RESEARCH CALL 2024

The Power-Carbon-Water Nexus (PCWtX)

GreenLab DTU VILLUM FONDEN

New Funding Opportunities

The GreenLab Research Platform is launching a call with four new research funding opportunities within the following mission-driven challenges:

- **Challenge A:** Power-Carbon-Water-to-X Trade-Off Assessment
- **Challenge B:** Multi-stakeholder Collaborative Models for Eco-Industrial Clusters
- **Challenge C:** Rethinking Grid Capacity in Industrial Clusters
- **Challenge X:** Open Challenge for Industrial Sustainability
- **Special event:** GreenLab test facility hackathon

The projects will be funded by VILLUM FONDEN, and the background for the call and the details of the challenges are described in this slide deck.

Application deadline:
November 15, 2024, at 15.00

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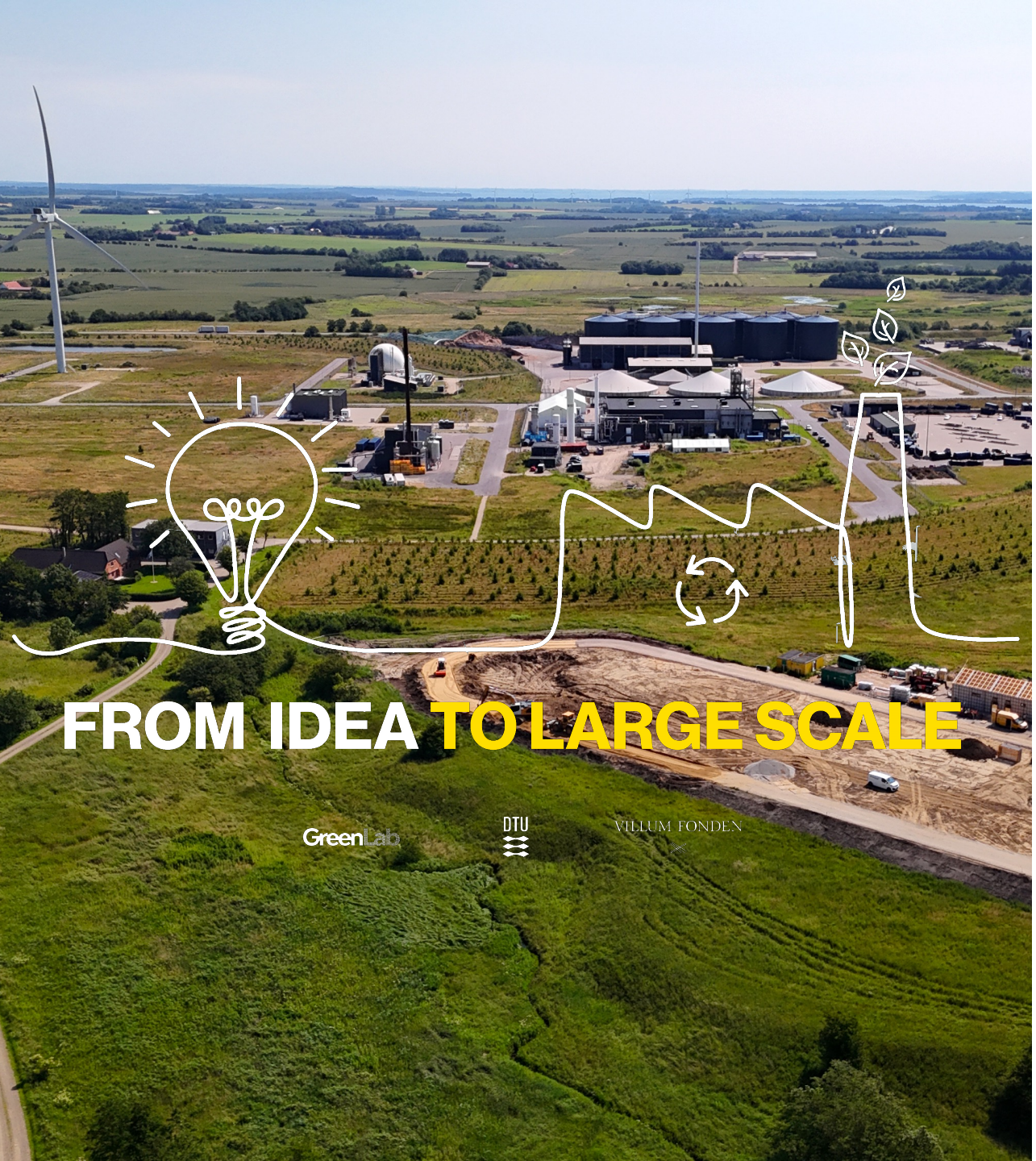

