



Design, implementation and production upscaling of novel, high-performance, cluster-based catalysts for CO₂ hydrogenation

PROGRESS REPORT



Grant Agreement No: 955650
Project start date: 01.11.2020
Duration of the project: 48 months
Due date: 30/11/2021 (M13)
Actual submission date: 05/01/2022
Dissemination level: CO
Author(s): Didier Grandjean

Progress Report

Contents

Summary	3
1. General progress of the action.....	3
1.1 Recruitment.....	3
1.2 S&T and local Training	4
1.3 Secondments	4
1.4 Network event.....	4
1.5 Management	4
1.6 Deliverable and milestones	4
2. Recruitment strategy.....	4
2.1 Preparation of announcements (October 2020).....	5
2.2 Official start of Campaign (November 2020)	5
2.3 ESR selection, final decisions (March 2021).....	5
2.4 Targeted start of employment (June 1 st , 2021).....	5
2.5 Catchy Recruitment survey	6
2.5.1 Gender balance	6
2.5.2 Countries distribution.....	7
2.5.3 ESR positions applications distribution	7
2.5.4 Advertisement of positions	8
3. Career development plan for each recruited researcher.....	8
4. Management of the action.....	8
4.1 Network Management	8
4.1.1 Supervisory Board (SB) Meetings	8
4.1.2 Network Events	9
4.1.2.1 Kick-off Meeting Project, Leuven, Belgium	9
4.1.2.2 Kick-off Training, Leuven, Belgium	9
4.2 Risks and ethics	9
5. Communication Activities.....	9
5.1 Catchy website	9
5.2 Social media.....	10
5.3 Outreaching events	10
6. Impact of the Action.....	10

Summary

Capturing CO₂ directly from the atmosphere, or more practically as it is produced from coal- or gas-burning power plants, and then converting it into useful fuels and chemicals is the most credible route to securing our future until we stop releasing so much CO₂ into the atmosphere. The conversion of CO₂ (hydrogenation) into methanol and C₂ products (ethanol, ethylene, etc.), convenient chemical intermediates for a host of products, offers us a tremendous opportunity to limit the problems we face. However, the high stability of the CO₂ molecule requires breakthroughs in the performance of current thermo- and electrocatalysts for CO₂ conversion that we will address jointly in a single project expecting important synergies.

CATCHY will create new, high-performance cluster-based catalysts for the conversion of atmospheric CO₂ into added-value synthetic materials with a catalysis-by-design approach based on advances in our atomic-scale understanding, analytical and in situ/in operando tools, and computational methods, while delivering a training programme that will give 14 early-stage researchers the expertise and skills required by employers in the European nanotechnology sector. The training programme is industry oriented, covering catalysis applications that relate directly to energy and climate-change problems. It is innovative, interdisciplinary and intersectorial, involving 10 Beneficiaries and 2 Partner Organisations. CATCHY will offer an interactive training approach that will cover the whole value chain, from the fabrication and characterization of cluster-based nanostructured surfaces, including non-deposited or free cluster and theoretical modelling developments, to the realization of innovative applications. CATCHY will contribute to Europe holding a competitive advantage for catalysis research in industry and academia.

1. General progress of the action

1.1 Recruitment

Catchy-ETN has started on November 1st 2020 and placed the recruitment target for all 14 ESRs on June 1st 2021. The Catchy website, launched in November 2020 (Deliverable D7.1), was used to advertise the whole project as well as the different 14 individual ESR positions. An online application form was created to centralize all the applications on the website and allowed a transparent and efficient recruitment by giving the PIs full access to the applicant list. The announcement of the 14 Early Stage Researchers positions was posted in Euraxess and a large selection of specialized job sites with an application deadline of January 31st 2021. Among the 271 applicants, 65 were shortlisted and interviewed in February-March 2021 and selected candidates were offered the position in March 2021. Four ESRs have started on the targeted date of June 2021, and several others started with a limited delay of a few months. The starting dates of ESRs 9 and 14 were delayed by a late obtaining of the Master diploma. There were specific issues for filling the positions of ESR 4, 7, 8, and 11. For the ESR 4 and ESR 7 positions none of the shortlisted candidates were judged suitable for the position (after the interview) and they were reopened. After the second round, with a slightly revised position description, suitable candidates were found but they started with significant delays (October 2021). For the positions of ESR8 and ESR 11 suitable candidates were found, who both accepted the position, but revoke the initial agreement before starting for personal and Covid related reasons. Those positions were reopened as well and new interviews were held. ESR8 could still start with limited delay (September 2021), while ESR11 will only start in January 2022.

