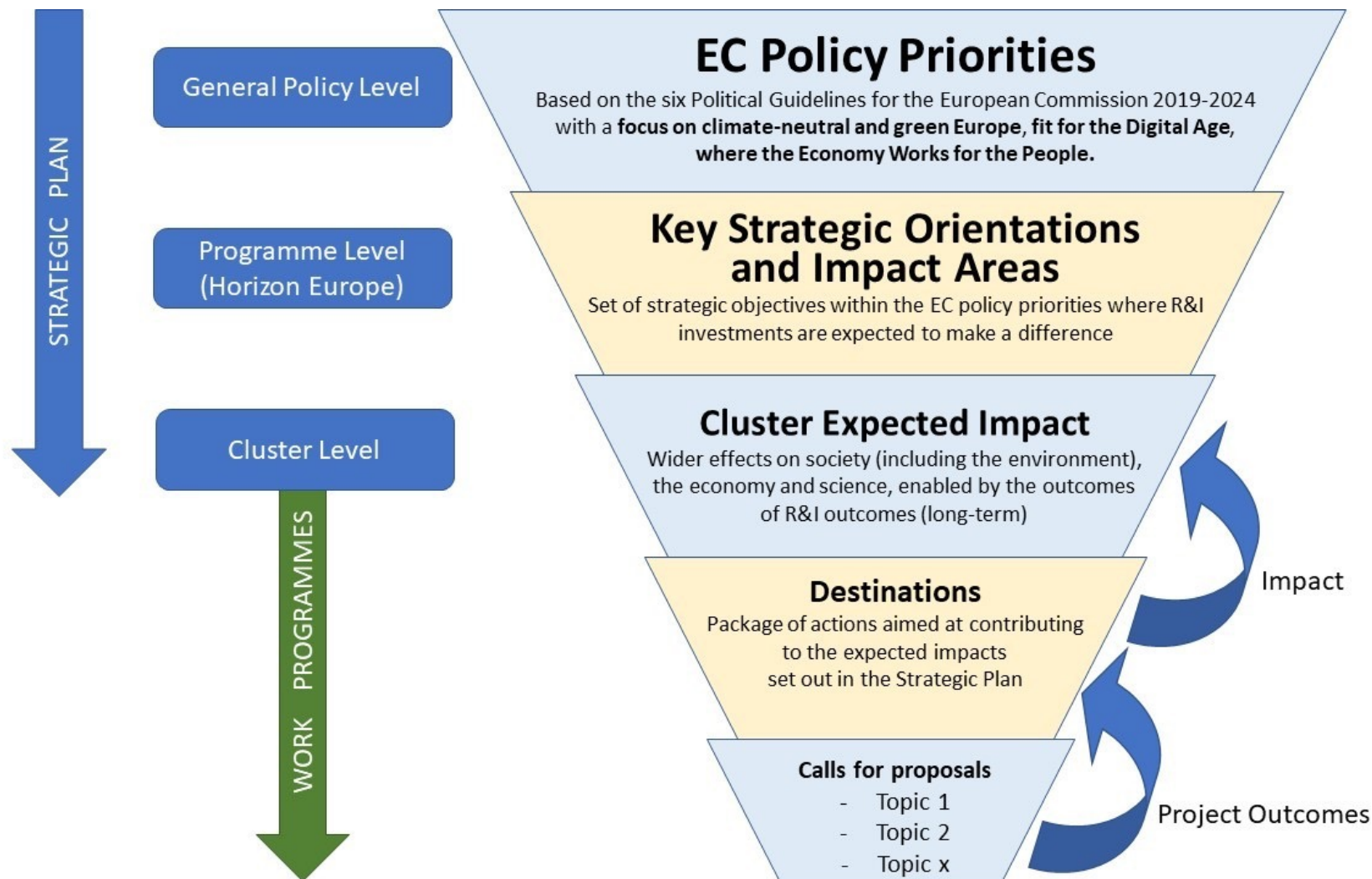
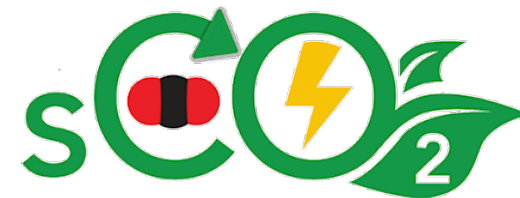


