

MSc CLEAN FOSSIL & ALTERNATIVE FUELS

**REDUCE EMISSIONS. DEVELOP ALTERNATIVE FUELS.
BUILD A SUSTAINABLE FUTURE.**



European Universities for a Clean Energy Future: Interdisciplinary Education, Training and Research

- Partnerships and key challenges of emerging European clusters to take forward the “Action Agenda” - **Carbon Capture, Utilisation and Storage**

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Silesian University of Technology & AGH University of Science and Technology, Poland

MSc Clean Fossil and Alternative Fuels Energy (CFAFE)!



The program primarily focuses on technologies that lead to the efficient and low-emission thermal and chemical conversion of fossil fuels and biomass at all levels and stages of the operation, as well as the application of unconventional hydrocarbons e.g. shale gas together with alternative fuels.

- High quality expert knowledge in fuels, combustion, environmental protection and renewables!
- High quality management and business knowledge and skills!
- High quality behavioural competencies and skills!
- **Harvard style case teaching**
- **Project based learning**
- **Challenge driven education**
- **Learning by doing**



Programme mobility options



Industrial involvement

- Internships
- Study visits
- Invited lectures
- **Master thesis assistance**
- Curriculum design assistance

CFAFE - Industrial Advisory Board



Programme course descriptions

University: SUT: Year 1

1. Project management.
2. Economics.
3. Advanced mathematics.
4. Business planning.
5. Combustion Of Fossil And Alternative Fuels.
6. Environmental Impact & Thermoeconomic Evaluation In Energy Sector.
7. Fundamentals of numerical methods.
8. Gasification and pyrolysis.
9. Heat and mass transfer.
10. Mathematical modelling of energy installations.
11. Modern boilers.
12. Optimization of Combustion Processes.
13. Pre-Diploma Project.
14. Review of modern energy installations.
15. Social communication.
16. Technologies of clean combustion.
17. Energy Recovery from Waste.
18. Air Quality Impact Assessment.
19. Internship.

University: IST: Year 2

1. Economy and Energy Markets.
2. Decision Support Models.
3. Biofuels.
4. Energy storage.
5. Photovoltaic Solar Energy.
6. Technology Based Entrepreneurship.
7. Waste to Energy.
8. MSc dissertation.

The remaining ECTS are chosen by the students (list of curricular units of specialization or complementary group).

University: AGH: Year 1

1. Environmental Protection in Energy Sector.
2. Computer modelling of technological processes.
3. Advanced coal technologies.
4. Business planning in energy sector.
5. Unconventional Hydrocarbons.
6. Chemical reactors.
7. Chemistry of coal.
8. Catalysis in fuel industry and air pollution control.
9. Biotechnology.
10. Fluidization and Solid-Gas Systems.
11. Gasification.
12. Carbon dioxide mitigation technologies.
13. Advanced liquid biofuels.
14. Industrial internship.



Freedom of choice!

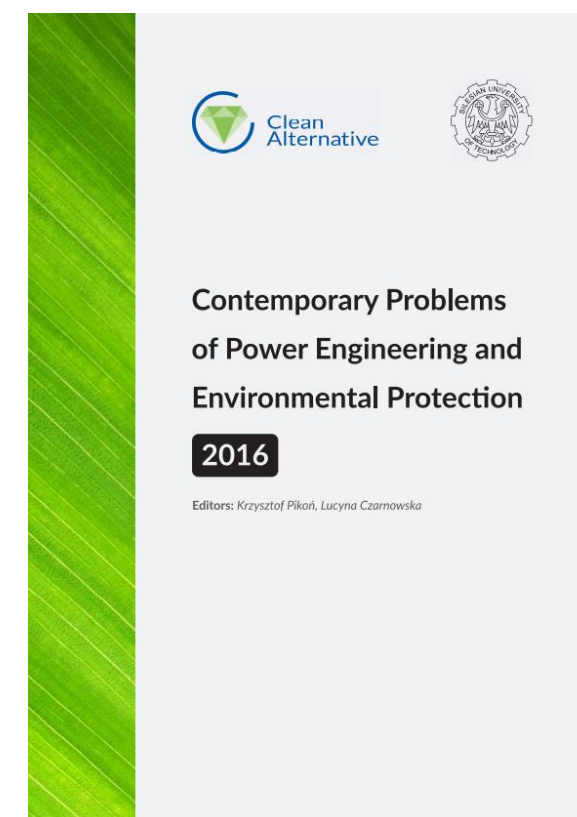
KAVA (KIC Added Value Activities)

Shaping business skills –
learning by doing!

