



Ministero dell'Istruzione, dell'Università e della Ricerca

SC3 SECURE, CLEAN AND EFFICIENT ENERGY **GIORNATA NAZIONALE DI LANCIO DEL BANDO 2020 IN HORIZON 2020**

Suggerimenti per presentare una proposta competitiva: esperienze di successo

CO2Fokus (ID: 838061)

CNR-ITAE

Consiglio Nazionale delle Ricerche

Istituto di Tecnologie Avanzate per l'Energia "Nicola Giordano"

Via S. Lucia sopra Contesse 5, 98126, Messina, Italy

Speaker: Dr. Giuseppe Bonura

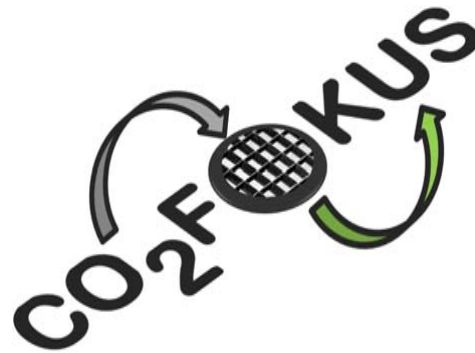
e-mail: giuseppe.bonura@itae.cnr.it





Topic: CE-SC3-NZE-2-2018 — Conversion of captured CO₂

Type of action: Research and Innovation action



CO₂ utilisation focused on market relevant dimethyl ether production,
via 3D printed reactor- and solid oxide cell based technologies

