« CatEnerChem »

Ecole Thématique CNRS -2022 Soutenue par INC – INEE- INSHS

A Roadmap for Catalysis to Support a Society Powered by Renewable Energies

Scientific and Socio-Economic Aspects of the Energy – Chemistry Nexus

35-H program

13h Catalysis & Chemistry
8h Social Sciences & Humanities
4h Serious Games, theater & workshops
5h Q&A+ **44 posters**
5h practicals

98 people on site

73 participants : 14 Staff + 59 PhD&PostDoc
14 speakers
11 organizers

22 remote attendants

6 participants : 4 Staff + 2 PhD
15 speakers +1 (pre-taped)

84.5 k€ budget

Registration fees 37 % +
Institutional support 63 %

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Scientific and Socio-Economic Aspects of the Energy – Chemistry Nexus

March 14th -18th, 2022 – Aussois (France)

« Transdisciplinarity to become more effective researchers & teachers in catalysis for the energy transition »

Color Code:

- General lectures
- Social Sciences & Humanities Lectures
- Catalysis Lectures
- Q&A, Debrief & Poster Sessions
- Practicals & Serious Games

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
	CH_4	**CO_2**	**NH_3**	**(Bio-)Polymers**
	Geo-politics	Economy (Game Theory)	Industrial Catalysis	Industrial catalysis
	Heterogeneous Catalysis	Industrial Engineering	Plasma	Recycling
				Biorefinery
	Poster	Poster	Poster	Poster
	Industrial Catalysis	Homogeneous Catalysis	Electrocatalysis	Biomass
		Life Cycle Analysis		Biofuels
	Q&A	Q&A	Q&A	Q&A
	Take-home Message	Take-home Message	Take-home Message	Take-home Message
Opening	**H_2**			**Conclusion**
Anthropocene	Photochemistry			Transition Scenarios
Renewable Energies	Biotechnology			Discussion
History	Industrial Production			Epistemology
	Q&A			Prize & Closing
Ethics	Psychology (Cognitive Biases)	Systemic Approach to Teaching	Problem-Based Learning	
Economy (Behavioural)	Take-home Message	Problem-Based Learning	Interactive Teaching	
Economy (Behavioural)	Economy (Behavioural)	Psychology (Cognitive Biases)		

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5h Q&A+ **44 posters**

5h practicals

Speakers, Discussion Leaders, Teachers

Intro

A. QUADRELLI (CNRS)
S. BORDIGA (UNITO)
W. STEPHEN (CRI, SW)-*r*
W. TUMAS (NREL, US) –*r*

History

A. MISSEMER (CIRED, F)

Economy & Psychology

B. RUFFIEUX (UGA)
L. AUFENBERG
H. KUNREUTHER (U. Penn)-*r*

CH_4

F. DI RENZO (CNRS Em)
M. NICOLAZZI (LIMES,I)-*r*
J.P. DATH (TotalEnergies, F) -*r*
J. VAN BOKOVEN (ETHZ &PSI)

H_2

V. ARTERO (CEA)
N. DUPASSIEUX (CEA)
T. LEPERCQ (Solairedirect, F) –*r*
C. ANDRONESCU (Duisburg)-*r*
K. VINCENT (Oxford, UK)-*r*

CO_2

T. CANTAT (CEA)
J. C. PEREAU (U. bordeaux)-*r*
M. SORENSEN (Haldor Topsoe)
W. LEITNER (MPG)-*r*
A. BARDOW (ETHZ)-*r*

NH_3

T. M. NGUYEN (H. Topsoe, DK)
R. INGELS (N2 APPLIED N)-*r*
Ib CHORKENDORFF (DTU, DK) -*r*

(Bio)Polym

E. GROPPO (UNITO)
N. FRIEDERICHS (Sabic)
V. MONTEIL (CNRS)-*r*
F. PICCHIONI (Groeningen NL)-*r*
C. PEREGO (ENI formerly)-*r*
K. BARTHA (U. Graz) -*r*

Scenarios & Debrief

F. CHANDEZON (CEA)
B. WECKHUYSEN 5Utrecht) –r
J. MICHEL (U Lyon)
J. KRATOCHVIL (U Lyon)

Epistemology & Ethics

M.-G. SALAMANCA (U Lyon)
P. ANASTAS (Yale U.)-r

Prcaticals

M.PREVOT (CNRS)
B. REUILLARD (CEA)
M. SIGNORILE (UNITO)
M. RAVI (U. Birgmingham)-*r*
X. CARRIER (SU)

In presenc *– r : in remote*

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Transdisciplinary chain of knowledge that the program has systematically explored:

- Elements of the systemic environmental, socio-economic and ethical context of the field
- Current state of the art of the industrial production in chemistry of 5 pivotal molecules at the energy/chemistry nexus (methane, hydrogen, carbon dioxide, ammonia, (bio)polymers)
- Identification of catalytic solutions currently at work and being improved for each molecule (photo-, electro-, bio-catalysis)
- Tools (epistemological, among others) for the analysis of the scenarios that these solutions imply, for example, the work via "serious games" for an awareness-raising work in order to favor the energy transition

