RENEWABLE ENERGIES
CHAIR_10 YEARS

DLR

UNIVERSITY
OF ÉVORA

EMSP Impuls

Renewable Energies Chair / October 2021

Scientific Symposium on Molten Salt Parabolic Troughs

Mission

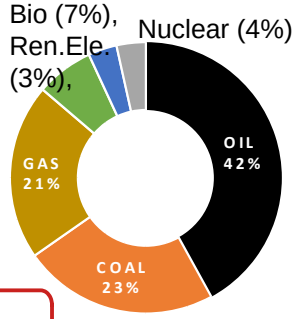
Solar energy for a decarbonized economy

- Promote the **development of solar energy technologies for the Energy Transition**

[1]

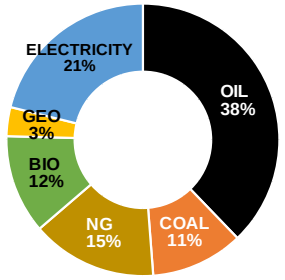
2017

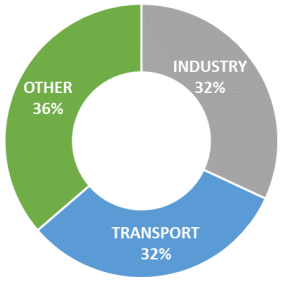
PEC (19,751 MTOE)



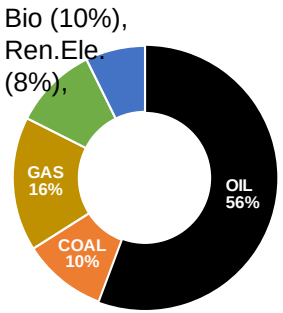
47%

FEC (EXCL. NEU 8,840 MTOE)



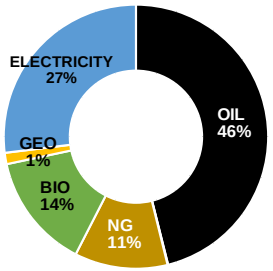


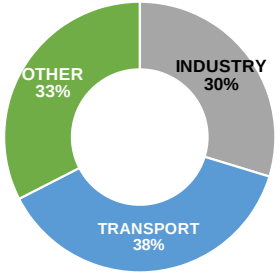
PEC (33 MTOE)



48%

FEC (EXCL. NEU 15.21 MTOE)





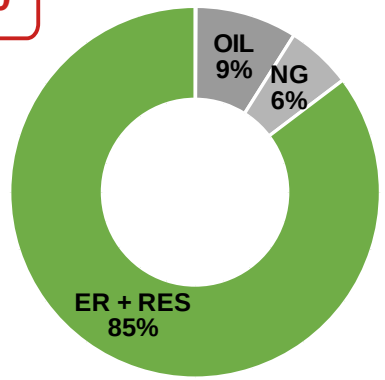
[2]

2050

RNC 2050

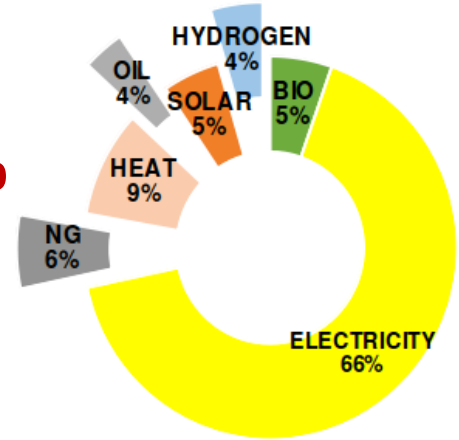
Electrification
Reduction of Energy Intensity
PEC: > 82% → 15% GHG
FEC: **Green electricity + RH&C + Renewable Gases and Fuels**

PEC (13 MTOE)



91%

FEC (11 MTOE)



Infrastructure

Applied research for increased competitiveness and scope

- Research Infrastructure **organized within INIESC** – National Research Infrastructure for Solar Energy Concentration (Évora Pole), **part of National RI Roadmap** (Roteiro) [3]