1.2 S&T and local Training

All ESRs (except ESR11) are already enrolled to PhD programmes and are attending courses related to their research fields. All have prepared their PDCPs, guided by their (co)supervisors and the Catchy training lead (TL). The ESR's local training is going according to the original plan. They have now all started local training and design of new in situ cells and reactors After their local training ESRs are catching up with the planned research work, after initial delay relative to the late recruitment.

1.3 Secondments

Secondment plannings have been adapted to accommodate the initial delay in the recruitment. The planning is monitored using the intranet of Cathy website – the TL keeps the overview.

1.4 Network events

All ESRs (except ESR11) participated in the Kick-off meeting that was the first network event held physically in Leuven in September 2021. It consisted in a Project Day presenting Catchy's objectives and proposed methodology as well as the activities/expertise of all beneficiaries and associate partners (28 physical plus 3 online participants). The second part was a S&T and generic skills training (see Deliverable D6.1) attended by a total of 33 participants (of which 5 online) including 8 external PhD students. The lectures were given by a combination of Catchy project members and 10 invited speakers, most of them present in person.

1.5 Management

Regular meetings of the SB are organized every few months and four meetings have been so far organised online (see section 4.1). Minutes are available on the Catchy intranet.

1.6 Deliverable and milestones

Most of the deliverables that concern the management, communication, IPR as well as the structure of the training network such as D7.1 Website online (KUL) and D7.2 Communication and Dissemination Plan (KUL) due on M3, D8.4 Data Management Plan (KUL) due on M6, D7.4 IPR policy (KUL) and D8.5 Personal career development plans (RU,KUL) due on M7 and D9.1 EPQ – Requirement No.1 (KUL) due on M12 have been submitted. Also the training deliverable D6.1 NWT1 Kick-off meeting (KUL) due M10 has been submitted.

S&T deliverables D1.1: Cluster deposition EC (DTU) and D4.1: Mass spectra metal-oxide clusters (UU) both due on M12 are slightly delayed due to late recruitment and will be submitted in January 2022; for D4.1 this likely will be a preliminary report.

Milestones regarding the recruitment and Doctoral guidance such as MS1: Pre-recruitment (KUL) due M3, MS2: Recruitment Completed (KUL) due M12 are submitted.

Due to the delays in recruitment Milestones MS3 (PDCP of each ESR approved by the SB) and MS4 (DCG of each ESR established and approved by the SB) both due August 2021 have not been met. Once the last ESR has started in January 2022, the last DCG will be established, and the last PDCP will be drafted, following which all will be submitted for SB approval in spring 2022.

2. Recruitment strategy

The followed recruitment strategy and plan adopted by Catchy SB was as follows:

2.1 Preparation of announcements (October 2020)

A general announcement (a joint advertisement of the 14 ESR positions and a template for the 14 individual announcements) was prepared by the Daily Manager (DM). Each future promotor prepared short text specific for each position.

2.2 Official start of Campaign (November 2020)

Catchy has opened a single call for the recruitment of all the ESRs. The advertisement of the different positions has been combined in a single announcement for the whole Project that was published in Euraxess (*EURAXESS Job Offer id: 575200*), FindAPhD, Nature careers, ResearchGate, LinkedIn, ABG, as well as on the Catchy website and on websites of the beneficiaries.

All candidates applied at the Catchy website. They were asked to indicate their preference for up to 3 positions and had to provide motivation letter, CV (Europass type), list of publications (if available), and other documents to demonstrate specific experience. All ESR applications were visible on the intranet part of the Catchy website for all PIs/promotors. Each ESR was selected by a specific Selection Advisory Committee (SAC, see description in the Catchy proposal, section 3.2.3) consisting of: the ESR supervisor, up to three co-supervisors (the secondment hosts), and optionally additional person(s) chosen by supervisor (such as the future PhD promotor if this is not the same person as the supervisor), the Equal Opportunity Officer (EOO, Sandra Lang) and the DM (Didier Grandjean). Each scientific member of the SAC (thus excluding the EOO and DM), made a selection of at least three good candidates for a preliminary short list (PSL). These PSLs (3 – 5 per ESR) were distributed among the SAC members. The PSLs were then reviewed by the EOO and the DM for assessment of equal opportunities / fair selection procedure and eligibility of candidates.

