

Individual, reliable, mission-focused

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# Sovereign value cycles in the energy sector

## The energy transition: A model instrument for sustainability

Germany is faced with a huge transformation process to make its economy and society sustainable by 2050. SDG 12 of the United Nations Sustainable Development Goals addresses responsible consumption and production. At the European level, the Green Deal and the Circular Economy Action Plan, which was updated in 2020, have set out additional key guiding principles for this transformation. These deal with the principles of how economic activity is carried out and the associated measures of value in a market of 500 million people.

The energy sector as a lead market has a key role to play in this transformation process. The massive development of renewable energy technologies for electricity, water and transportation is the central starting point for reducing greenhouse gas emissions. As a key driver of climate policy, the energy sector is responsible for committing to the paradigm shift that is needed and striving to become sustainable, circular and sovereign.

## CIRCONOMY® – a networking initiative for the transformation of the energy sector

Existing networking initiatives mostly have a regional or technological focus. What is missing in practice is the mission orientation set out by the Commission of Experts for Research and Innovation (EFI) as a requirement in its 2021 report. Through the CIRCONOMY® brand, Fraunhofer is addressing this requirement and pooling R&D capacities and expertise in multi-disciplinary, multi-sector and mission-led networks, the CIRCONOMY® Hubs, which are not geographically limited in scope. Individual, highly agile groups provide integral support to the energy sector as a lead market in urgent areas such as circular material flows, ensuring sovereignty of decision-making and economic and ecological sustainability. This drives crucial innovation policy objectives for Germany and Europe.

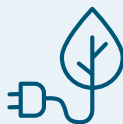
## Sovereignty as a prerequisite for a resilient energy transition

We need to rethink value chains: Traceability, sustainability and resilience are essential for ensuring that the European energy transition can be put into practice and accepted by society. Businesses have often delegated sovereignty over processes and products to global supply systems. Supply bottlenecks during the Covid-19 pandemic exposed our dependence on global trade routes. Energy technologies contain specific, sometimes critical, rare materials that are mostly produced and processed outside the EU.

As well as the associated supply risks, globalized supply chains often lack transparency about which environmental and health and safety standards are being met.

## Your path to the circular economy

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1. Working together to shape the transformation of the chemical industry as a lead market
2. Establishing industry-wide, supra-regional networking
3. Mission-oriented, agile cooperation in a reliable data space
4. Tailored proposals for solutions

#WeKnowHow

## Photovoltaics (PV) as an example of action needed



x 20

Greenhouse gas emissions from PV: Supply chains (scope 3) account for 99.94 % of total emissions and need to be reduced in a targeted way.<sup>1</sup>



x 45

The EU's share of the PV supply chain is minimal: 11 % of polysilicon, 1 % of ingots/wafers, 0.4 % of cells and 4 % of modules were produced locally in 2019.<sup>3</sup>



Around 45 % of polysilicon production comes from Xinjiang, China, where charges of forced labor came to light in 2020.<sup>4</sup>

According to forecasts, a cumulative total of 60 million t of used modules will have been disposed of by 2050.<sup>5</sup>

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Through digitalization we have the potential to shape supply chain management sustainably, and this is therefore integrated into CIRCONOMY® as a central optimization tool.

### From value chain to value cycle – a holistic approach

The transformation of value chains into value cycles is a central instrument for conserving natural resources and reducing greenhouse gas emissions. In the energy sector, cycle management faces a series of techno-economic obstacles. Quality standards and cheap raw materials are impediments to the systematic use of recycled materials in production. Despite the imposition of recycling quotas, it is often uneconomical to extract high-quality secondary raw materials from used products. The long service life of energy technologies is also a challenge when it comes to end-of-life strategies such as repair and reuse.

The transition to a circular economy requires systemic innovations as well as a value system that prioritizes not just the monetary aspects, but also the added ecological and social value of value cycles. CIRCONOMY® is ready to help overcome these multidimensional challenges.

### Fraunhofer as a key partner for the energy sector

The cooperative structures of CIRCONOMY® Hubs produce fast, creative decision-making, agile, out-of-the-box collaboration, and digital access to state-of-the-art findings. From detailed industry-specific issues to energy system analysis using multiple technologies, our experts in the different institutes are able, thanks to our internal network, to deal with a wide range of concerns in the energy sector.

Our expertise in sustainability assessment, digitalization and data management, circularity, energy technologies, material flow management, manufacturing engineering and process development allows us to create customized innovations for sovereign value cycles and to design them sustainably:

1. Lifecycle assessment in accordance with ISO 14040/44
2. Data collection/inventory analysis
3. Resource efficiency and raw material criticality
4. Certification and energy rating
5. Health monitoring of the use phase
6. Assessment of recycling activities
7. Techno-economic assessment

We tackle these fundamental issues in the form of R&D research projects and collaborations with industry.

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<sup>1</sup> Solarcentury (2021): Solar: A Force for Good. ESG Expectations for the Solar Sector.

<sup>2</sup> IRENA (2021): World Energy Transitions Outlook: 1.5°C Pathway. International Renewable Energy Agency. Abu Dhabi.

<sup>3</sup> European Solar Manufacturing Council (12.04.2021): Press Release: Solar Manufacturing Renaissance in Europe – Appeal for RRF Commitment.

<sup>4</sup> Kaplan, T.; Buckley, C.; Plumer, B. (2021): U.S. Bans Imports of Some Chinese Solar Materials Tied to Forced Labor. In: The New York Times, 02.08.2021.

<sup>5</sup> IRENA; IEA-PVPS (2016): End-of-Life Management: Solar Photovoltaic Panels.