Diagram designed by Paul Bersans, based on EC documents



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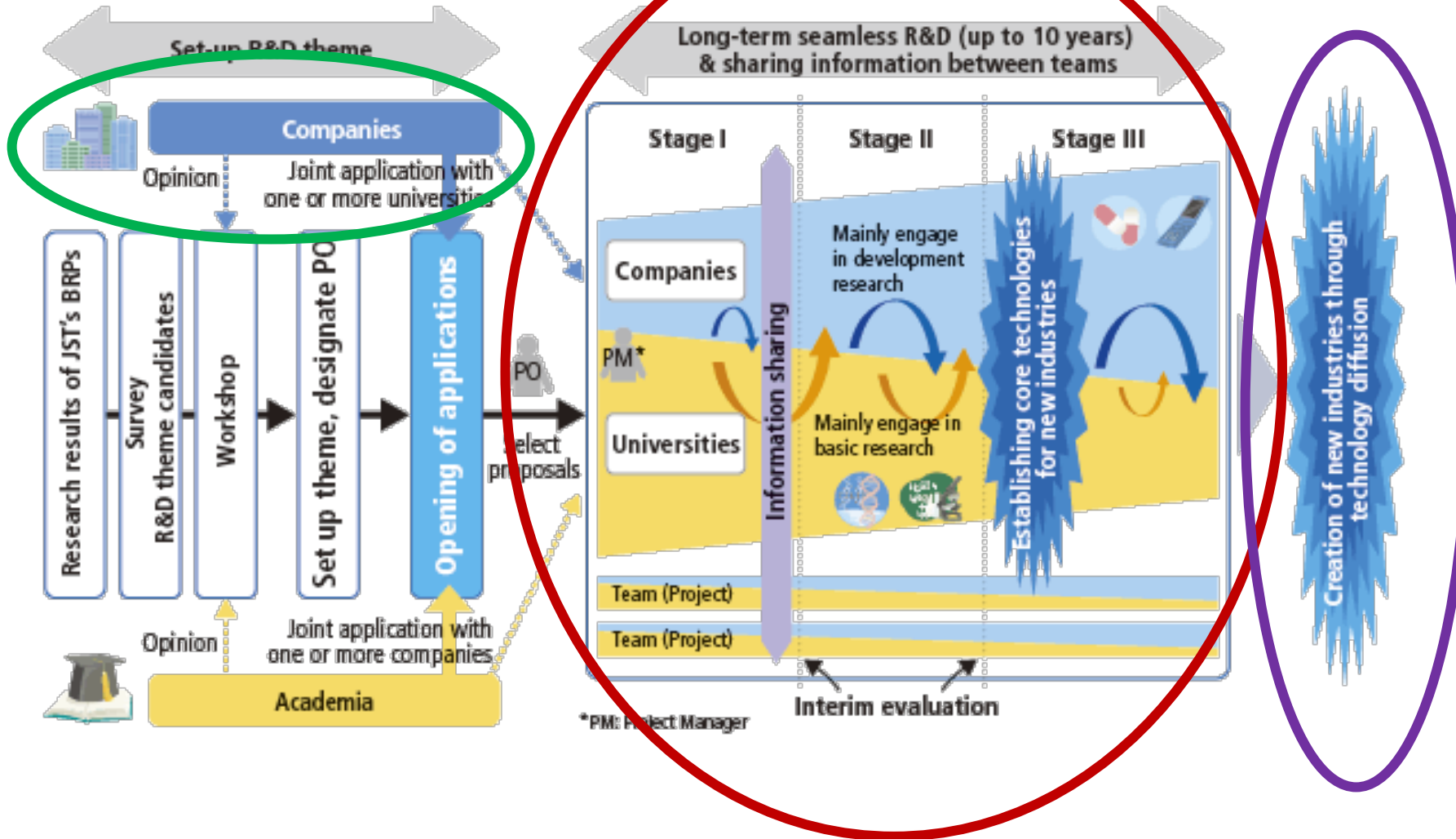
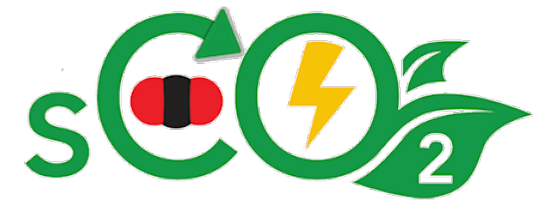
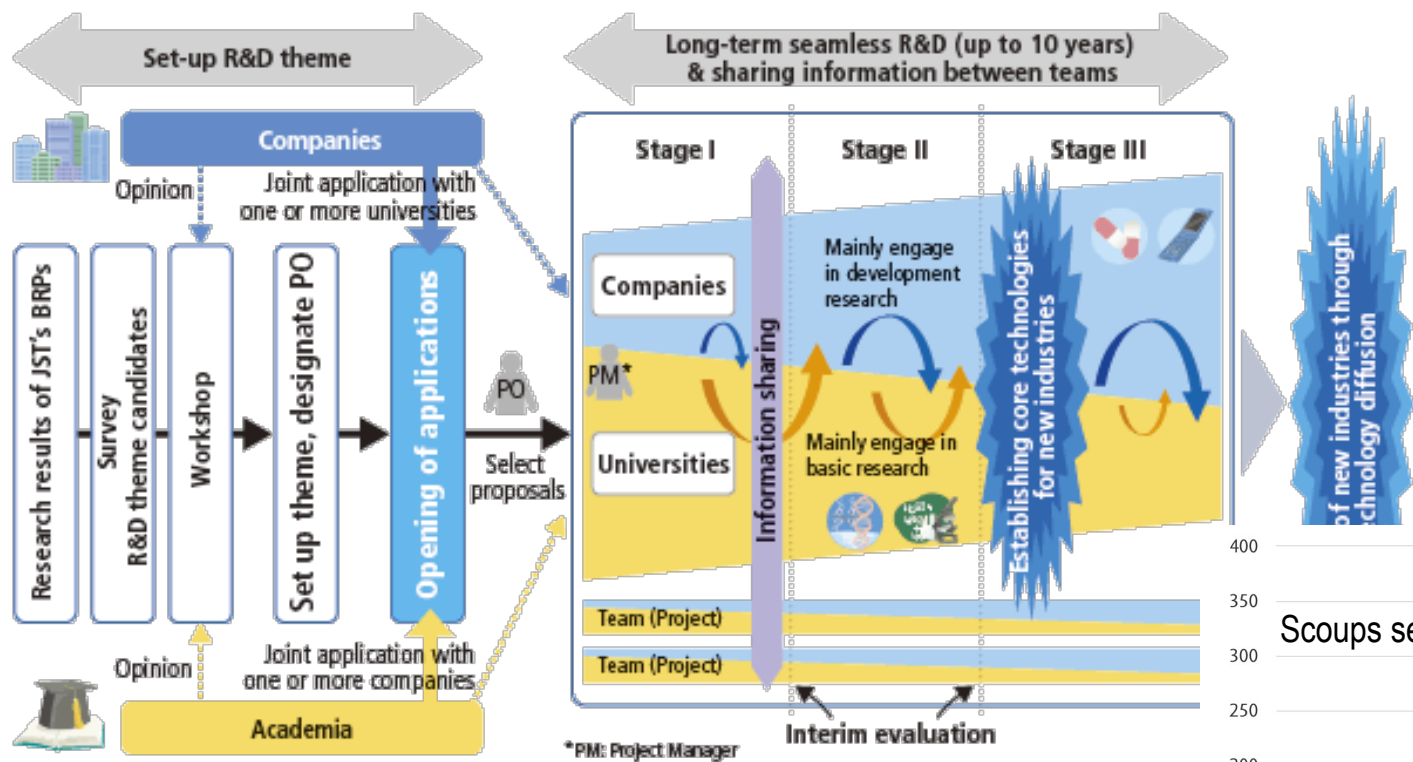


Figure credits: Industry-Academia Collaborative R&D Programs, Japan Science & Technology Agency



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2004  
Dostal  
(MIT)