The future supervisor of the ESR prepared a final short list with 3 to 5 candidates who were invited for an online interview. The short lists for each ESR position were then made available on the intranet part of the Catchy website (accessible for supervisors only) allowing to spot overlap of shortlisted names, which is possible because candidates could apply for multiple positions. At the closing date January 31st, 2021 we received a total of 271 applications on the Catchy website.

2.3 ESR selection, final decisions (March 2021)

After the interviews the SAC, led by the future supervisor of the ESR, took the final decision. The supervisor then offered the position to a candidate. Once accepted, the supervisor communicated the names of the selected ESR candidates to the DM who published them on the Catchy intranet.

2.4 Targeted start of employment (June 1st, 2021).

Only ESRs 3, 12 and 13 started on the planned date of June 1st 2021. ESRs 1, 2 and 14 on August 1st, , ESR 10 on August 18th, ESRs 5 and 6 started on September 1st, ESR 8 on September 20th, ESRs 4,7 and 9 on October 15th. ESR 11 will start in January 2022.

ESR 1, 9 and 13 have undergone two-week quarantine upon their arrival at their respective hosts. Additionally, ESR 13 has contracted Covid one month later and has not been available for an additional two weeks. ESR 9 starting date was also postponed by two weeks for medical reasons. Additional delays ranging from 2 to 4 weeks have finally been reported for the visa delivery in their respective countries (Pakistan, India and China) directly or indirectly related to Covid.

Although ESR 2 accepted the position in March/April, he started on August 1st due to delay in obtaining the UK visa.

The ESR 4 and ESR 7 (RU) positions have been re-advertised end of April 2021 (EURAXESS Job Offer id: 632039) due to low numbers of suitable applications (respectively 8 and 5 first choice candidates) received in the first round. Both positions have been accepted at the beginning of July. Due to lengthy visa applications both ESRs started October 15, 2021.

The ESR 8 (KUL) position has been re-advertised in June 2021 (EURAXESS Job Offer id: 632039) after the decision of the selected candidate (Mrs. Mengqi Duan, China, set to start on August 1st 2021) to cancel her application for personal reasons. A new candidate Mrs. Dimitra Papamichail (Greece) was then selected. She has started on September 20th, 2021 causing a delay of 2-3 months.

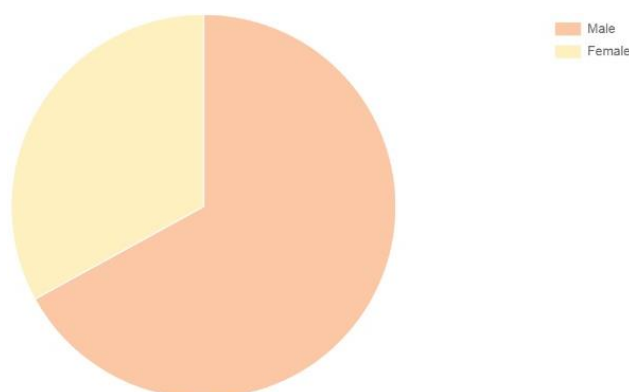
Covid had severe impact on the recruitment process of ESR11. Two candidates whose paperwork were done and approved by DTU chose to subtract their applications very close to their planned starting date. This resulted in two additional application processes. The ESR 11 (DTU) position has been re-advertised in July 2021 (EURAXESS Job Offer id: 665556) after the decision of the selected candidate (Mrs. Yasemen Kuddusi, Turkey, set to start on August 1st 2021) to cancel her application for personal reasons. One of the reasons was that she had been away from her family for 1.5 years due to COVID. A new candidate Mr. Ching Wai Fong (China) was hired with a starting date of November 15th, 2021. However, the candidate revoke the work agreement with DTU due to difficulties in getting a work permit in Europe directly caused by Covid. He was indeed unable to obtain a work permit at the Danish consulate in Hong-Kong, which was shut due to Covid restrictions, nor able to travel to the main Danish consulate in Shanghai. A new candidate Mr. Filippo Romeggio (Italy) has been recruited with a planned starting date of January 15, 2022 corresponding to delay of at least 6 months from the original plan.