Start: 01/07/2019

Durata: 42 mesi

Budget: 4M€

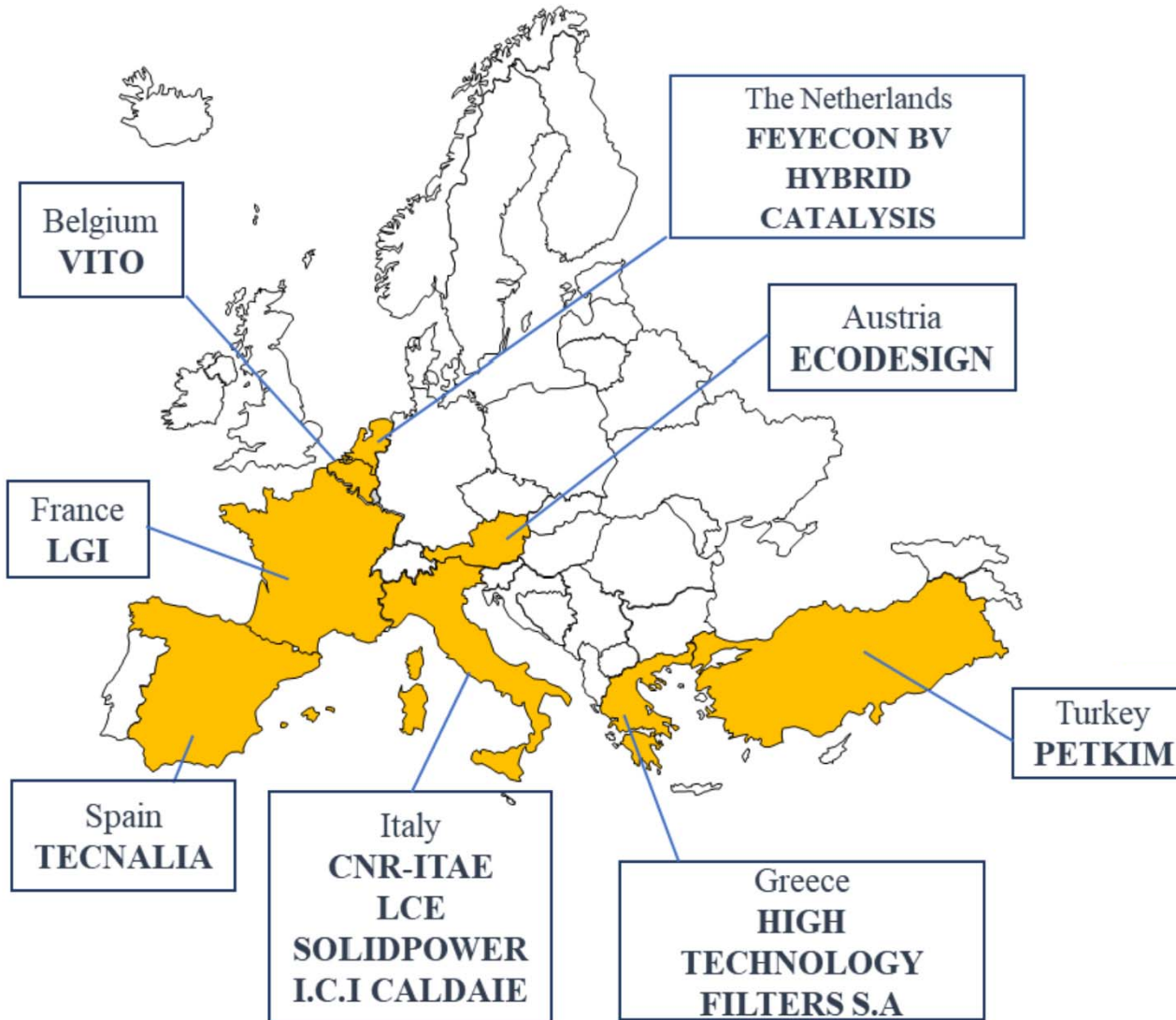


«Tips» per il successo

- Chiari obiettivi della proposta (cosa si vuole realizzare?)
- Pertinenza degli obiettivi al *topic*
- Credibilità della metodologia, originalità nell'esecuzione dei vari *task*
- Ambizione / innovazione / avanzamento rispetto allo stato dell'arte (Perchè lo si sta facendo? E' utile? E' una priorità EU? Perchè proprio adesso? Perchè proprio tu?)
- Approccio interdisciplinare, integrazione di contributi da varie discipline
- Impatto: ricerca di nuove soluzioni tecnologiche, creazione di nuovi mercati, valutazioni socio-economiche (cosa realizzerà il progetto?)
- Piano di sfruttamento dei risultati (Chi sarà interessato ai risultati? Quali saranno i mezzi di diffusione e chi i fruitori dei risultati tecnico-scientifici?)
- Qualità ed efficienza del piano di lavoro (Struttura del lavoro)
- Complementarietà dei partecipanti (enti di ricerca/università, SME, grandi industrie)
- Competenze per raggiungere gli obiettivi: ruolo valido e attivo di tutti i partner
- Costi/Durata



CO2Fokus: il partenariato



- 3 RTOs
- 8 SMEs
- 1 IND



GOAL: Development of catalytic reactions and solid oxide cell systems for the economically and environmentally viable direct production of dimethyl ether (DME) by CO₂ hydrogenation. The project allows for scale up in the short to medium term with a 30% improvement in energy efficiency

The concept is based on a single step process using captured CO₂ and separately generated hydrogen to produce dimethyl ether (DME) using a novel multichannel reactor

Integration of contributions from the following disciplines: material production, supercritical CO₂, additive manufacturing, catalysis and chemical engineering

Significant advances expected in the development of the innovative multichannel reactors employed with integrated catalyst systems and solid oxide electrolyser cells (SOEC). Advancement of the state-of-the-art of tailored multimetallic hybrid catalysts.