[3, 4]

INIESC – National Research Infrastructure on Solar Energy Concentration

Évora (leader)

UNIVERSIDADE DE ÉVORA

Lisbon

LNEG

PECS

Two axis sun tracking platform

EMSP

Molten Salts CSP Plant (3.6 MWth, 560°C)

PV/EES

PV microgrid & advanced batteries

DNI

Resource monitoring network

[5]

Germany (HPS2)

Bundesministerium für Wirtschaft und Energie

DLR

EMSP – Évora Molten Salt Platform

Assets and activities so far

- **7 projects, 15.7 M€ funding** (10.2 M€ | 4.3 M€ | 1.2 M€)

[5] HPS2 — 6.6 M€ | RI — Federal Ministry for Economic Affairs and Energy

[6] MS-OPERA — 2.2 M€ | O&M — Federal Ministry for Economic Affairs and Energy

[7] NEWSOL — 1.2 M€ | TES — HORIZON 2020

[3] — 2.2 M€ | RI — ALENTEJO 2020 | PORTUGAL 2020 | UNIÃO EUROPEIA

[8] ALFR Alentejo — 0.6 M€ | LFR — ALENTEJO 2020 | PORTUGAL 2020 | UNIÃO EUROPEIA

[9] — 1.4 M€ | RI — ALENTEJO 2020 | PORTUGAL 2020 | UNIÃO EUROPEIA

[10] EuroPatMoS — 1.5 M€ | O&M — SOLAR-ERA.NET — Federal Ministry for Economic Affairs and Energy — fai

EMSP – Évora Molten Salt Platform

Assets and activities so far

- **Solar field** with MS HTF**,** 2-Tank **MS-TES, Water/Steam** Cycle

HelioTrough® 2.0: 684 m, 4,500 m²
HTF: Molten Salts
Power: **3.5 MW_{th}**
Tmax: **565 ºC**

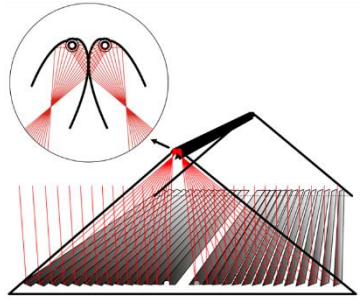
Power: **1.8 MWth @ 14.0 Mpa / 560 ºC**
Economizer/evaporator, air cooled condenser, pressure reducing station

2-Tank TES
34 m3 (ca. 92 tons salt)
Capacity: **5.4 MWh @ 565 °C / ΔT = 275 K**

EMSP – Évora Molten Salt Platform

Assets and activities so far

- **Solar field** with MS HTF**,** 2-Tank **MS-TES, Water/Steam** Cycle



Advanced Linear Fresnel
440 m²
HTF: Molten Salts
Power: **0.3 MW_{th}**
Tmax: **560 ºC**

Thermocline TES
28 m3 (Salt + Filler)
Capacity w/ filler: **2.9 MWh**
@ 500 °C / ΔT = 210 K