2.5 Catchy Recruitment survey

We received a total of 389 applications (271 in the first run) for the 14 advertised ESR positions.

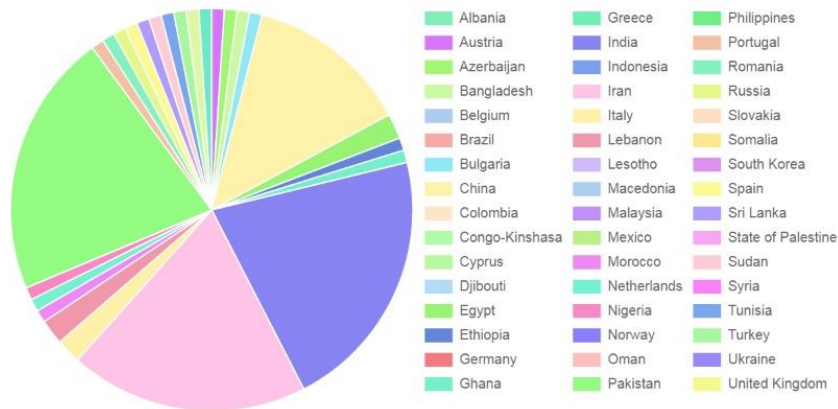
2.5.1 Gender balance

A gender balance of 33 % female 67 % male was observed for the candidates. The gender balance is reflected in that of the recruited ESRs (36 % female, 64 % male).



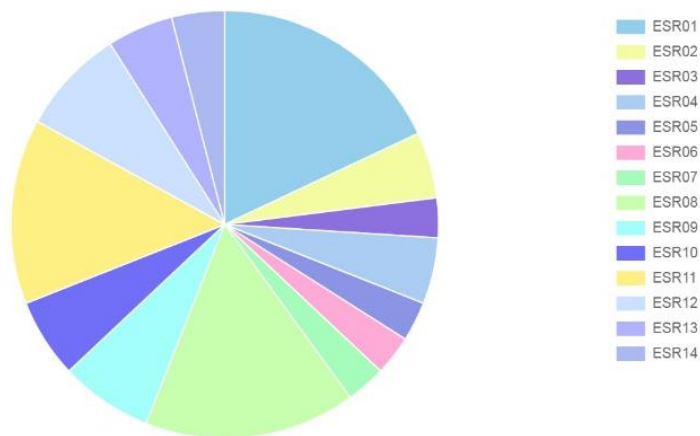
2.5.2 Countries distribution

The applicants originated from 51 different countries with 74 % of the applications coming from India, Pakistan, Iran and China, while European applicants represented only 8 %. The fact that half of recruited ESRs are Europeans is attributed to a higher quality of their applications.



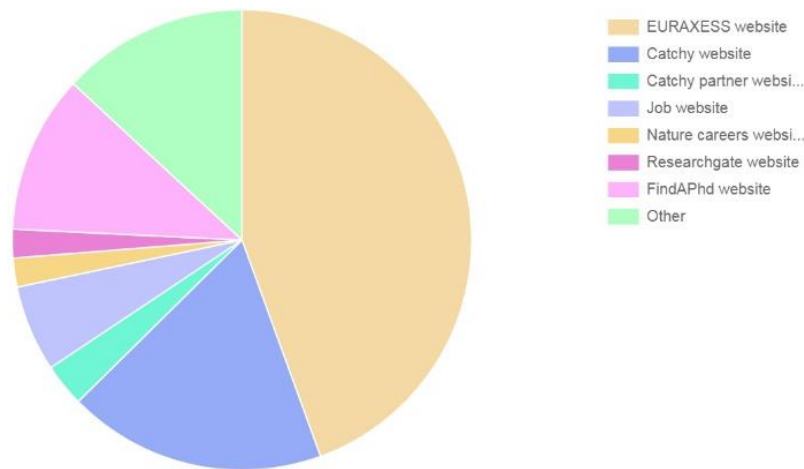
2.5.3 ESR positions applications distribution

ESR 1, 8 and 11 (8 and 11 were opened twice) gathered the most applicants while ESR 5, 6 and 7 the least.