Background

GreenLab is an eco-industrial cluster in Skive, Denmark. Located in a rural agricultural community with access to renewable energy, carbon sources, and available water, GreenLab is looking to grow sustainable industry and Power-to-X with the companies located there. Moreover, the SymbiosisNet is being developed here – a unique combination of digital and physical infrastructure that allows the companies in the park to share their excess resources and unharnessed energies with each other, building a working circular economy.

Since 2021, GreenLab's Research Platform has initiated 12 research projects and a fellowship program funded through a donation from VILLUM FONDEN. The projects and fellowship candidates have been chosen from four rounds of funding calls with mission-driven challenges.

The main theme of the research has been Industrial Sustainability and Symbiosis for PtX value chains. Read more about previous projects and calls here.

From July 2024, VILLUM FONDEN has chosen to continue the support of the GreenLab Research Platform, and we are therefore launching a series of new funding calls.

The scope of the continued platform has been broadened to not only look at the challenges related to the energy side of PtX, but also include the strongly linked challenges in the use of biogenic carbon and sustainable water sourcing including reuse of waste sources.

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Research Missions at GreenLab

At GreenLab, we work with mission-driven research, recognising that the challenge of the green transition in industry is a complex problem, not one that will be solved by a single technology or idea, but rather a concerted effort in the same direction from many different actors. We have identified four research missions upon which our research platform stands.

Industrial Sustainability

A Global Model for Eco-Industrial Clusters and best practice for true sustainability

Eco-industrial Cluster Design

Development of the design manual for the green industrial clusters of the future

Flexibility to Green Energy

Optimization of and between absorption of fluctuations from renewable energy, consumption flexibility, and infrastructure costs for storage and conversions

Sector Coupling

Demonstration of valuable sector integrations that can show the way to scalable initiatives for the rest of society

Local Impact

Building upon local resources and thereby bringing value to and from the local rural and agricultural communities

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The Power-Carbon-Water Nexus (PCWtX)

PtX plays a key role in the power shift of society, the energy sector, and industry. However, this places a large emphasis on the supply of green power, which is only part of the equation for a de-fossilized future.

We also need to supply renewable, biogenic carbon sources for the industries which currently rely heavily on carbon from fossil fuels.

Supply of carbon will, for a foreseeable future, be strongly coupled to agriculture and circular economy in industry. Links to sustainable agriculture as a carbon source and cleverly balanced usage of carbon from industry is thus also critical in the green transition.

The energy-water-nexus has been ubiquitous in the sustainability agenda for decades, but the advent of PtX-H_2 value chains just further emphasizes the importance of this link and of balanced resource management in relation to water.

We want to combine these aspects by placing focus on the Power-Carbon-Water Nexus

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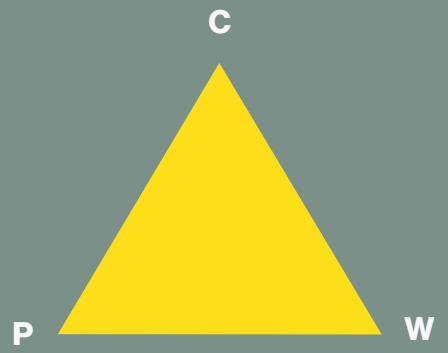
Challenge A