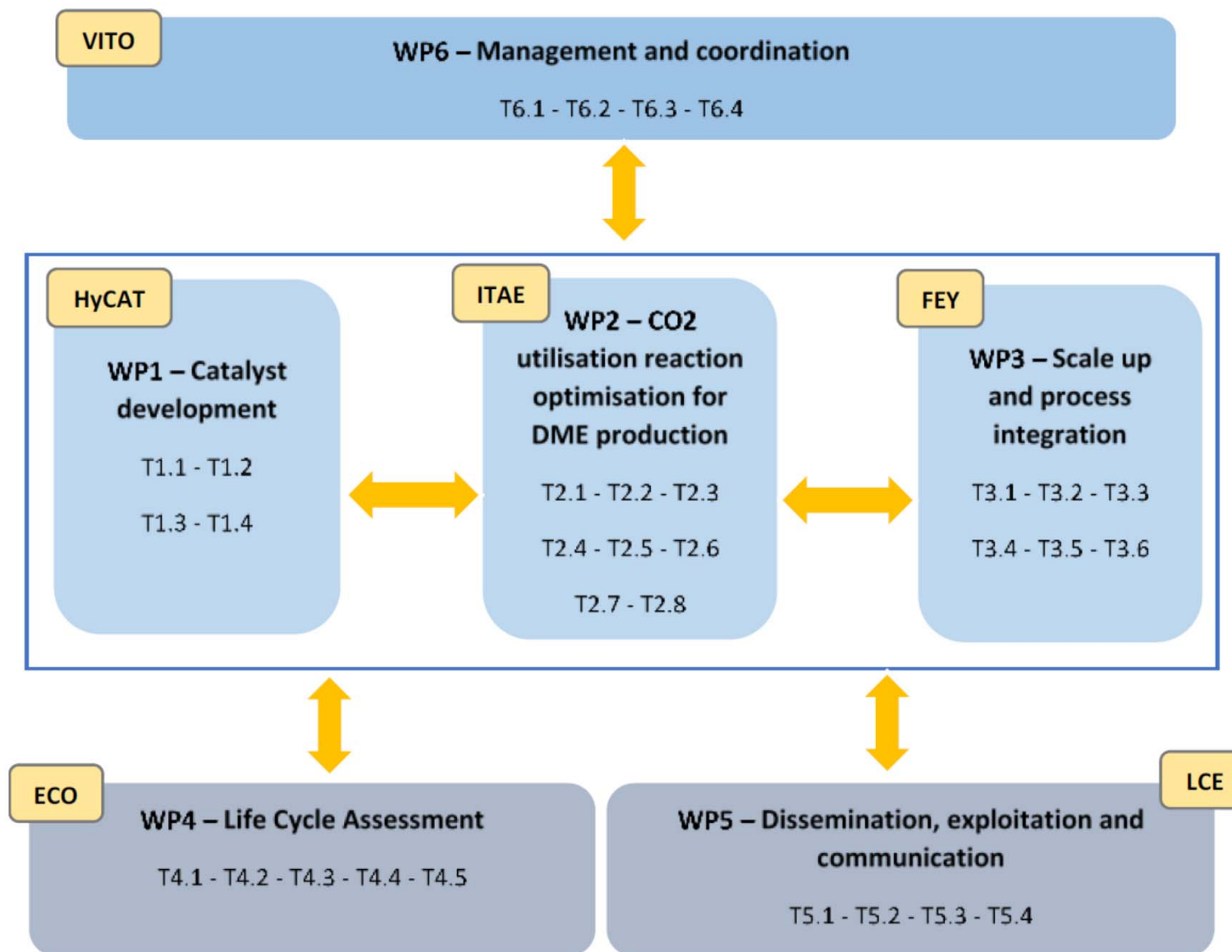
Innovative use of the chemical vapour deposition technique for the preparation of carbon nanotube catalysts

New solutions for the conversion of captured CO₂ to useful products such as fuels and chemicals

Replacement of fossil resources normally used for methanol and DME production, with creation of new markets with impact on the Circular Economy



WP Number ⁹	WP Title	Lead beneficiary ¹⁰	Person-months ¹¹	Start month ¹²	End month ¹³
WP1	Catalyst Development	4 - HYBRID	61.00	1	24
WP2	CO2 utilisation reaction for DME production, novel proof of concept	3 - CNR-ITAE	127.00	6	30
WP3	Reaction optimisation and process integration	6 - FEYECON	115.00	24	42
WP4	Life Cycle Assessment (LCA), socio-economic assessment (LCC, S-LCA)	7 - ECODESIGN	54.00	15	36
WP5	Dissemination, exploitation and communication	8 - LCE Srl	39.00	1	42
WP6	Management and coordination	1 - VITO	24.00	1	42
WP7	Ethics requirements	1 - VITO	N/A	1	42
Total			420.00		