Courses nad workshops!

Conference by young
scientists for young
scientists!

Kick off – networking
opportunities!



KAVA (KIC Added Value Activities)

Study visits!

- **Institute for Chemical Processing of Coal, Zabrze, Poland**

- PGE - Bełchatów lignite mine
- PGE - Bełchatów Power Plant
- MetalERG, Oława, Poland
- MASTER Sp., z o.o., Tychy, Poland
- Guido Mine, Zabrze, Poland
- Waste incineration plant, Kraków, Poland
- Power Plant Łagisza
- Amec Foster Wheeler, Sosnowiec, Poland
- The Porąbka-Żar pumped-storage power plant, Poland
- Hydropower – Water and Energy Nexs Project, Portugal

CCTW: Clean Coal Technology Centre



The infrastructure has been created to form unique **research facilities** which will lead the **R&D works** targeted at the development of know-how for the purpose of commercialisation of innovative **Clean Coal Technologies**.

Technological characteristics of **test stands**:

- Testing plant for pressurized gasification and **oxy-combustion** of solid fuels in Circulating Fluidized Bed
- Testing plant for **CO₂ removal in absorption process**
- Testing plant for fuel conversion in **chemical looping reactor**
- Testing plant for solid fuels pyrolysis/**gasification**
- ...

CCUS in CFAFE *and other* programmes (SUT) – examples and good practises

University: SUT: Year 1 - CFAFE

1. Project management.
2. **Economics.**
3. Advanced mathematics.
4. Business planning.
5. **Combustion Of Fossil And Alternative Fuels.**
6. **Environmental Impact & Thermo-economic Evaluation In Energy Sector.**
7. Fundamentals of numerical methods.
8. **Gasification and pyrolysis.**
9. Heat and mass transfer.
10. **Mathematical modelling of energy installations.**
11. **Modern boilers.**
12. Optimization of Combustion Processes.
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MSc dissertation – examples (from Power Engineering programme at SUT):

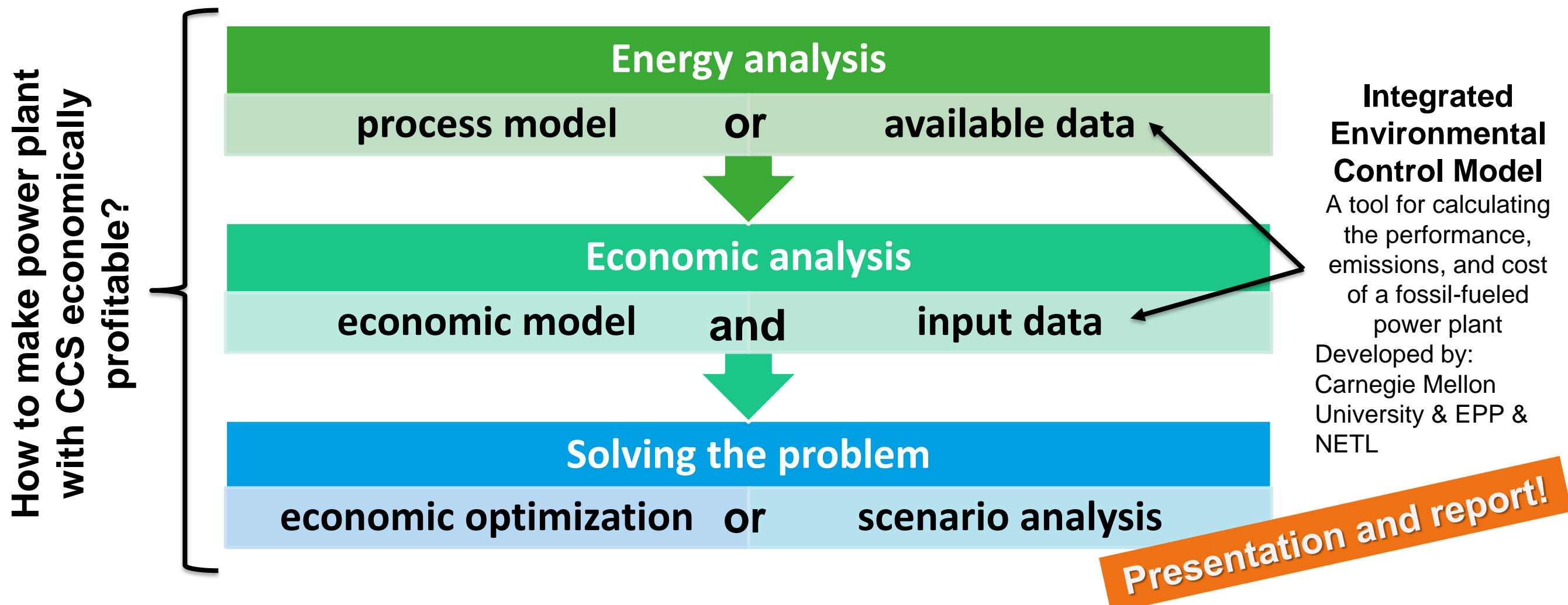
- **Energy analysis and economic assessment of the CO₂ compressors interstage cooling heat integration into the supercritical steam cycle.**
- Economic assessment of the power plant with CO₂ capture, utilization and storage.
- Environmental assessment of the power plant with CO₂ capture, utilization and storage.
- Exergy analysis of the supercritical power plant with amine based CO₂ capture installation.