2.5.4 Advertisement of positions

Among used advertisement media, Euraxess and the Catchy website were the most successful, ResearchGate and Nature Careers the least.



3. Career development plan for each recruited researcher

The Catchy Management Team drafted a Personal Career and Development Plan (PCDP) template addressing such questions as project planning, project milestones, secondments, but also training of scientific and personal skills, and the personal ambitions of the ESRs. The PCDPs are intended to form a planning for the ESRs' projects and are subject to an annual revision based on intermediate results and updated scientific insights. Each ESR has drafted her/his own PCDP, which, upon mutual agreement between ESR and the ESR's advisor, was sent to the training lead, Joost Bakker of RU, for feedback. This feedback was used to construct a final PCDP. ESR 4 and ESR 7, whose PI is the training lead, sent their PCDP to their respective WP leaders for feedback.

The due date of May 31, 2021 for deliverable D8.5, the submission of 14 PCDPs, was not met due to delays in the recruitment process. Instead, D8.5 was submitted on October 2, 2021, with five PCDPs still missing, either due to very recent start dates, or start dates in the future. At the time of writing, only two PCDPs are still missing. By the time they are completed, estimated in March 2022, we will submit a final version of D8.5.

4. Management of the action

4.1 Network Management

4.1.1 Supervisory Board (SB) Meetings

Regular meetings of the SB are organized every 6 months. Four meetings have been so far organized exclusively online due to the pandemic situation. Minutes are available online on Catchy intranet. Two ESRs (3 and 9) representatives have been elected and have participated in the last meeting.

- **SB Meeting 1**, November 10, 2020, 1:30 pm – 6:30 pm
- **SB Meeting 2**, January 5, 2021, 2:00 pm – 3:30 pm
- **SB Meeting 3**, June 30, 2021, 5:00 pm – 7:00 pm
- **SB Meeting 4**, December 6, 2021, 10:00 am – 12:00 pm

In the future SB meetings will continue to be held either online or in combination with the network training events to minimize the travelling costs and CO₂ footprint.

4.1.2 Network Events

4.1.2.1 Kick-off Meeting Project, Leuven, Belgium

September 14, 2021, 9:00 am – 10:30 pm, Organised by KUL

Catchy Project presentation (Day 1) was held at Martin's Klooster in Leuven city centre. 28 participants were physically present plus 3 additional participants online. This day consisted of the presentation of CATCHY's objectives and proposed methodology, overview of the activities/expertise of all beneficiaries and associate partners, and first work package discussions. It was closed by a dinner.

4.1.2.2 Kick-off Training, Leuven, Belgium

September 15, 2021, 9:00 am – September 17, 2021, 3:30 pm, Organised by KUL and VITO

(Electro)catalysts for the capture and conversion of atmospheric CO₂ into added-value fuels

CATCHY Kick-off Training was held at College De Valk 3 (KU Leuven) in Leuven (see Deliverable D 6.1). The training was attended by all the ESRs (except ESR 11) hired by that time. ESRs 4 and 7 who did not have the appropriate visa attended online. A total of 33 participants including 8 external PhD student participants from KU Leuven, University of Duisburg-Essen, Germany and Université de Lorraine, France attended the training event in person and 5 persons were additionally presenting and/or following the meeting online. No registration fees were asked. The 8 lectures of the S&T training event were presented by 5 invited speakers outside of the Catchy network plus 7 speakers from the Catchy partners. The 4 lectures of the skill training were presented by 5 invited speakers from VITO and KU Leuven. The lectures are available on the Catchy website for Catchy members.