2005  
Wright  
(SNL)

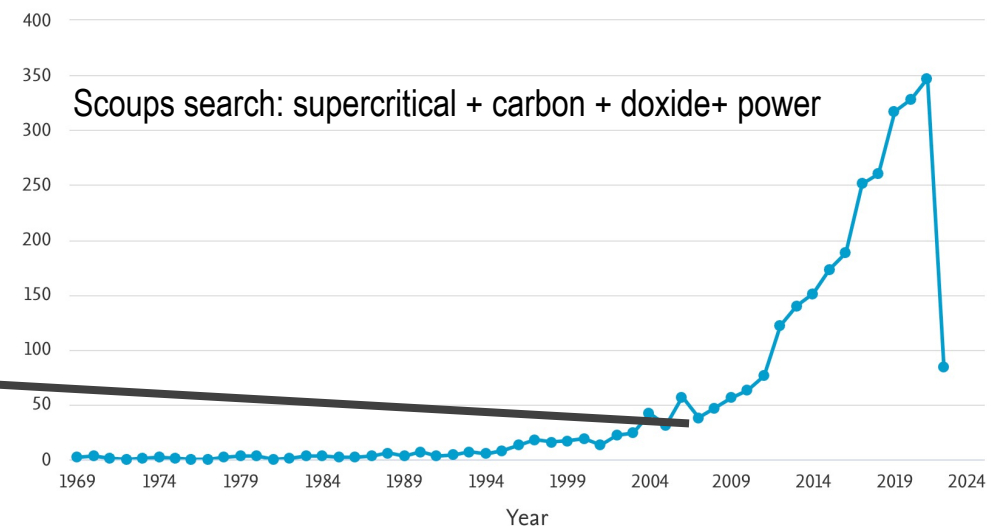


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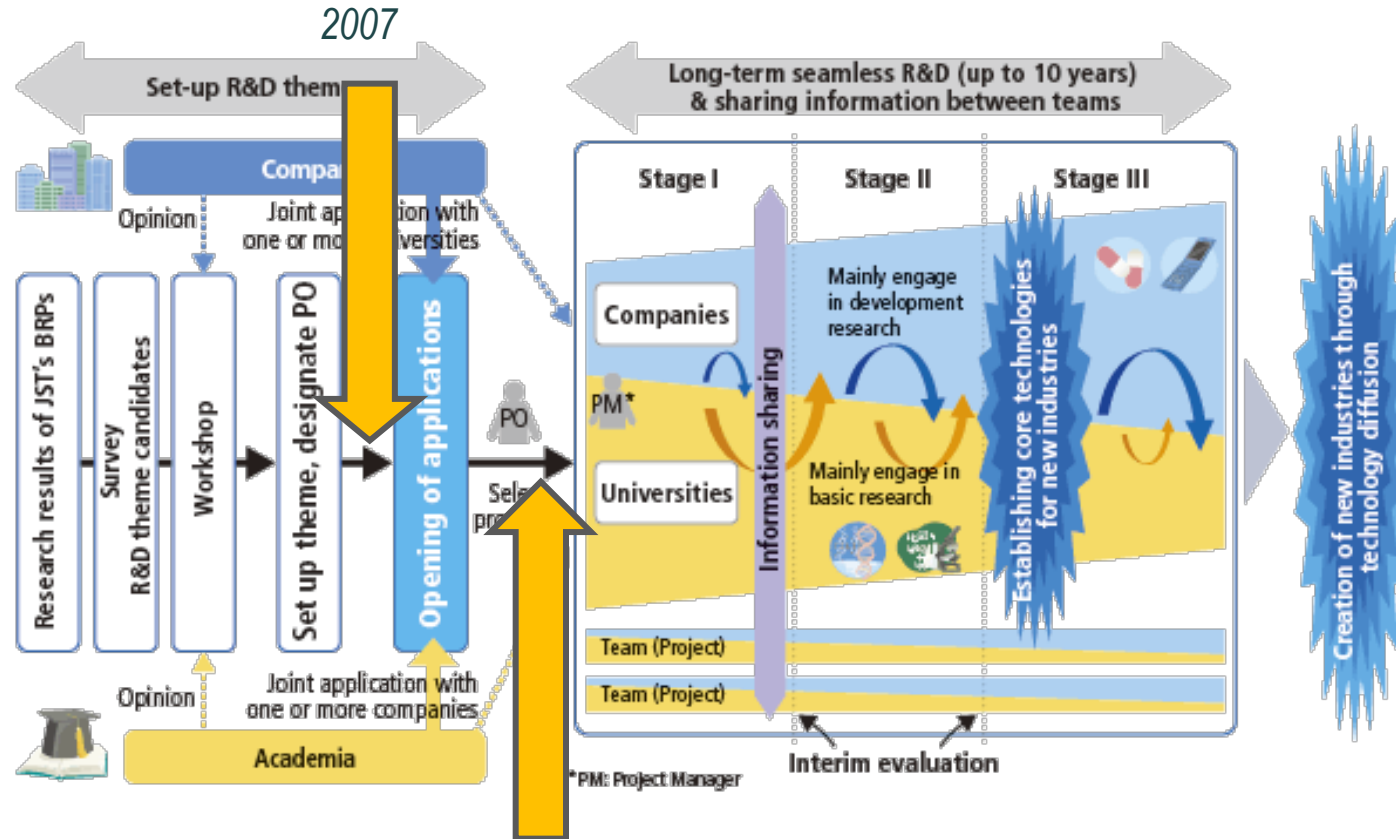
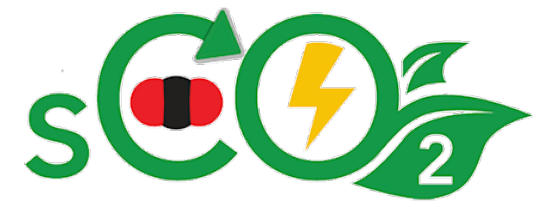


Figure courtesy T. Himeno

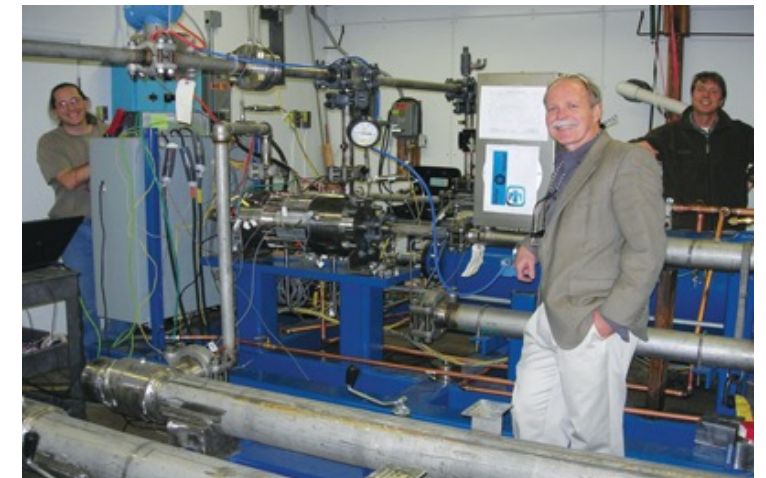


Figure credits: Sandia National Lab

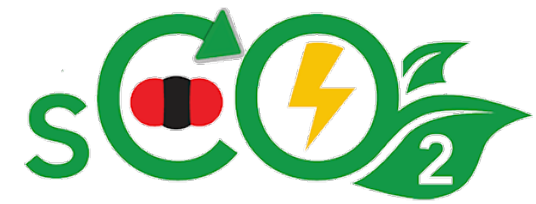


2012

Figure credits: Industry-Academia Collaborative R&D Programs, Japan Science & Technology Agency