EMSP – Évora Molten Salt Platform

Assets and activities so far

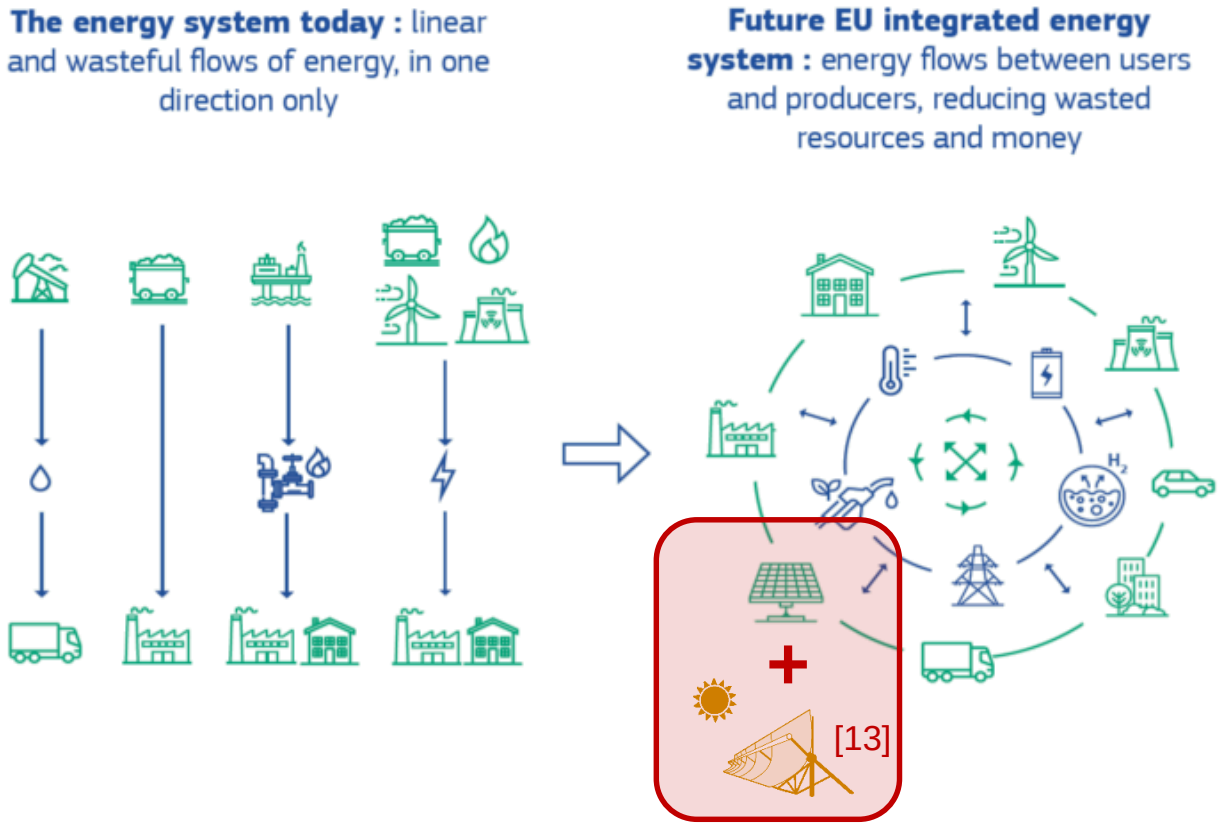
- **21 partners from 8 countries** (7 Europe, 1 South Africa)


[11]

EMSP – Évora Molten Salt Platform

Emulate the future energy system

- Research towards **maximizing Solar energy incorporation into the future enery system**



EMSP – Évora Molten Salt Platform

Emulate the future energy system

- **Ongoing / foregoing** activities

Adapted from [12, 13]

Power2Heat
Connection of 100 kWp PV to 2.9 MWth MS Thermocline
Ongoing (Q3 2022)

Carnot Battery
Connection of HT-HPump and ORC to Power2Heat facility
Foregoing (under discussion with National partner)

EMSP – Évora Molten Salt Platform

Emulate the future energy system

- **Ongoing / foregoing** activities

Adapted from [12, 13]

Power2Heat Ongoing (Q3 2022)