Power-Carbon-Water-to-X Trade-Off Assessment

- In the PCWtX nexus, comparing trade-offs between different material uses is crucial for understanding and evaluating potential solutions to assess the impact of their implementation. There are various assessment methods that can be used to accomplish this
- However, direct comparisons within the PCW space are challenging. For example, how do you compare water usage to carbon sequestered? Accounting for these trade-offs builds a fuller picture, and thereby a more informed decision can be made in the PCW space
- We want to use GreenLab as a case study to explore solutions and to develop a language for discussing trade-offs in this space



Missions related to challenge:

- **Industrial Sustainability**
  - Supply/Demand Flexibility
  - Eco-Industrial Cluster Design
  - Sector Coupling

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Challenge B

Multi-stakeholder Collaborative Models for Eco-Industrial Clusters

- In the green transition, society often faces ”the chicken and the egg” challenges – balancing dependencies such as market offtake vs production of hydrogen. An open question is if such complex problems are best solved by vertical integration by a strong single business or if they should be solved by multi-stakeholder collaborations
- At GreenLab, we are exploring a specific solution to the question above, since we are working with the complexity of having multiple business stakeholders. We would like to have researchers put this position into an academic context with comparison to other collaborative models
- We often use the narrative of being inspired by ”the cooperative movement”, and we hope that this project will inspire and challenge us on that narrative as well as outline potential future collaborative models for eco-industrial clusters

Missions related to challenge:

- **Industrial Sustainability**
  - Eco-Industrial Cluster Design
  - Local Impact

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Challenge C

Rethinking Grid Capacity in Industrial Clusters

- The power grid for electricity distribution often faces underutilization due to design for peak load as well as N-1 redundancy concerns. There is thus a substantial perceived gain for DSOs by optimizing the degree of utilization through load shift and local buffering
- At GreenLab, we are working on a holistic optimization across multiple energy vectors, whereby extra degrees of freedom are accessible. The problem lies in outlining a roadmap for this development, taking into account the continuous development of technologies and market prices
- We are specifically hoping to obtain a science-based outline of the opportunities for local optimization and concrete recommendations for infrastructure investments which maximize the value of having a local energy cluster through a cost-benefit analysis

Missions related to challenge:

- **Industrial Sustainability**
  - Supply/Demand Flexibility
  - Eco-Industrial Cluster Design
  - Sector Coupling

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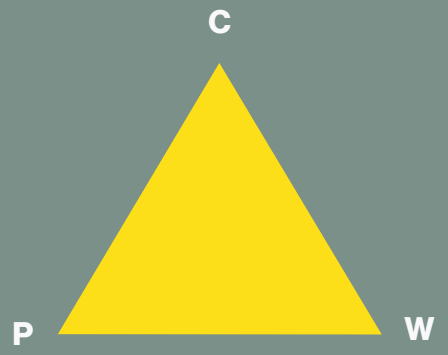
Challenge X

Open Challenge for Industrial Sustainability

- At GreenLab, we continuously identify new challenges, and we see the research activities targeting the challenges as steppingstones on the journey towards industrial sustainability. This is our way of doing mission-driven research
- However, there are always things that we have not thought of, or which fall outside our fields of expertise
- Our ideas for new challenges are almost always founded in dialogues with partners, researchers, and other guests at GreenLab, and we therefore also welcome ideas that fall outside the existing challenges. If an idea is well-justified and supports our missions we may choose to initiate a research project directly for this idea, or we may define a new challenge based on the idea for one of the next calls for project proposals

Missions related to challenge:

- **Industrial Sustainability**
  - Supply/Demand Flexibility
  - Eco-Industrial Cluster Design
  - Sector Coupling
  - Local Impact



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SPECIAL EVENT:

GreenLab Hackathon

- **Event:** Compete together with your team to win the prize of an awarded GreenLab-VILLUM project on transforming GreenLab test facility assets into a leading national platform for Research and Education within PtX

- **Scope:** GreenLab's new assets include electrolysis and two different battery types, forming the foundation for a test platform embedded in the symbiosis. The hackathon challenge focuses on how the platform can be developed so it becomes relevant for both early TRL industry tests and university research.