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2013

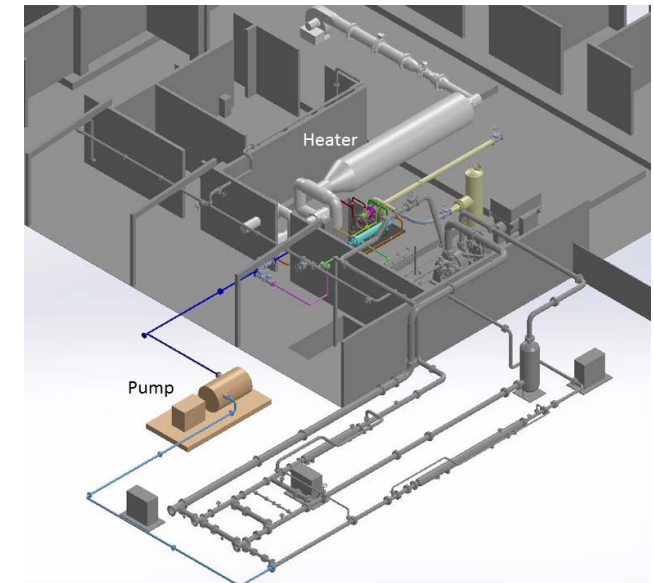
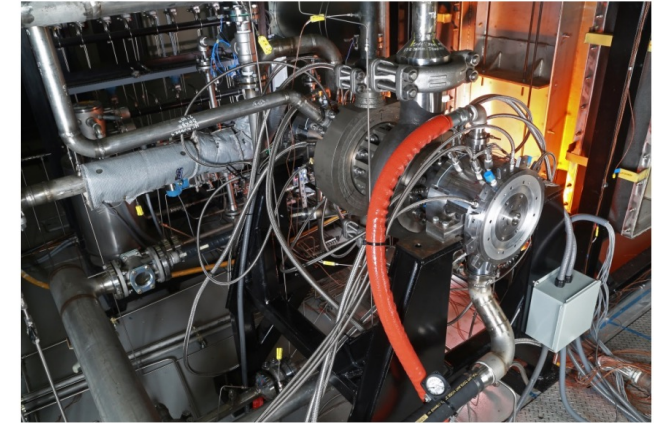
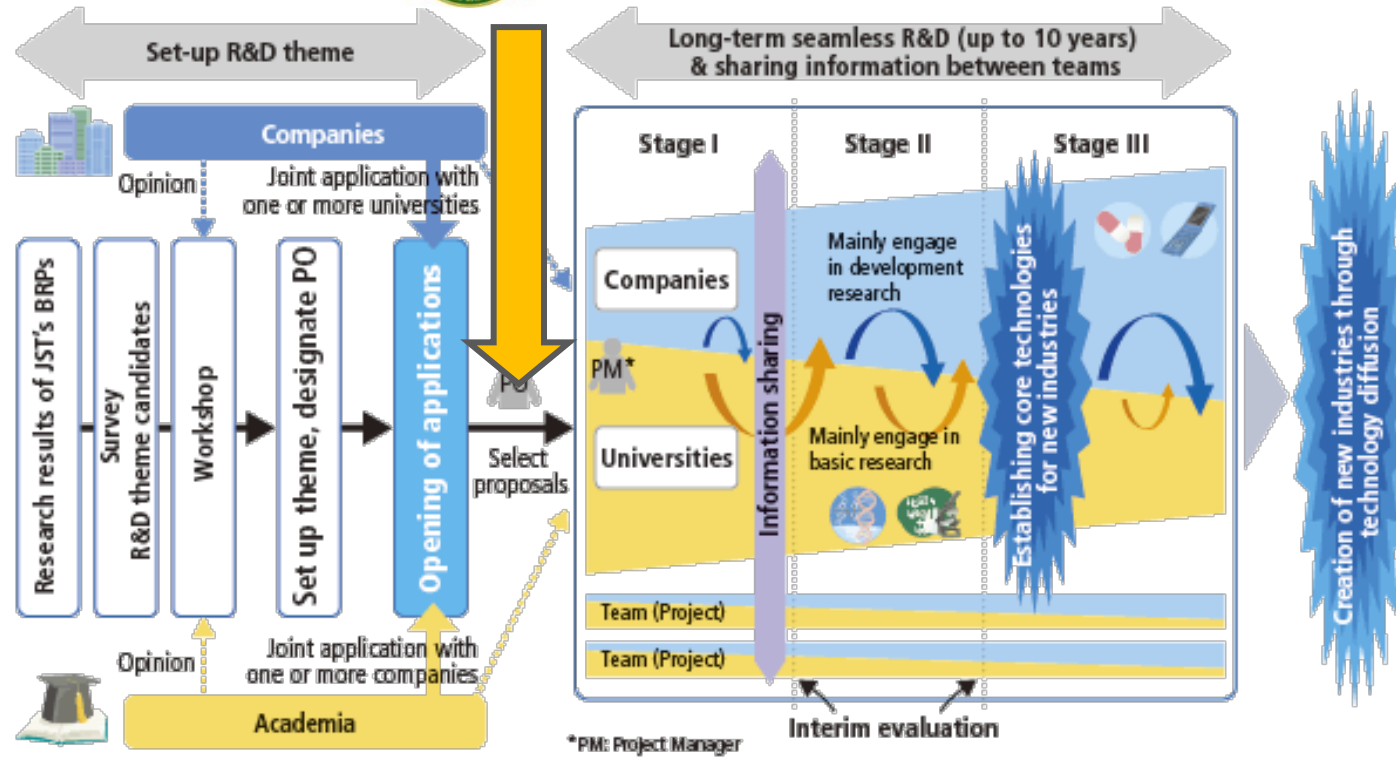


Figure credits: Industry-Academia Collaborative R&D Programs, Japan Science & Technology Agency

Figure credits: J. Moore et al., Paper ASME GT2015-43771





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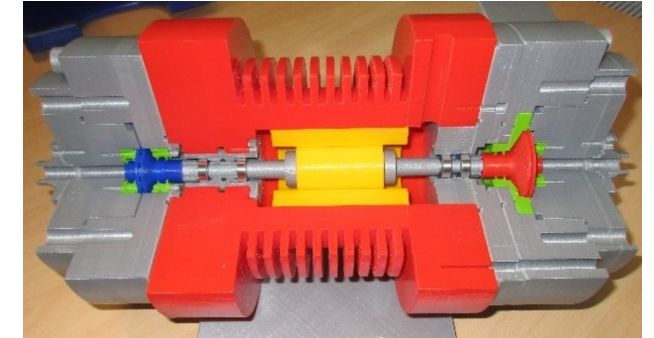
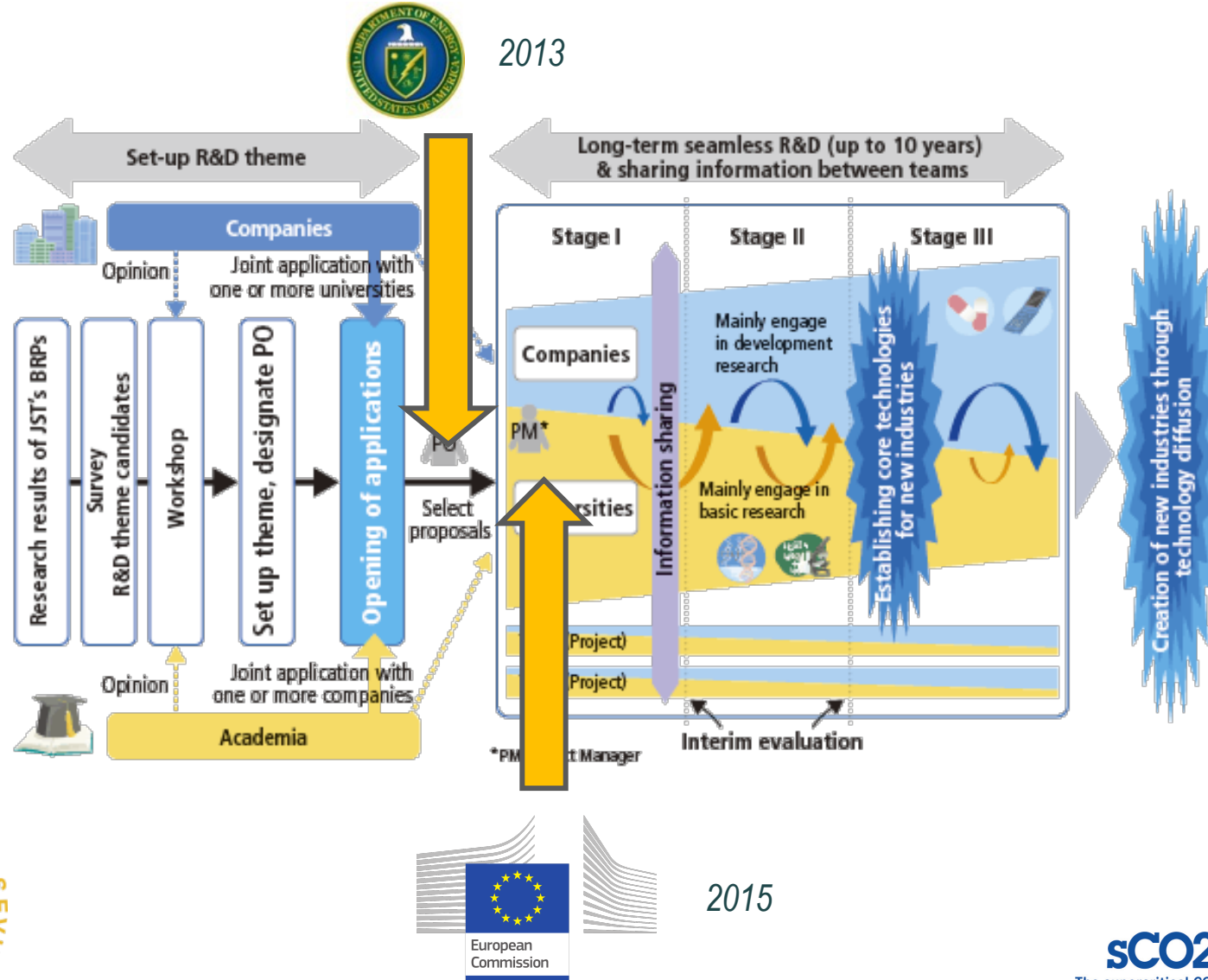
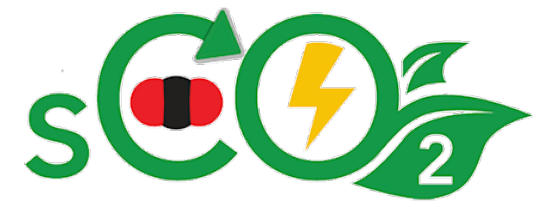