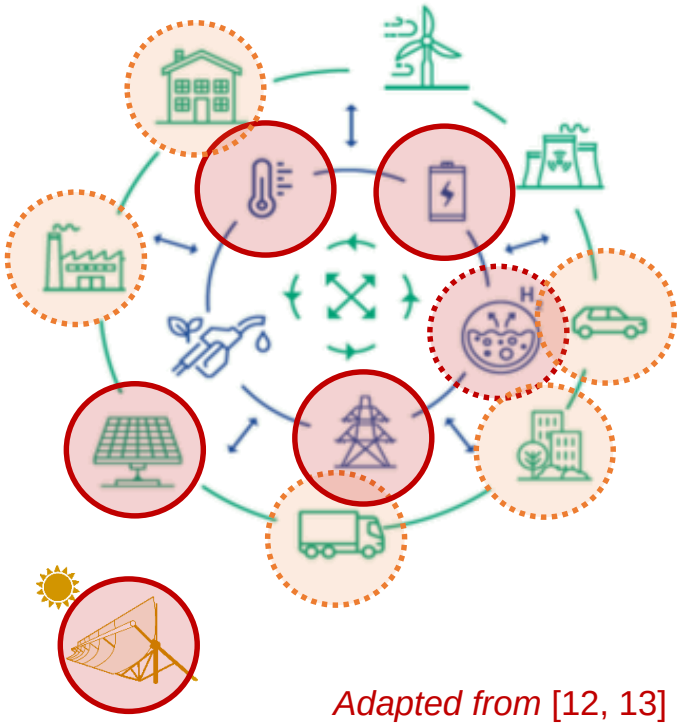
Carnot Battery Foregoing (2023)

Solar driven electrolysis
CSP driven H2O (MD/RO desalination) + H2 (electrolysis) production
Foregoing (under discussion with European partner)
Concept (National partner identified)

EMSP – Évora Molten Salt Platform

Emulate the future energy system

- **Ongoing / foregoing** activities



Adapted from [12, 13]

Power2Heat Ongoing (Q3 2022)

Carnot Battery Foregoing (2023)

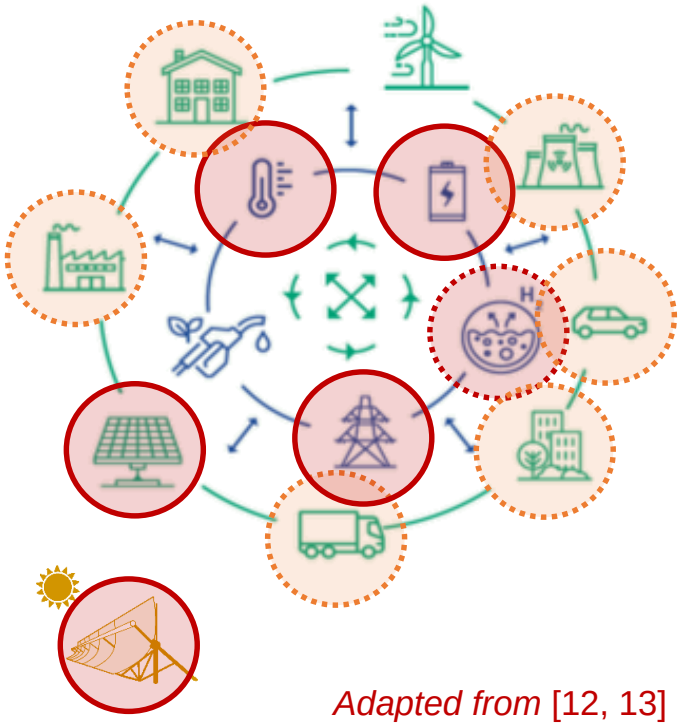
Solar driven electrolysis Concept (2023)

Autonomous Solar grid
Integration of existing PV and EES assets in existing autonomous grid (nearby village)
Installation of Power Block @ EMSP
EMSP integration in the grid
Integration of electrolytic H2 production
E-mobility integration w/ existing charging station
Energy community (UEvora + Valverde)
Foregoing (under discussion with National partners)

EMSP – Évora Molten Salt Platform

Emulate the future energy system

- **Ongoing / foregoing** activities



Adapted from [12, 13]

Power2Heat Ongoing (Q3 2022)

Carnot Battery Foregoing (2023)

Solar driven electrolysis Concept (2023)

Autonomous Solar grid Foregoing (proposal 2022)