CCUS in CFAFE and other programmes (SUT) – examples and good practises

Economics (CFAFE) and Financial analysis in power engineering (PE)

Lecture + problem solving classes (project based learning)

The main objective of the course is to teach students how to prepare a business plan for a project in the power sector.



CCUS in CFAFE *and other* programmes (SUT) – examples and good practises

Mathematical modelling of energy installations (CFAFE and PE)

Lecture + hand-on training (learning by doing)

The aim of the course is to introduce students to contemporary computer aided methods and software for modelling and simulating energy systems and installations (incl. CCS technologies).

Hands-on training - students solve problems in the field of power plant design using the following software:



by F-Chart Software



**EBSILON®
Professional**

by STEAG Energy Services

Other software available:

- GateCycle from GE
- Cycle Tempo from University of Delft
- PROmax from Brian Research Institute

**GENERAL EQUATION-
SOLVING PROGRAM**

**UNIVERSAL
SIMULATION SYSTEM**

CCUS in CFAFE and other programmes (SUT) – examples and good practises

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New software available from 2017/2018 academic year!

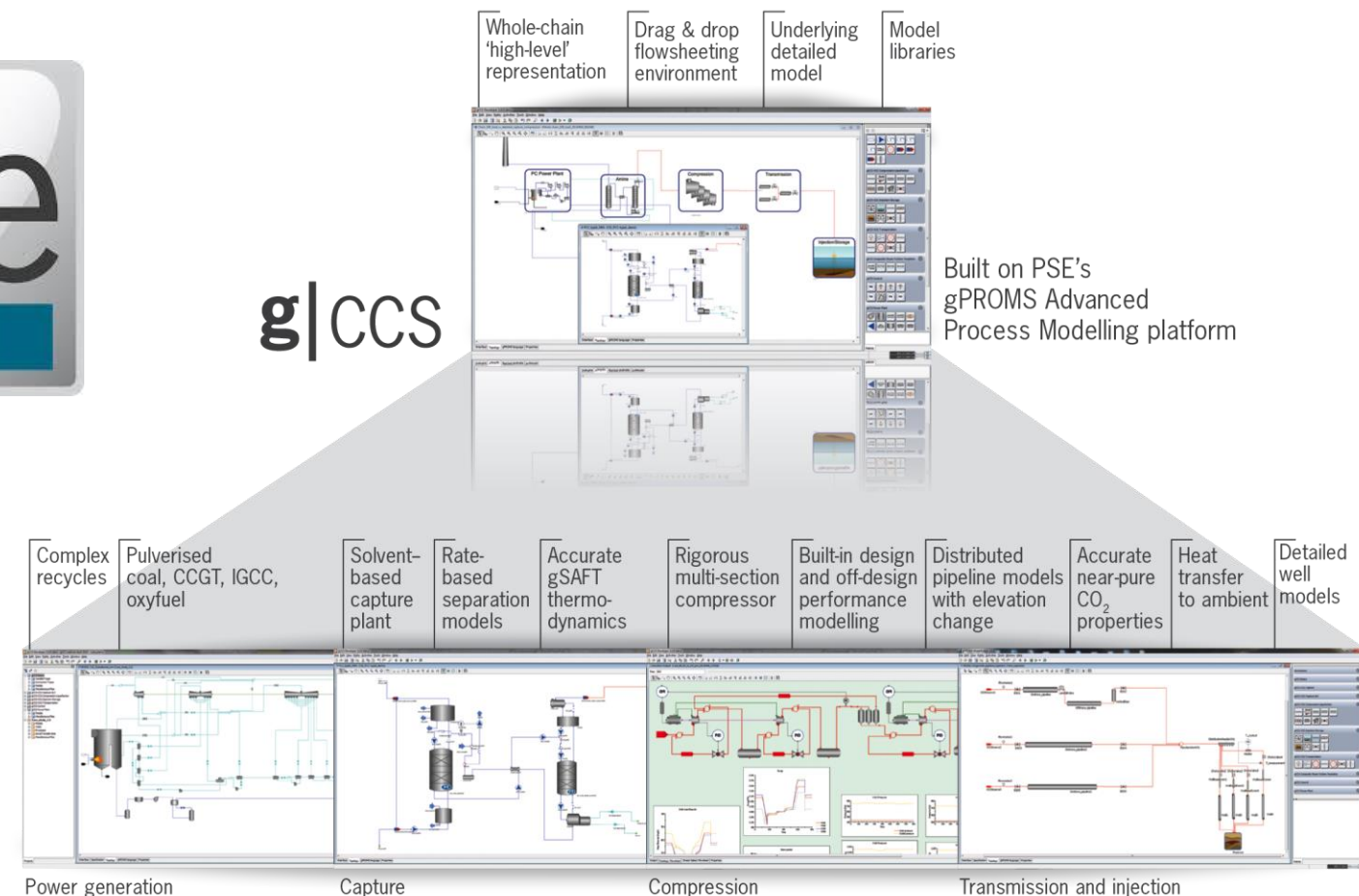
gPROMS platform by Process System Enterprise