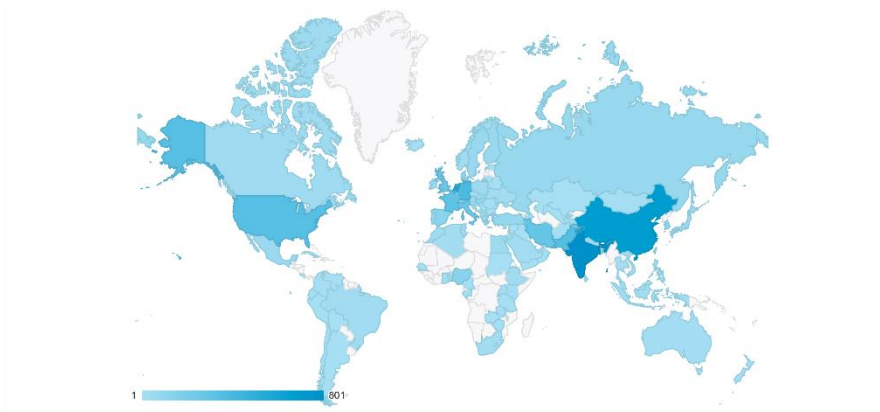
4.2 Risks and ethics

The main risk involved is "Delay in Recruitment" and its consequences for the consortium and the scientific progress of the project. The CATCHY timetable, in particular the secondment and training plan have been readjusted in agreement with all the Participants to take these delays into account. Environmental compliance and safety regulation will be secured by informing Catchy members about the possible health hazards as well as harm to the environment caused by the nanoparticles /nanoclusters and highly toxic substances (methanol, CO) that will be produced and used during the research. This information as well as the measures that will be taken to mitigate the risks are described in Deliverable D9.1 that is available to the research staff on Catchy website intranet.

5. Communication Activities

5.1 Catchy website

The main website of the network is hosted at www.catchy-etn.eu and features both a public as well as a password protected area (see Deliverable D7.1). A total of 6700 visitors (2400 new users) have been reported since the website creation in November 2020. The age distribution shows a very prominent fraction of young visitors, 41 % are 25-34, 28 % 18-24, 12 % 35-44 with a good gender balance (56 % male, 44% female). Outside Europe, visitors are mostly located in India (12%), China (10%), Pakistan (5%), USA (5%), Iran (4%) as shown in the map below (Google Analytics).



5.2 Social media

In addition to the official website, Catchy is also present on Facebook, LinkedIn (managed by Esperanza Sedano Varo (ESR12)), Instagram (managed by Deema Balalta (ESR10)) and Twitter (managed by Imran Abbas (ESR1)) that are directly accessible from the main website of the project.

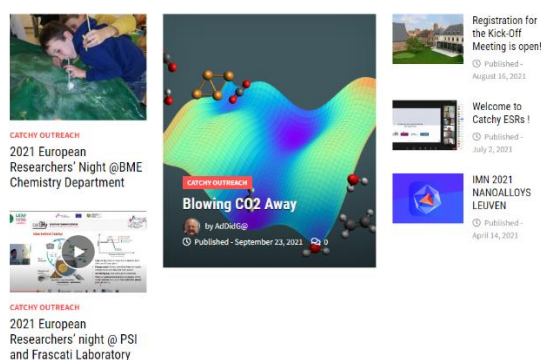
5.3 Outreaching events

Two outreach events have been already organized by Catchy ESRs in the framework of the 2021 European Researchers' night. These events were highlighted on the Catchy website.

Maximilian Winzely (ESR14) presented Catchy and his role in the project at Frascati Laboratory. This is now a video part of the Leaf YouTube channel.

Renata Sechi (ESR5) prepared a 3D board game (titled "Blowing CO₂ away") representing the 3D energy-landscape of the CO₂-reduction reaction. Each player pushes a little ball from one side to the other of the table by blowing into a straw. Children, students and adults that came to play at the CH-building of BME, in Budapest had the possibility to discuss the best strategies to finish the game.

CATCHY POSTS



6. Impact of the Action

The immediate impact has been to train the fellows with a broad portfolio of skills and practical experience of cross sector working and encourage them to act as ambassadors for the European ideal of integration.

Through the kick-off meeting they have already gain new knowledge, including scientific, technological, business and generic aspects, *team-working*, *communication*, *public engagement*,

project management, research leadership, creativity, research methods, teaching, enterprise, research ethics, problem solving and IP management. Through local training the ESRs have started to develop a broad knowledge of cutting edge techniques that form the core tools of high level cloud related research and will understand the research and innovation pathways and the perspectives of industry.

The presence of the Catchy ESRs at the different partners has allowed increasing the awareness of CO₂ conversion as viable solution for the global warming issues as well as increasing the visibility of European programs in the groups and allowed others PhDs in the group to beneficiate from some training provided by Catchy.