MSc and PhD tutorships

Technology development

Components qualification

O&M training

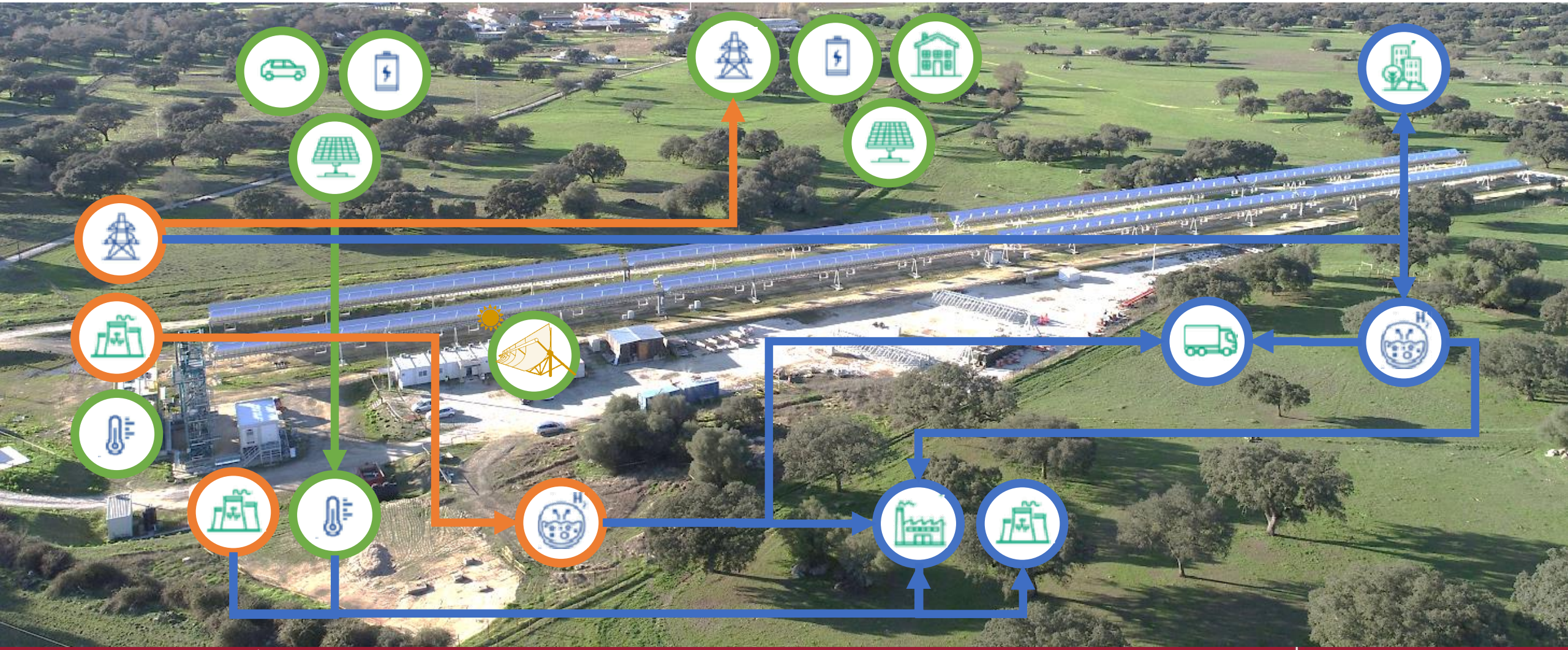
Technology demonstration

EMSP @ Academia and Industry

EMSP – Évora Molten Salt Platform

Emulate the future energy system

Icons adapted from [12, 13]



EMSP – Évora Molten Salt Platform

Emulate the future energy system

Icons adapted from [12, 13]

Foregoing discussion:

6-3-5 Method

6-3-5 Method: 18 ideas to concrete problems in 30 minutes

6 participants > 3 ideas > 5 minutes

- **Brainwriting method! Let the ideas flow!**
- **Don‘t discuss the ideas during the collection phase!**

- **How to use the form:**
- write down 3 ideas in the first line (5 minutes)
- pass your form to your right neighbor
- add own ideas refining or adding to the 3 ideas already given on the form received
- Repeat 2 and 3 until you receive your 1st form

- For ease of further processing, please add your e-mail in the first column each time you fill in a line

