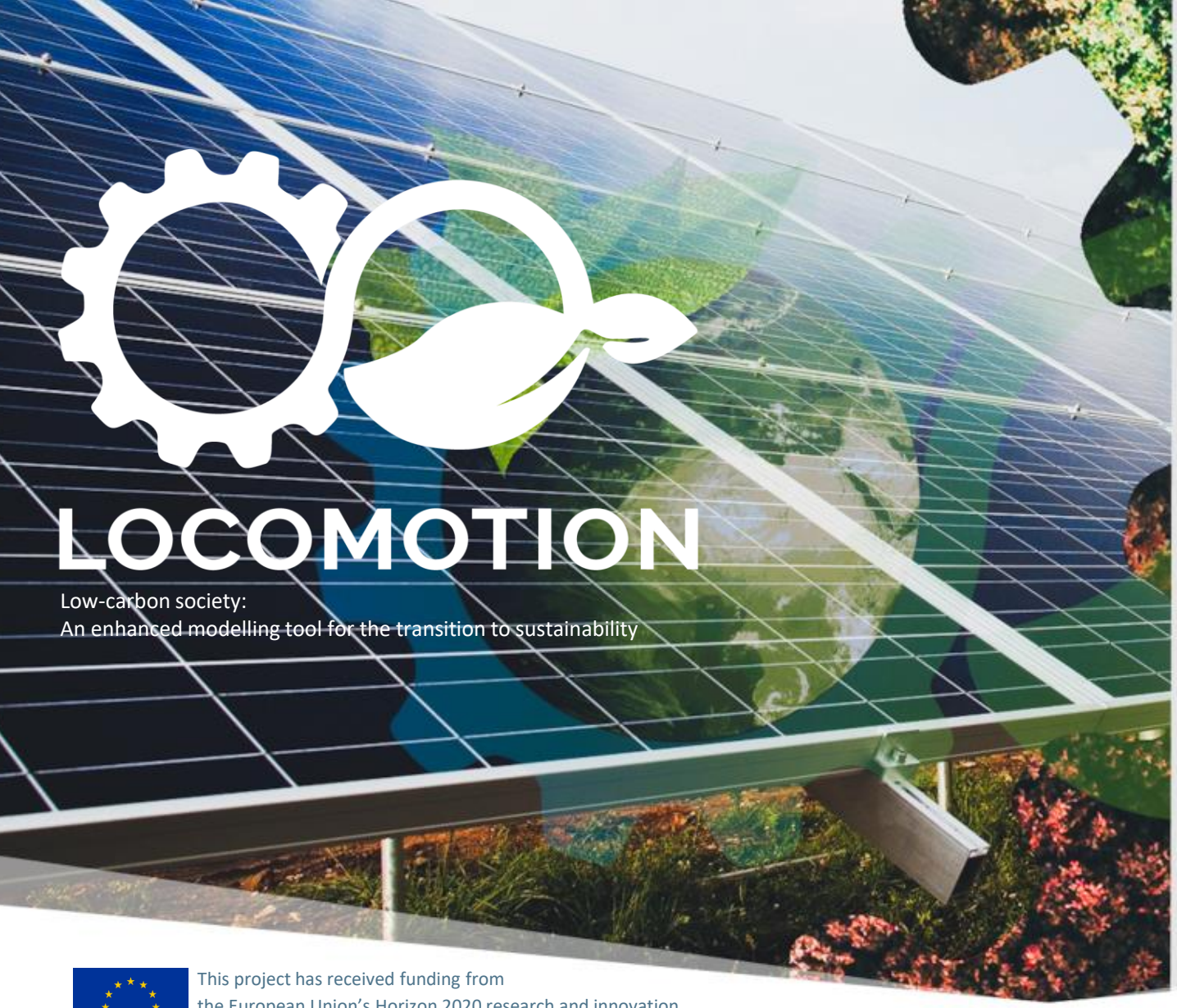

LOCOMOTION

Low-carbon society:
An enhanced modelling tool for the transition to sustainability

LOCOMINAR

Material Requirements for the Green Transition

26th January 2022, 10:00 – 11:30 am CET

European Environmental Bureau (EEB)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821105.

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"LOCOMOTION aims to enhance the existing MEDEAS IAMs to provide policy-makers and relevant other stakeholders with and open source, well-documented model to assess the feasibility, effectiveness, costs and impacts of different sustainability policy options"

The project

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- Duration: 1st June 2019 – 31th May 2023
- Coordinator: Universidad de Valladolid (Spain)
- Partners:

UNIPI, SDEWES, AEA, BC3

CESAR, UoI, CRES, FC.ID

UNU-EHS, EEB, CREAF, CARTIF, INN

LOCOMOTION

- *Low-carbon society: an enhanced modelling tool for the transition to sustainability*

- Horizon 2020

- LOCOMOTION is developing scientific models and tools to assess the socioeconomic and environmental impact of different policy options in order to help society make informed decisions about the transition to a sustainable, low-carbon future.