- **gCCS** is a system modelling tool for support of design and operating decisions across the CCS chain.

New possibilities!



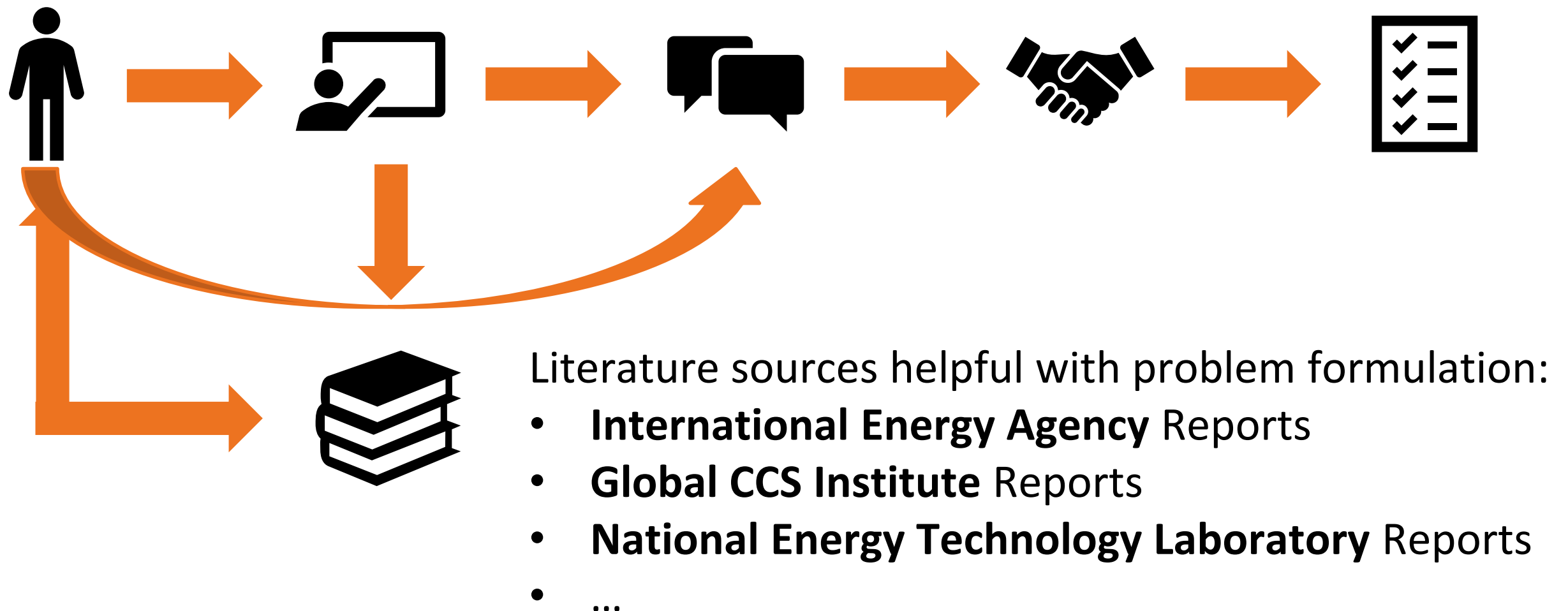
g|CCS