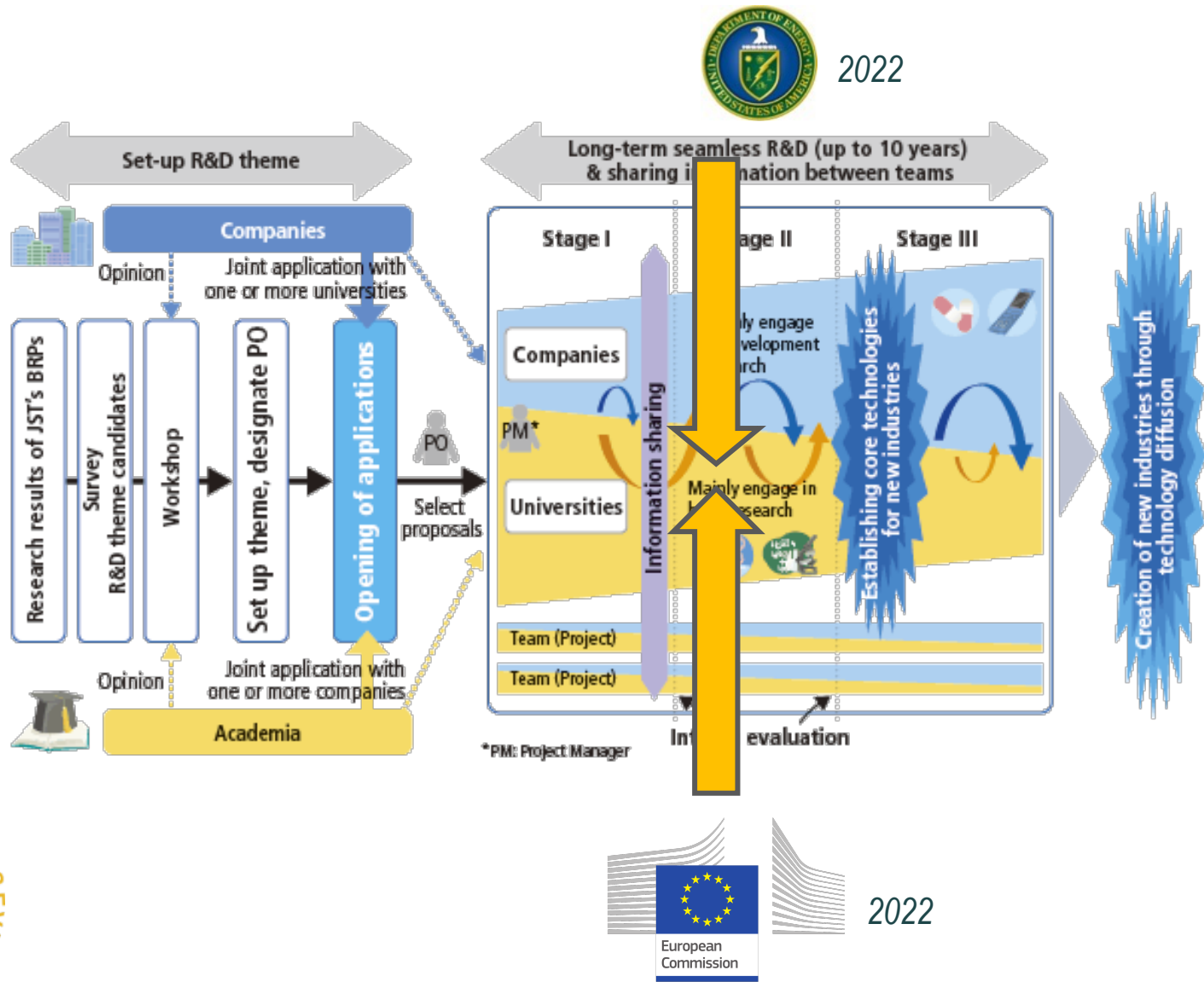
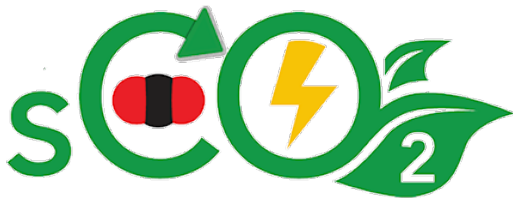
Figure credits: Industry-Academia Collaborative R&D Programs, Japan Science & Technology Agency

Figure credits: ScO2-Hero website

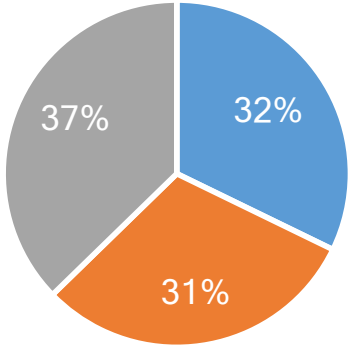


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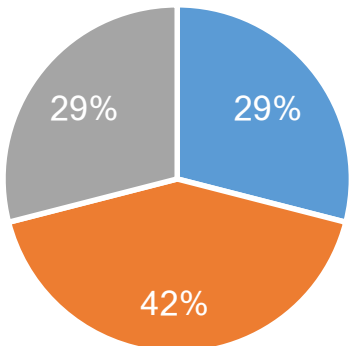
7<sup>th</sup> Supercritical CO<sub>2</sub> Power Cycle Symposium, San Antonio TX