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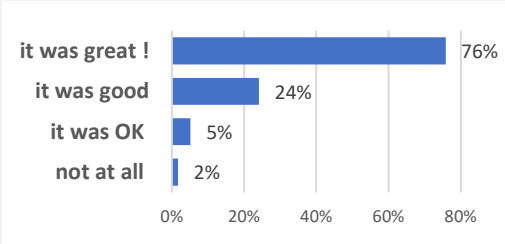
Results of **62 answers** (68% participation)

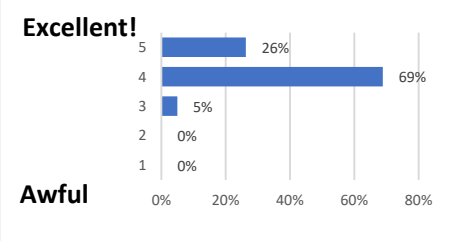
Survey

among
91 people on site
who attended at least
Monday & Tuesday

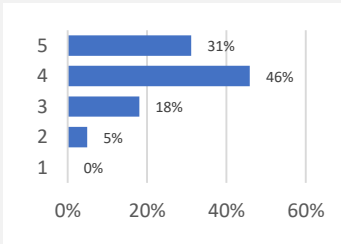
*Did you like the **transdisciplinary character** of the school?*



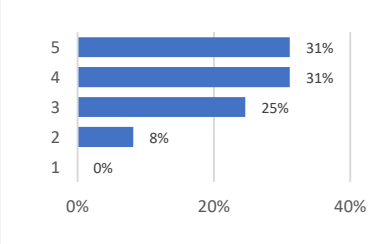
*How do you **rate the lectures** part of the programme?*



*…rate the **serious games, theatrical workshops, take home message and video***



*… rate the **practicals on catalysis with new pedagogies***



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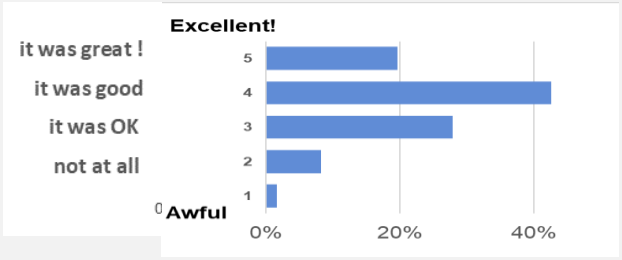
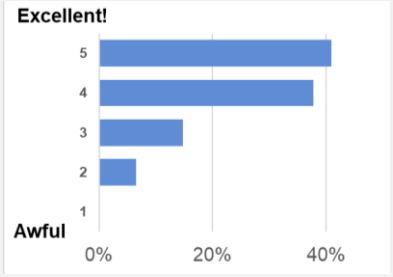
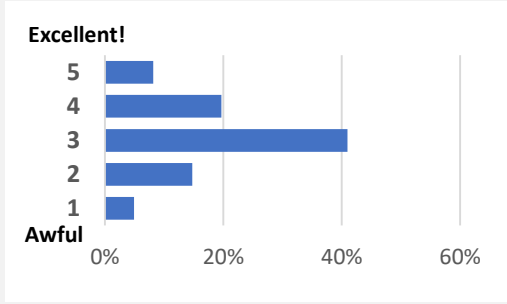
How would you rate the overall timetable (quantity of lectures and other events, time to network and meet the participants)?



How do you rate in overall the infrastructures?



…The hybrid solution (in presence and remote) was mostly induced by the covid-19 situation. How do you think the hybrid solution overall affected the school?



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Main scientific & pedagogic take-home lessons from the CatEnerChem experience:

1. **The link between chemistry and the broad framework of the Anthropocene** is strong and provides a relevant framework for complex systemic analysis of the energy-chemistry nexus

2. The importance of **embedding advances in a specific research topic** (e.g. chemical use of CO_2, defossilized production of NH_3) in **a broad understanding of the underpinning cycle** (carbon cycle, nitrogen cycle) and the underlying planetary boundaries

3. The relevance of concepts from philosophy, epistemology, history, geography and other SHS disciplines to understand and **overcome the disciplinary compartmentalization and reductionist approach** that still runs through our field and that are little in line with the systemic and complex nature of the changes underway.

4. The classic face to face lessons were well complemented by the power of **new learning methods** (e.g. theater-based workshops on ethics, interactive practicals through instant polling, debriefing sessions, video recording of self-reflexive considerations, practicals based on systemic approaches, serious games in psychology, long Question&Answer sessions, …) that reflect the systemic, demanding, reflective and decentered nature that the Anthropocene requires