Energy industry infrastructure in a circular economy perspective

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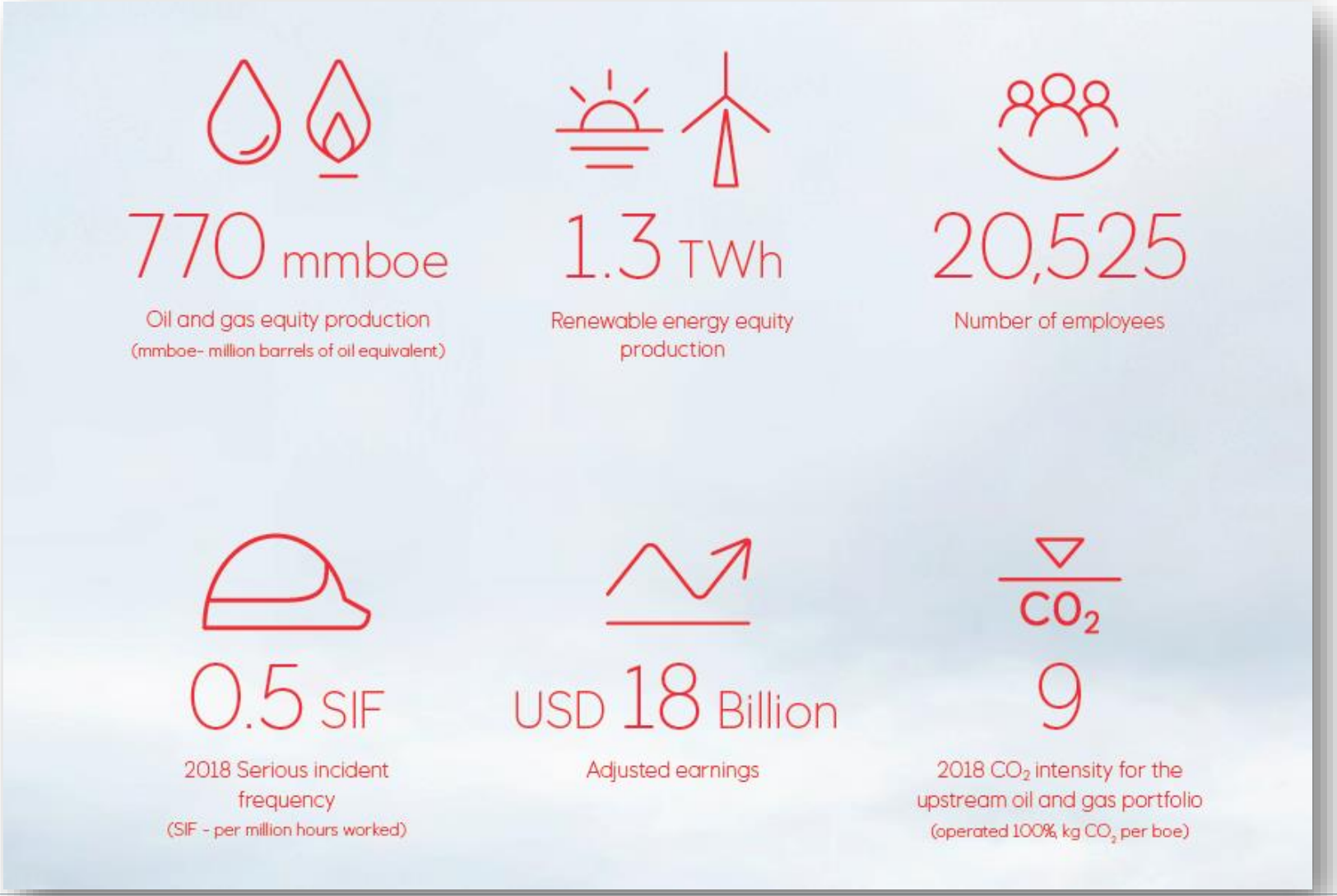
Equinor at a glance: 2018



Our sustainability priorities

Low carbon

Creating a low-carbon business advantage

Being at the forefront of the energy transition

Carbon efficient oil and gas producer

Driving innovation and technology development

Always safe

Responsible operations

Safety is our first priority

Managing our environmental impact

Respecting human rights and promoting integrity

Sustainability is embedded in our:

- Values
- Business model
- Strategy
- Governance

High value

Creating shared value

Providing energy and creating value for shareholders

Creating economic value and opportunities for society and communities

Developing people and promoting diversity and inclusion

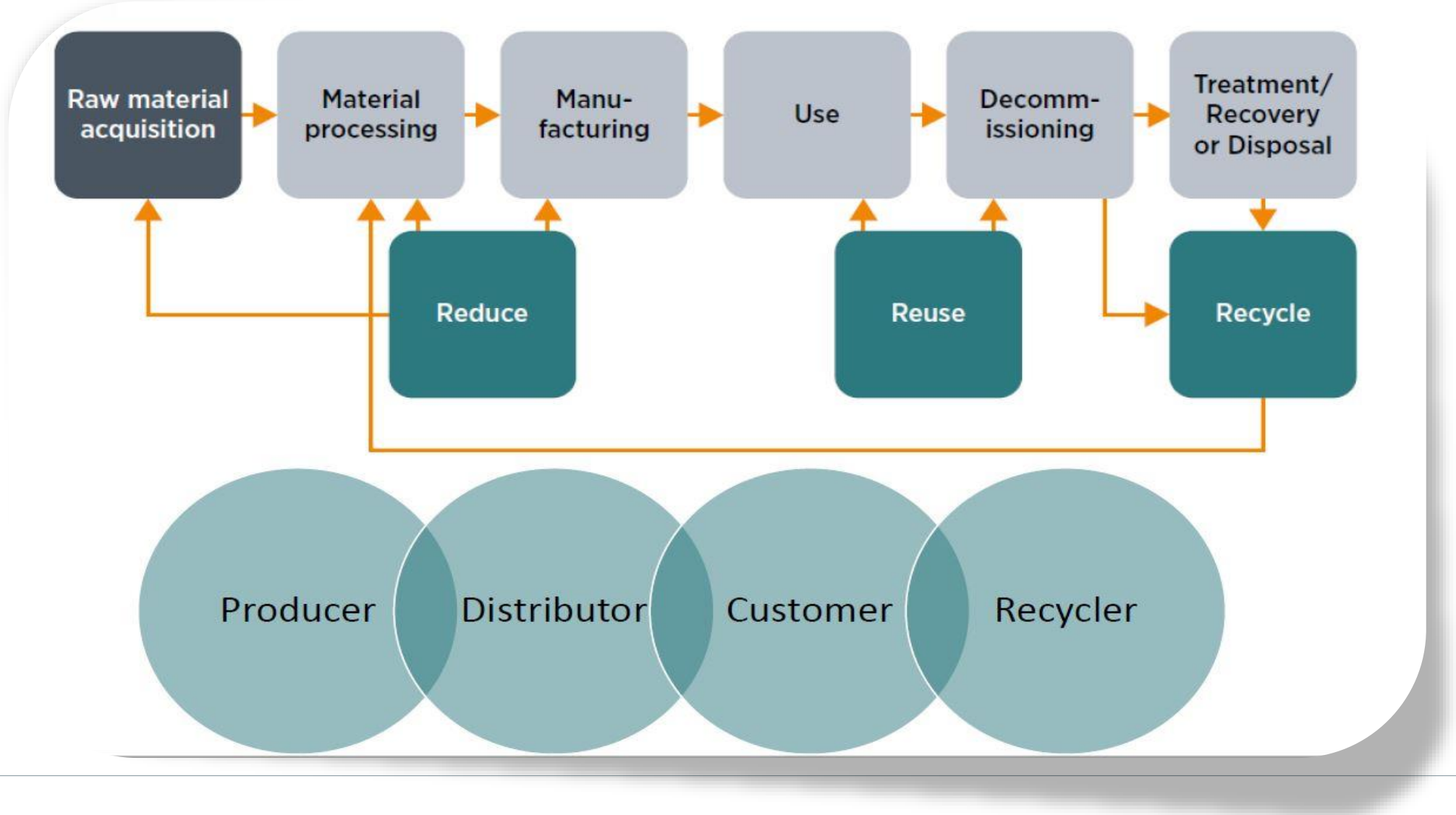
We believe in transparency and collaboration for greater impact

Our contribution to the UN Sustainable Development Goals

Equinor supports the UN Sustainable Development Goals (SDGs) and shares the view that business has a key role to play in the implementation of the goals. Our main contribution to the society is the energy we deliver, the economic value and jobs we create, the people we develop, our efforts to reduce greenhouse gas emissions, and pursuing safe and responsible operations.