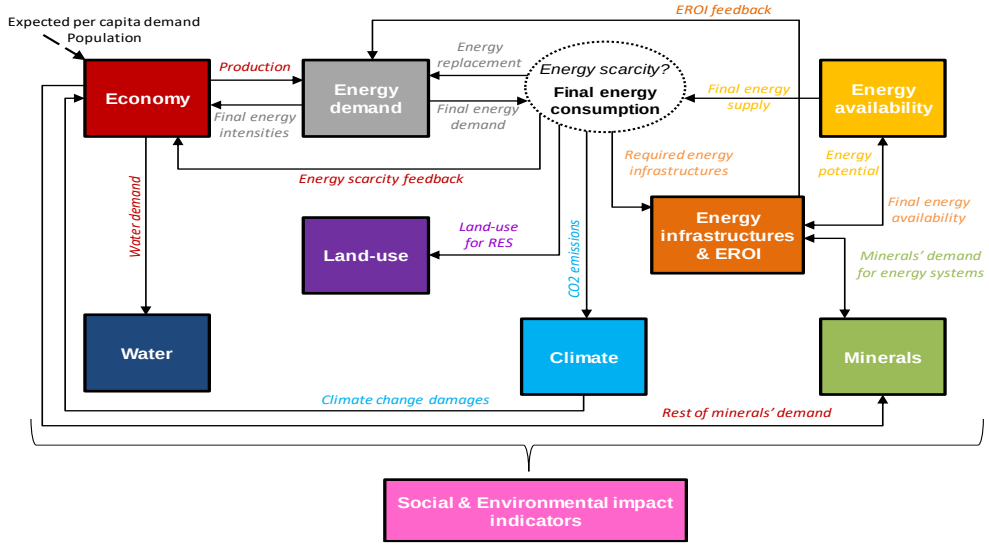
- LOCOMOTION's model (WILIAM) will assess:
  - The European Green Deal
  - The Transition to climate neutrality by 2050
  - The effects of pandemics
  - And much more…

WILIAM

- WILIAM stands for *Within Limit Integrated Assessment Model*. It is made up of several interrelated models:
  - Economy and finance
  - Renewable and non-renewable energy
  - Energy infrastructure and technologies
  - Environment
  - Climate change
  - Population and society
  - **Raw materials**
    - ➢ Availability of materials needed by the economy and demanded for the development of energy infrastructures
    - ➢ Evolution of recycling rates
    - ➢ Energy consumption associated with the extraction of minerals estimated

Current situation and available results

- 2,5 years into the project
- Modelers are currently integrating all submodules into one
- First results available in Q1 – Q2 of 2022
- Available data is based on results obtained through IAMs developed by the EU-funded **MEDEAS** project, on which LOCOMOTION is built upon and aims to develop (both thematically and geographically)



Link between LOCOMOTION, materials and the Green Transition

- To achieve the Green Transition, there has been increasing attention on renewable energy and transportation technologies. It is expected that both of these will increase the demand for materials.

- Tight link between **energy** and materials

- Change in **mobility** linked to material exhaustion

- LOCOMOTION looks at the **quantity** of materials; the demand for each material compared with the levels of available metrics of **reserves and resources**; as well as **social and environmental justice**

Material Requirements for Renewable Energy

A **50 MW wind farm** (*current subtechnology mix*) with a lifetime of 20 years requires:

	Construction	Operation
	kg	kg
Steel	6305000	
Iron (Fe)	1100000	
Copper (Cu)	135000	5800
Aluminium (Al)	101500	10800
Nickel (Ni)	5550	
Neodimium (Nd)	3050	
Dysprosium (Dy)	243	

What does the research say on material requirements x RES?

- Focus on Green Growth narrative (3 scenarios: % of RES in electricity mix in 2060)
- The green transition could drive a **re-materialisation** of the economy because RES would require a substantial amount of minerals relative to the current estimated levels of reserves and resources
- E.g. In a Green Growth 100% RES scenario, the model estimates that the cumulated extraction demand would **surpass** the current levels of reserves for several minerals
  → Questions the Green Growth narrative
- Risks:
  - **availability** of minerals
  - but also **geopolitical**

Material Requirements for electric batteries

+chargers

kg/MW	LiMnO2	NMC-622	NMC-811	NCA	LFP
Aluminium	500	693	693	483	1478
Copper	289	429	429	295	855
Iron	0	0	0	0	765
Lithium	34	71	60	31	96
Manganese	509	110	55	0	0
Nickel	0	335	412	192	0
Cobalt	0	110	55	40	0
Phosphorus	0	0	0	0	425
Graphite	310	405	405	272	825
Plastics	515	705	705	345	1800

Tesla 5 NCA

What does the research say on material requirements x mobility?