- Each table will tackle a different problem

Problem:			
Participants:			
Email:	Idea:	Idea:	Idea

6-3-5 Method: 18 ideas to concrete problems in 30 minutes

Example

- **How to use the form:**
- write down 3 ideas in the first line (5 minutes)
- pass your form to your right neighbor
- add own ideas refining or adding to the 3 ideas already given on the form received
- Repeat 2 and 3 until you receive your 1st form

Problem: **How to increase our sales of chocolate pudding?**			
Participants:			
Email:	Idea:	Idea:	Idea
Mr. A	***New packaging***	***Loyalty points***	***Reduced sugar***

6-3-5 Method: 18 ideas to concrete problems in 30 minutes

Example

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Problem: **How to increase our sales of chocolate pudding?**			
Participants:			
Email:	Idea:	Idea:	Idea
Mr. A	***New packaging***	***Loyalty points***	***Reduced sugar***
Ms B	***In form of choco beans***	***Loyalty Pass***	***Stress health aspect***

6-3-5 Method: 18 ideas to concrete problems in 30 minutes

Example

- **How to use the form:**
- write down 3 ideas in the first line (5 minutes)
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Problem: **How to increase our sales of chocolate pudding?**			
Participants:			
Email:	Idea:	Idea:	Idea
Mr. A	***New packaging***	***Loyalty points***	***Reduced sugar***
Ms B	***In form of choco beans***	***Loyalty Pass***	***Stress health aspect***
Ms C	***Pudding filled into chocobeans***	***Points and pass for all productlines***	***Choclate makes happy***
Mr D	***No need for cooling: sell at cashpoint***	***Premium for collected points***	***Info-campaign on health aspects of chocolate***
Ms E	***Scrapbook for children at cashpoint***		***“choco pudding makes happy families”***
Mr F	***Complete scrapbook: Free zoo entry***	***First 5 to reach 1000 pointe invite to factory***	***Family nature trips***

6-3-5 Method: 18 ideas to concrete problems in 30 minutes

Example

- **Evaluation and presentation:**
- Evaluation (will take about 30 minutes):
- Each participant has 3 points to allocate to the 3 best ideas on each form (1 minute per form)
- Each table discuss and select 1 Winner (in total, from all forms)

- To be briefly presented to the plenum and discussed

- **Each table will tackle a different problem:**
- How pave the way to market? (power plants)
- Which other applications can be targeted?
- How can R&D contribute to cost reduction?
- How can R&D eliminate technology risks?
- How can competing companies cooperate towards technology cost reduction?
- …..

Problem: **How to increase our sales of chocolate pudding?**			
Participants:			
Email:	Idea:	Idea:	Idea
Mr. A	*New packaging* ★★★	*Loyalty points* ★★	*Reduced sugar* ★
Ms B	*In form of choco beans* ★	*Loyalty Pass*	*Stress health aspect* ★
Ms C	*Pudding filled into chocobeans* ★★	*Points and pass for all productlines* ★	*Choclate makes happy*
Mr D	*No need for cooling: sell at cashpoint* ★	*Premium for collected points* ★	*Info-campaign on health aspects of chocolate*
Ms E	*Scrapbook for children at cashpoint* ★		*"choco pudding makes happy families"*
Mr F	*Complete scrapbook: Free zoo entry* ★	*First 5 to reach 1000 pointe invite to factory*	*Family nature trips* ★★★

References

1. World Balance, IEA Energy Statistics (2017)
2. Roteiro para a Neutralidade Carbónica, RNC 2050 (2019)
3. Portuguese Roadmap of Research Infrastructures, FCT / MCTES (2020)
4. INIESC – Infraestrutura Nacional de Investigação em Energia Solar de Concentração, FCT / PO Alentejo / PO Lisboa. Candidatura: 22113 – INIESC AAC 01/SAICT/2016 (2017-2021)
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13. Adapted from https://commons.wikimedia.org/

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RENEWABLE ENERGIES CHAIR

CONTACT US!

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