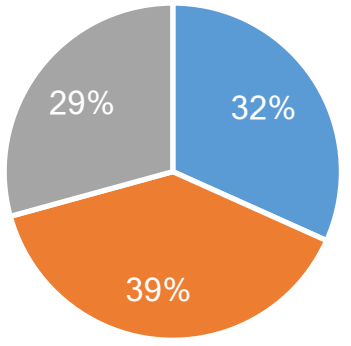
sCO<sub>2</sub> 2014



sCO<sub>2</sub> 2016



sCO<sub>2</sub> 2018



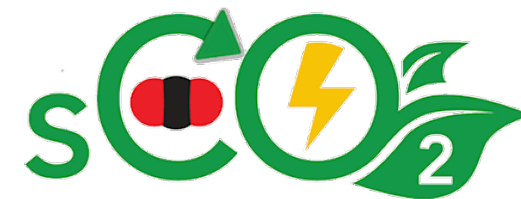
■ Academia ■ Industry ■ Government

Figure credits: Industry-Academia Collaborative R&D Programs, Japan Science & Technology Agency



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1

**sCO<sub>2</sub> HeRo**  
The supercritical CO<sub>2</sub> heat removal system

2015-2018

2.8 M€

4



**sCO<sub>2</sub>-4-NPP**

2019-2022

2.8 M€

3

**SCARABEUS**



2019-2023

5 M€

5



2020-2024

10 + 3.5 M€

6

**COMPAS<sub>sCO<sub>2</sub></sub>**

2020-2024

6 M€

7



2021-2025

14 + 5 M€

2



2018-2021

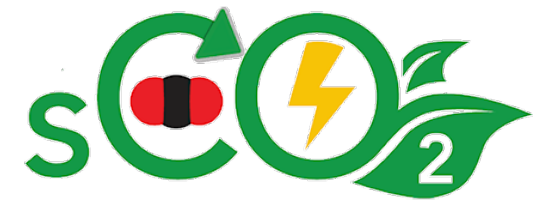
5.6 M€

This projects have received funding from the European Union's  
Horizon 2020 research and innovation programme



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GAS TURBINE TECHNOLOGY

ETN aims to initiate projects and standardisations that can achieve tangible advances and cost reductions in gas turbine technology



ETN Global is a non-profit membership association bringing together the entire value chain of the gas turbine technology.

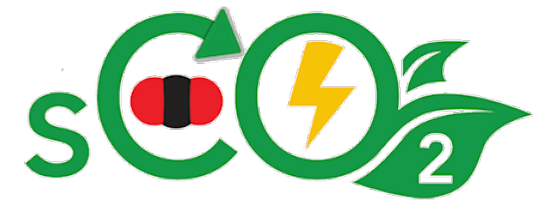


ETN  
Global



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ETN  
Global

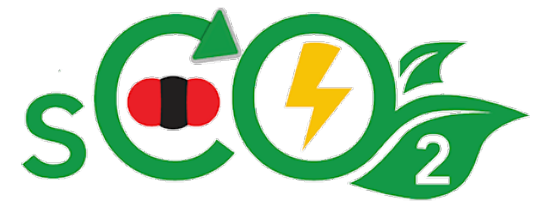
The ETN Project Board is responsible for identifying promising technology solutions based on the (user) community's needs and policy requirements





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## ETN's sCO<sub>2</sub> WG survey results

28 January 2022



**ETN**  
Global



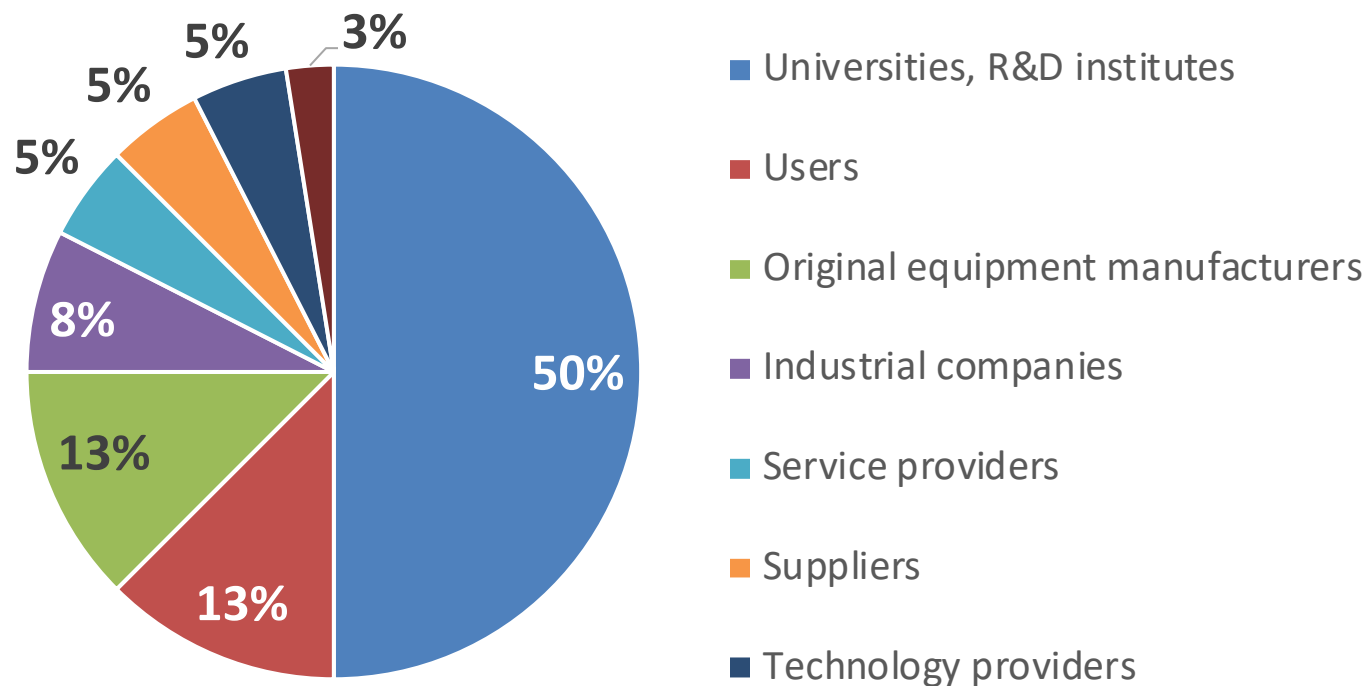
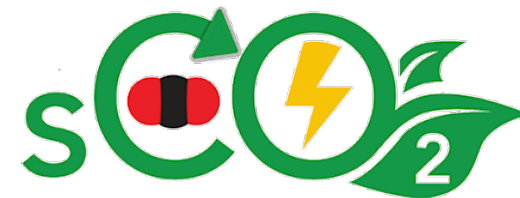
**ETN**  
Global

[Link](#)