KPIs evaluation

Key Performance Indicators (KPI)	State-of-the-art	CO2Fokus	Post CO2Fokus
Energy efficiency (MJ/ton DME)	2300 [#]	20-30% reduction	>30%
Catalyst & reactor design	TRL 3-4	TRL 6	>TRL 6
Catalyst durability (hrs)	10 ²	10 ³	> 10 ⁴
Pressure (bar)	30-70	30	<30
Temperature (°C)	280	250	<250
CO ₂ /H ₂ feed (N L/h)	33/100	500/1500 or larger by numbering the tubes in multichannel reactor	industrial point source
DME yield (%)	20-25	>30 (multichannel reactor)	>40
CO ₂ conversion (%)	30	>30	>50
CO ₂ emission footprint (kg CO ₂ /ton) (calculated from reference ⁶)	>840	300-600	600

(* single tube reactor, [#] produced directly from syngas 640,5 kWh/ton DME *3,6 = 2305,8 MJ/ton DME¹³)

**TRL**

Technology proposed	Current → target TRL	Justify current TRL
Scaled-up production of conventional catalysts	4 → 6	Series of stable and highly selective catalysts have already been identified in the literature in the market and their properties explored in direct DME reactions (conventional route from methanol to DME). The formulations for DME production from CO ₂ and H ₂ need further development.
Innovative CNT-based catalysts	3 → 5	The present TRL is 3, and the objective is to realise the scale-up at 100 gr/hr of the most promising compositions, with a final target of TRL 5.
Multi-channel, multi-tubular reactors for selected reactions	4 → 6	By means of in-house developed, adaptable 3D printing techniques a series of reactors will be manufactured and employed for process intensification with improved mass and energy transfer to lead to cost reduction.
SOEC co-electrolysis for DME production	4 → 5	The present TRL of the co-electrolysis SOEC system is 4 and is expected to reach 5; The advancement will be the system's operation for running H ₂ production in electrolysis mode; in addition some further exploration of direct fuel use will be carried out.
Electrolysis for H ₂ production	5 → 6	
DME use as a fuel cell	3 → 5	
Reactions at mini pilot-scale	4 → 6	Existing single tube and multichannel reactors have already been preliminarily tested in similar routes by the partners. The optimised process design and tailored operating conditions for direct conversion CO ₂ and H ₂ will be scaled up from its present TRL 4 into a higher TRL with a final goal of reaching level 6.



Gender analysis in CO2Fokus

Coordinator: Dr. Vesna Middelkoop (VITO)

WP leaders: 3 women (WP3, WP4, WP5)

Total number of female active in CO2Fokus=40% of the total listed participants.

- *Each partner organization commits to gender quality in terms of human resources taking into account salary and working conditions*
- *The management of CO2Fokus will monitor gender aspects in the project on a regular basis.*



Evaluation Summary Report

Total score: 13.5 (Threshold: 10)

Criterion 1 – Excellence

Score: 4.50 (Threshold: 3/5.00)

Criterion 2 – Impact

Score: 5.00 (Threshold: 3/5.00)

Criterion 3 – Quality and efficiency of the implementation

Score: 4.00 (Threshold: 3/5.00)

1st on the waiting list

Total funding amount for NZE-1 and NZE-2 calls shared

Topic NZE-1: 5 million euro not funded

Enough for financing CO2Fokus on NZE-2



Punti di Contatto Nazionale (NCP) di Horizon 2020 in Italia

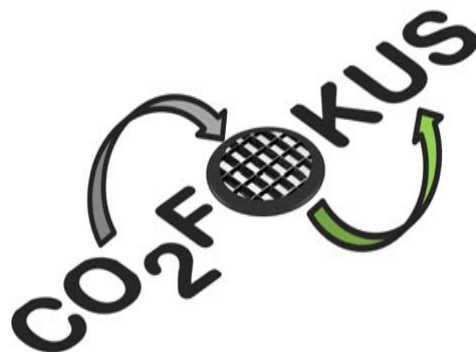
Gli NCP in APRE offrono un servizio, a titolo gratuito, di informazione e assistenza su:

- la priorità tematiche o i programmi di ricerca;
- gli strumenti finanziari; le procedure amministrative;
- la preparazione della proposta (incluso il pre-screening).

I Punti di contatto nazionale in APRE possono essere raggiunti telefonicamente al numero 06 48939993 o per posta elettronica

Prof. Riccardo Basosi, delegato al programma Energia H2020 (PC member)

Fine Gennaio 2019: Inizio negoziazione



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