CCUS in CFAFE *and other* programmes (SUT) – examples and good practises

MSc dissertation (PE)

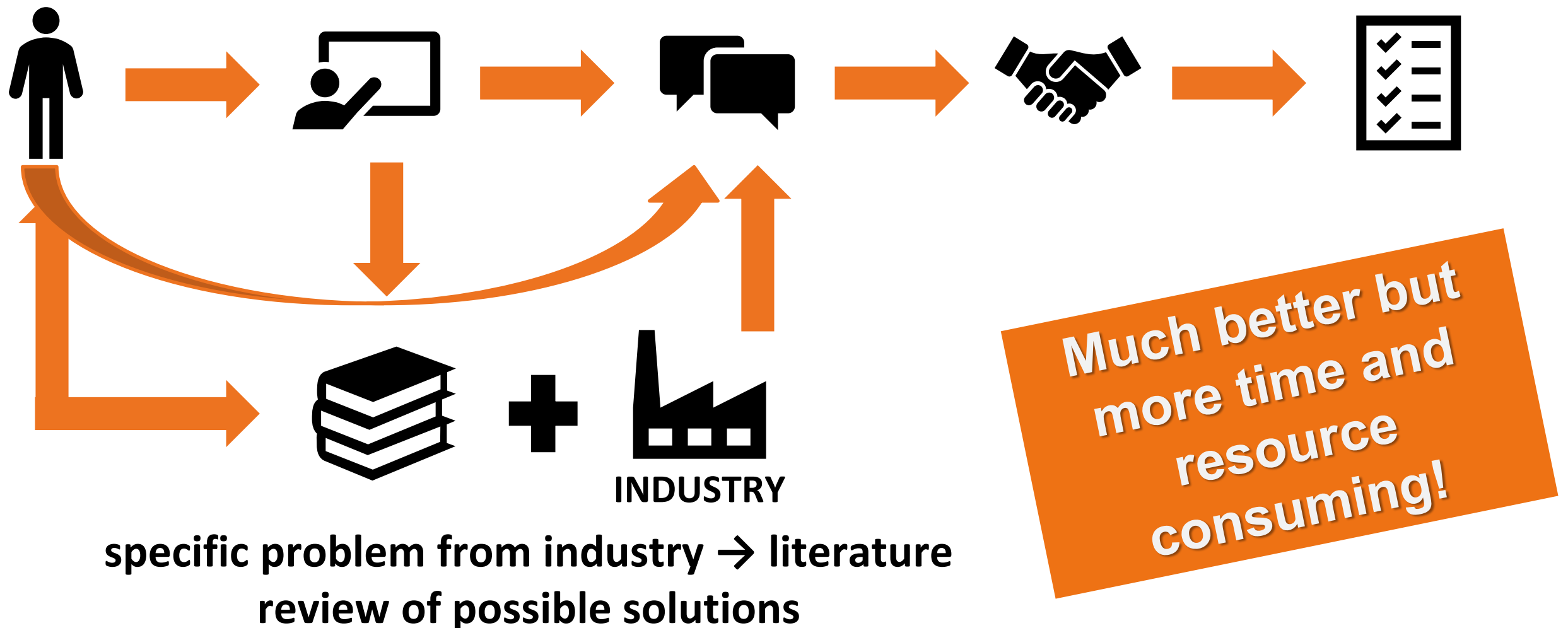
How to formulate the topic and work plan of the thesis in CCS field?