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Professional sector

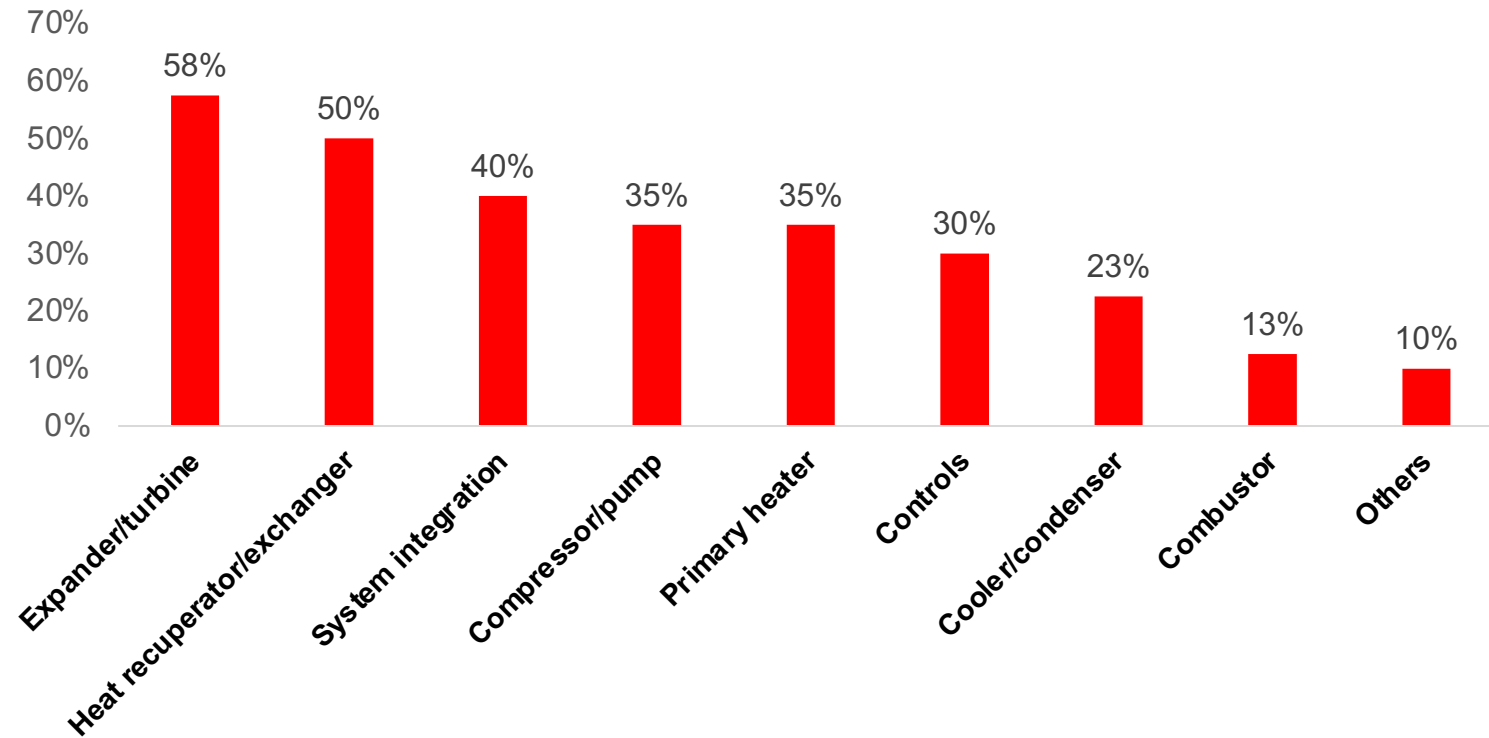
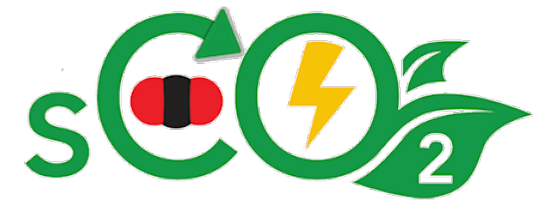


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Global



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Which component needs more development?



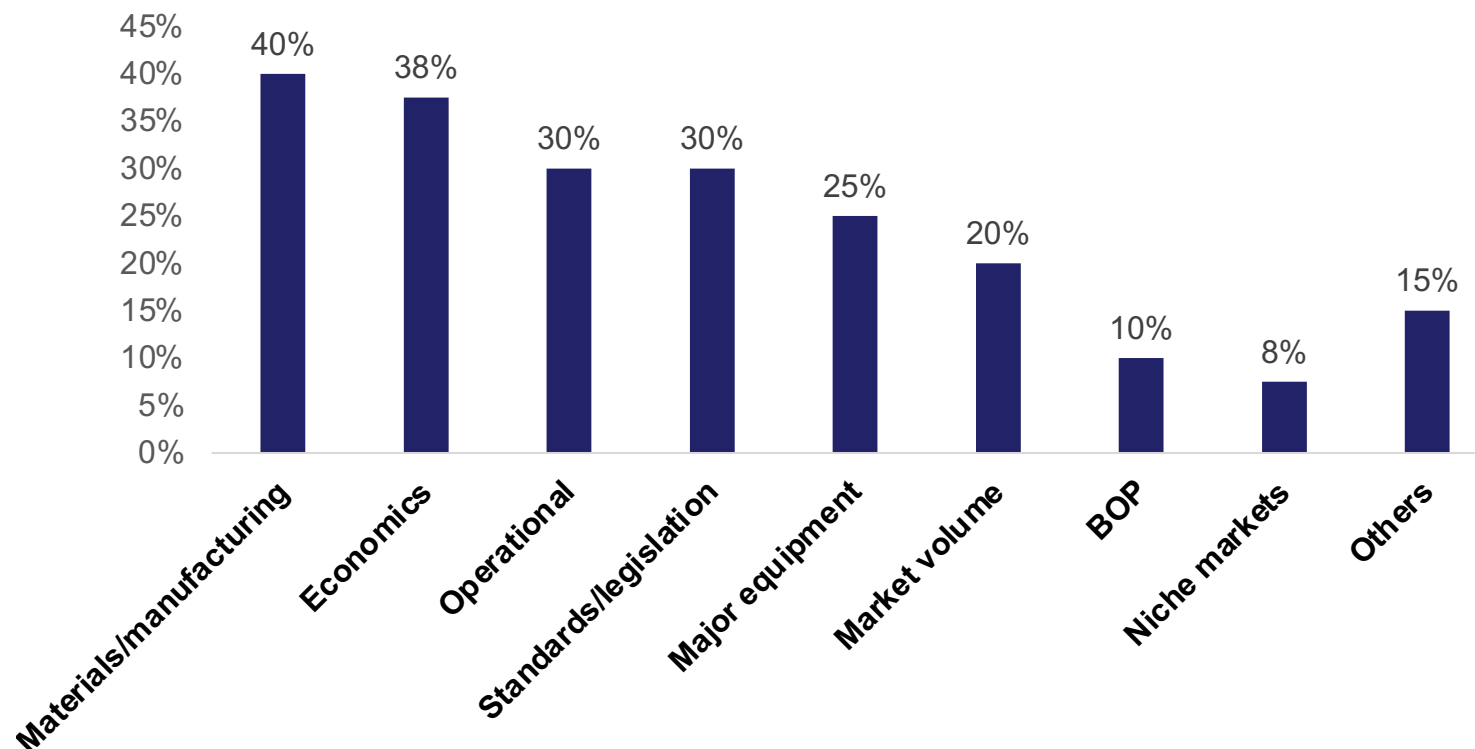
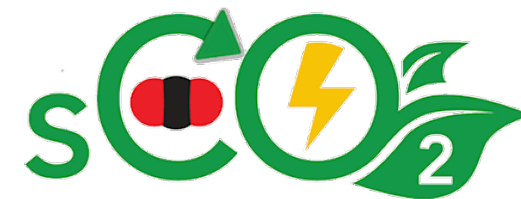
ETN  
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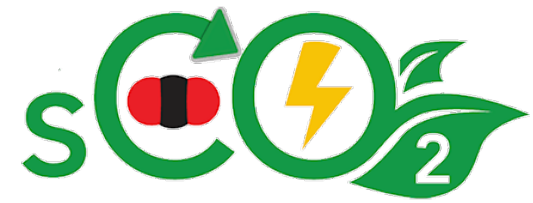
Which area is being overlooked the most?