- **Date and time:** Tuesday February 25, 2025, from 9.00-22.00

- **Venue:** Elværket Skive - co-hosted by Læringsambassaden Skive, who will facilitate the use of their Makerspace/FabLab

- **Format:** Participants will have specs and data on the units available as well as tools for making miniature mock-ups of concepts for the platform

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Research Community Days

Researchers and industrial partners

As part of the VILLUM FONDEN projects you will attend Research Community Days in Skive every 2nd month, with other researchers and industrial partners.

Informal presentations

The format of these days allows for informal presentations from our research partners with a focus on questions and discussions.

Workshops

Organised to benefit the researchers, often run by industrial partners of ours to strengthen Industrial-Academic partnership and gain access to invaluable process information.

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Funding detail

How to apply:

Project proposals for the three first challenges can be uploaded here before the deadline November 15, 2024, at 15.00. The challenge on test facilities involves participation in the hackathon in February 2025 (more info later)

Number of projects for this round:

Up to four projects in this call

Consortium composition:

- One or more participants from the Danish universities
- GreenLab Skive
- (Optional) Other relevant partners, including site partners at GreenLab [self-financed]

Funding detail

Expected project sizes:

250.000 – 1.000.000 DKK to cover research salary, travel expenses and lab consumables

Project duration:

Between 6-18 months with a flexible start date, no later than March 1, 2025

Co-Financing:

- Not required from university partners
- Non-university partners must fully fund their own activities in the project

Overhead:

15%, which needs to be included in the budget proposal

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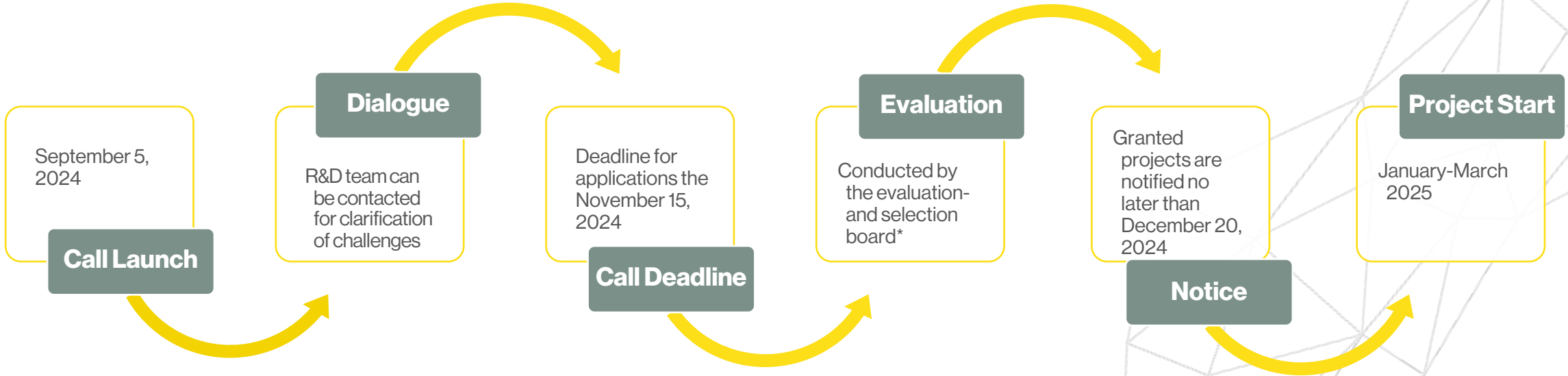
Timeline



*Evaluation- and selection board consists of the following representatives from Danish Universities and GreenLab:

AU - Heather Anne Swanson
AU - Lars Ditlev Mørck Ottosen
DTU - Wenjing Angela Zhang
DTU - Henrik Madsen
DTU - Dogan Keles
SDU - Henrik Wenzel
AAU - Florin Iov
GreenLab - Ebbe Kruse Vestergaard
GreenLab - Eoghan Rattigan

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Reach out if you have questions

Ebbe Kruse Vestergaard

Research Director

ebkv@greenlab.dk

Eoghan Rattigan

Industrial Sustainability Scientist

eora@greenlab.dk

Leon Aahave Uhd

Project Manager DTU

laauh@dtu.dk

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