- Designed **4 scenarios** to analyse the main dynamics of global transport material expenditure:
  1. EV trends
  2. High EV
  3. E-bike
  4. Degrowth

- Results show that the most **critical minerals** for these transition scenarios will be aluminium, copper, cobalt, lithium, manganese and nickel

What does the research say on material requirements x mobility

- The only scenario whose trends in mineral requirements do not rise exponentially is **Degrowth**.

- Important to note that the model assumes a doubling of the **recycling rate** for the EV High, E-bike and Degrowth scenarios

  - Even in scenarios with a very high increase in recycling rates, the deployment of electric vehicles still finds limits.
  - But recycling is key as shown in the case of the Degrowth scenario.

Recommendations

New energy and mobility technologies require large amounts of materials. In a 'business-as-usual' scenario, some minerals will be exhausted and there will be shortages.

1. **Reduction** in the demand for transport and energy through policymaking

2. **Optimisation** of the management of mineral resources (e.g. recycling)

3. Need for medium and long-term planning of the green transition with a **global assessment** perspective that takes into account **materials** (not just financial requirements) but also other aspects such as **social equity**

References and disclaimer

- Disclaimer: EEB is not part of the research and modeling team so for **technical questions** we can share academic papers
- **References**:

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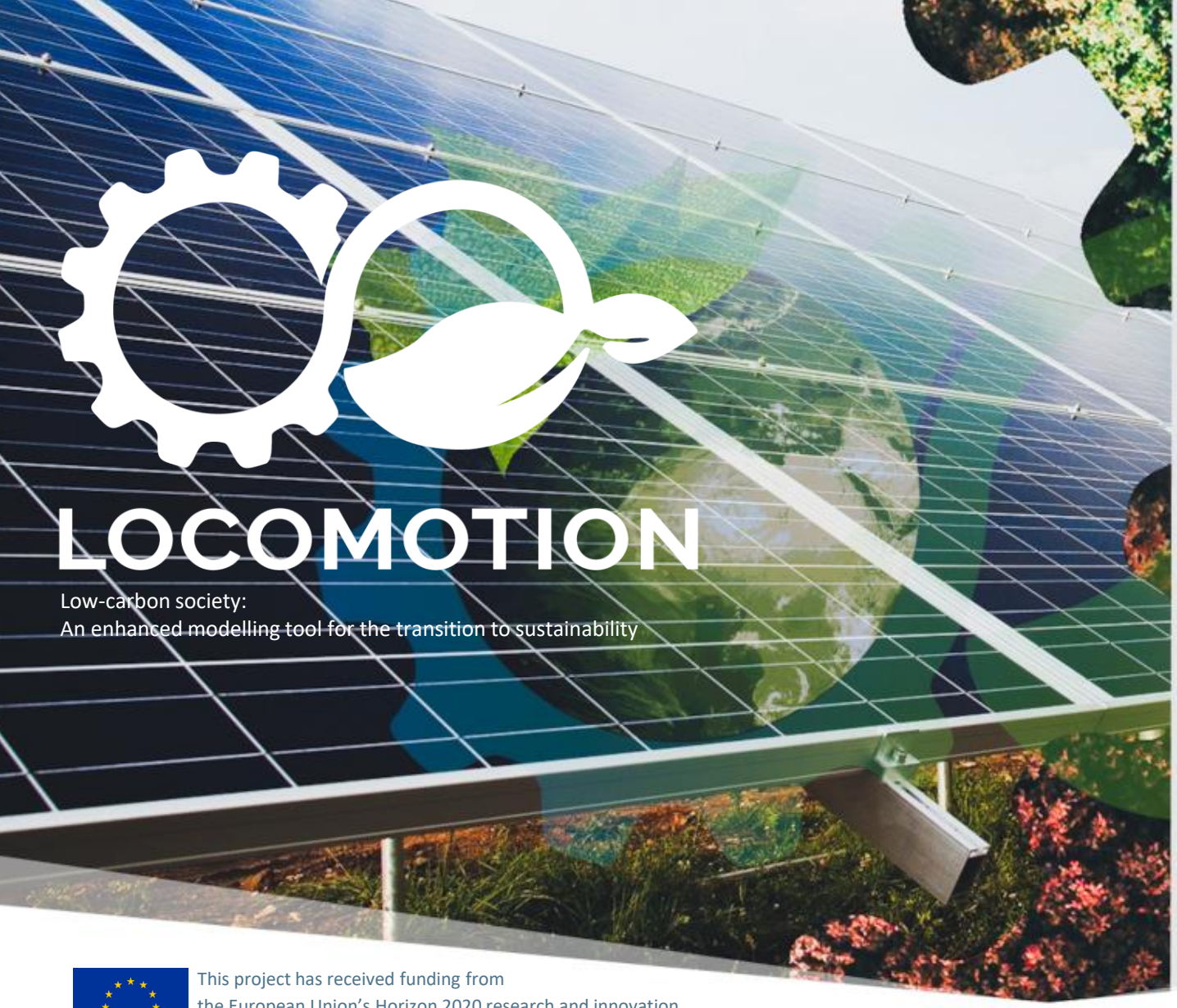

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