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## **Supercritical CO<sub>2</sub> Working Group call for global survey participation**

ETN's Supercritical CO<sub>2</sub> Working Group launched a review survey in November 2021 to identify the needs and recommendations of our stakeholders to support the uptake of sCO<sub>2</sub> technology and its associated market requirements. The outcome of this initiative was presented to the sCO<sub>2</sub> WG members and other contributors in January 2022.

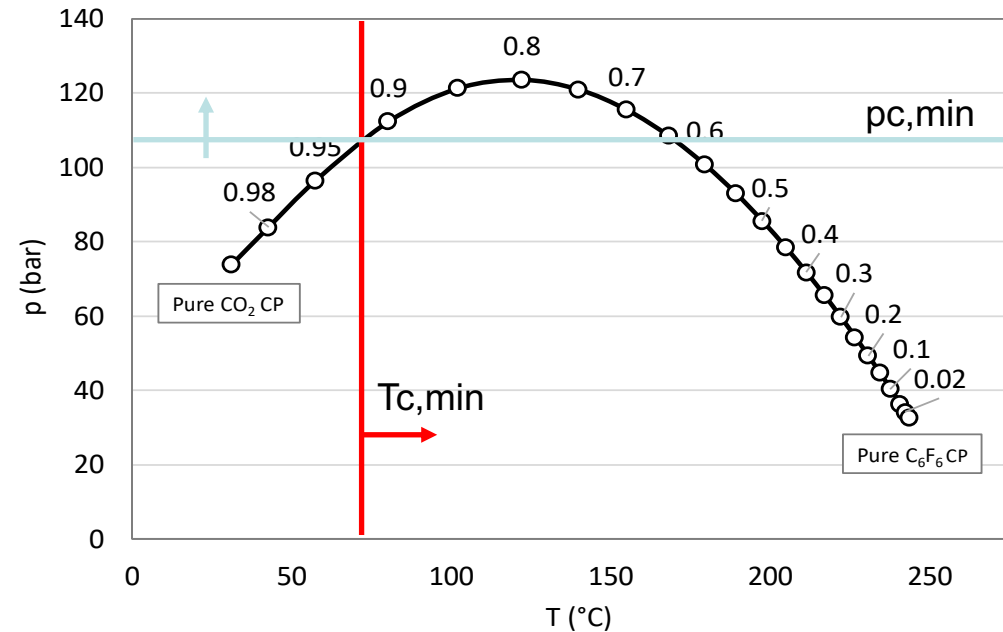
sCO<sub>2</sub> WG calls now on global participants to make the survey even more representative. To this end, ETN will make the survey form available to all [Supercritical CO<sub>2</sub> Power Cycles Symposium](#) participants, taking place between 21 and 24 February in San Antonio, USA. However, the survey remains open to all other sCO<sub>2</sub> stakeholders and can be filled in [here](#).



**ETN**  
Global

## Thermodynamic Assessment and Optimisation of Supercritical and Transcritical **Power Cycles** Operating on CO<sub>2</sub> Mixtures by Means of Artificial Neural Networks

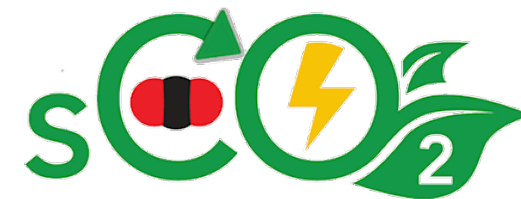
Crespi et al., Paper Track 1 – Power Plants & Applications 4 | 7.45– 9.15 AM, Salon A





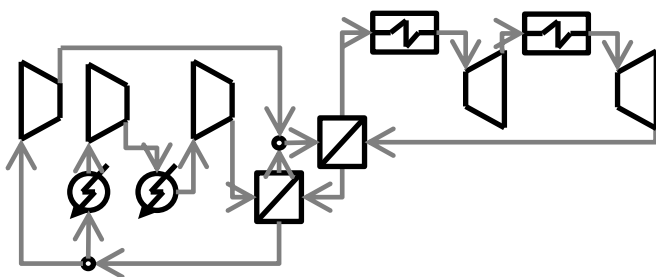
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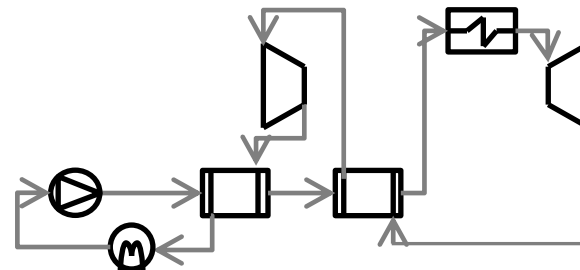
Pure sCO<sub>2</sub> : Recompression+IC+RH

800	58.7	56.9	56.4	56.0	55.6	55.4	54.9
775	57.9	56.4	55.8	55.3	54.8	54.5	53.8
750	57.1	56.0	55.1	54.1	53.4	53.5	53.1
725	56.1	54.6	54.2	53.8	52.9	52.6	52.0
700	55.3	53.3	52.8	52.9	52.0	51.6	51.0
675	54.4	52.6	51.7	51.5	51.0	50.5	50.0
650	53.4	51.5	50.7	50.5	49.9	49.4	48.8
625	52.4	51.3	50.3	49.5	48.8	48.3	47.7
600	51.2	49.6	49.2	48.0	47.3	47.0	46.5
575	50.1	48.9	47.2	47.0	46.0	45.8	45.2
550	48.8	47.4	46.7	45.9	44.8	44.5	43.7
TIT / PIT	34	38	42	46	50	54	58

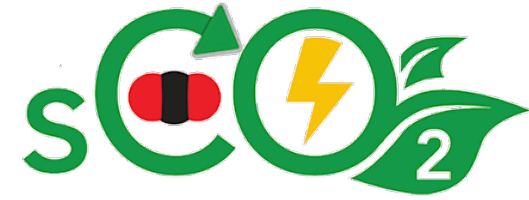


CO<sub>2</sub> - TiCl<sub>4</sub>: Precompression

800	57.5	57.1	56.4	55.9	55.4	54.8	54.1
775	56.6	56.3	55.6	55.2	54.6	54.0	53.3
750	55.8	55.5	54.8	54.3	53.8	53.1	52.4
725	54.9	54.6	54.0	53.5	52.9	52.2	51.5
700	54.0	53.7	53.1	52.6	52.0	51.3	50.5
675	53.1	52.8	52.1	51.6	51.0	50.3	49.5
650	52.5	51.7	51.2	50.7	50.0	49.3	48.4
625	51.1	50.7	50.4	49.6	49.0	48.2	47.4
600	50.1	50.0	49.1	48.5	47.9	47.1	46.5
575	49.4	48.4	47.9	47.6	46.7	46.1	45.4
550	48.1	47.2	46.9	46.2	45.6	45.0	44.3
TIT / PIT	34	38	42	46	50	54	58



- Blends enable thermal performance comparable to best-performing pure sCO<sub>2</sub> cycle, but with significantly simpler layouts
- Potential to reduce costs and increase flexibility



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*Thank you!*

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