CCUS in CFAFE *and other* programmes (SUT) – examples and good practises

MSc dissertation (PE)

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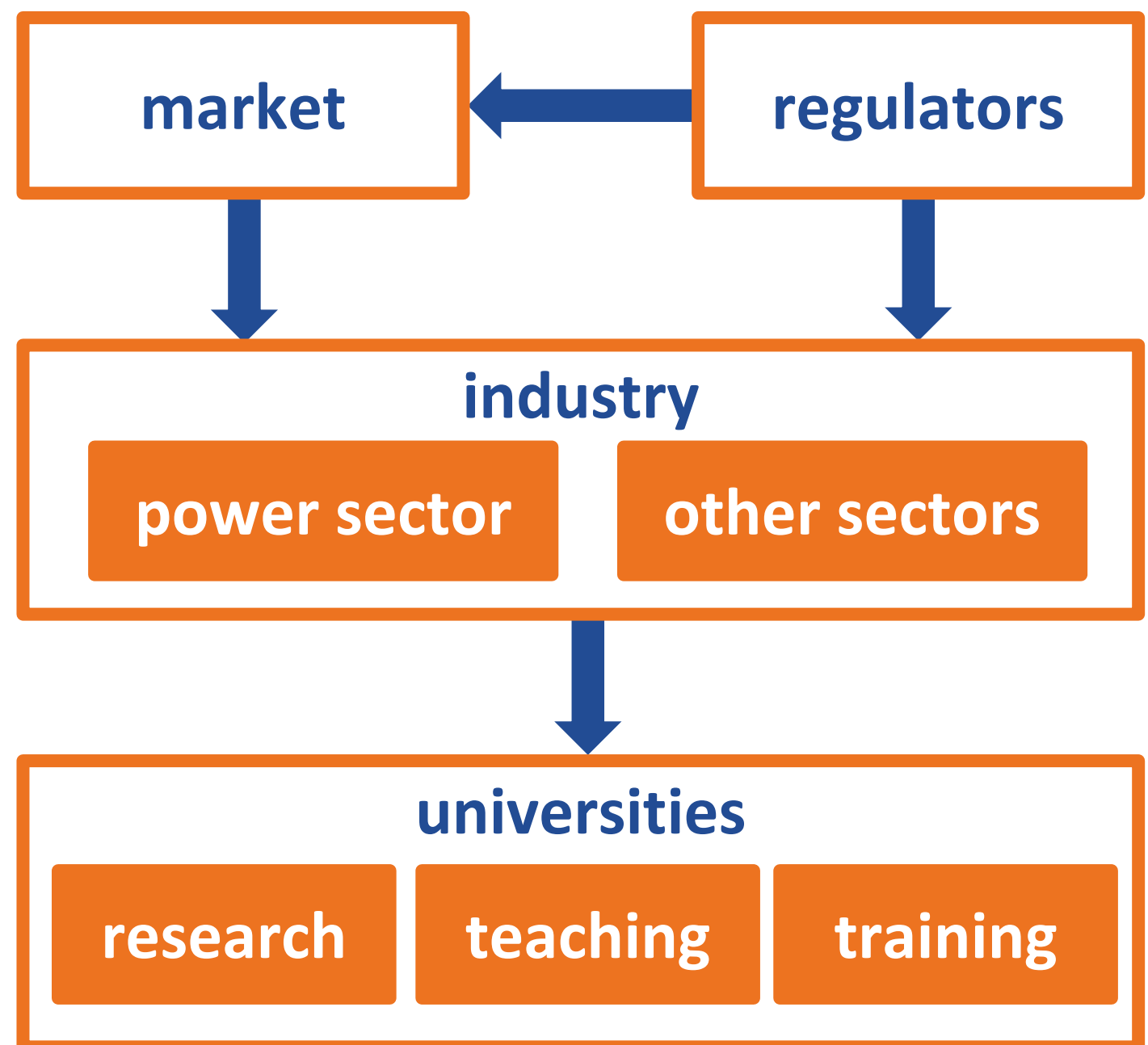
Challenges for CCUS technologies in universities research, teaching and training programmes

Main challenges:

- lack of regulatory initiatives
- lack of market-driven initiatives
- focusing only on the power sector
- social acceptance
- ... ?

Examples:

- renewable vs CCS in SET Plan or national and EU energy and climate policies
- H2020 calls



Thank you for your attention!

Additional information
www.cleanalternative.eu



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Clean Fossil and Alternative Fuels Energy MSc program



Graduation Ceremony, Barcelona

#energygamechangers

<http://CleanAlternative.eu>