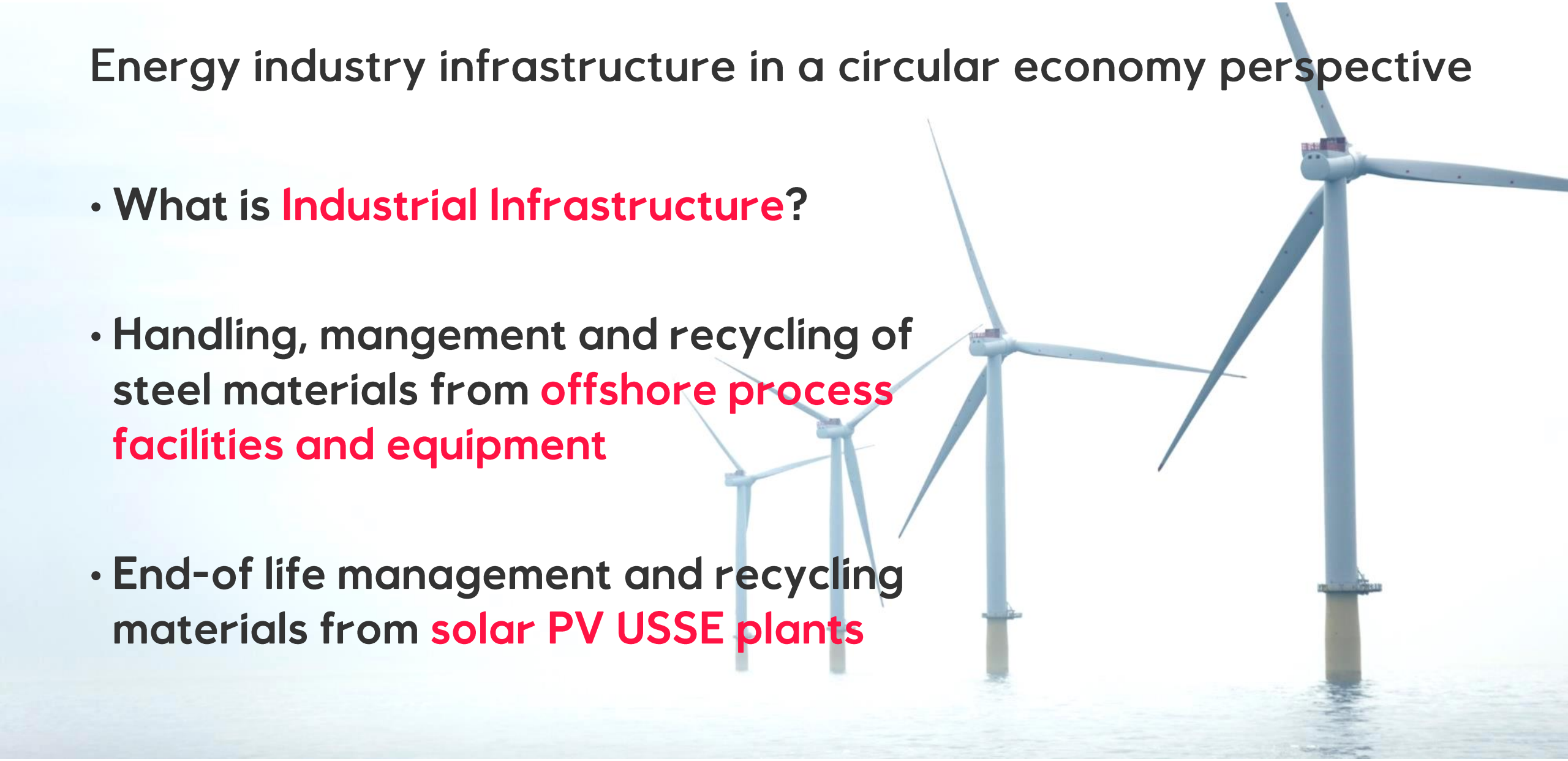
We recognize that our business activities may have both positive and negative impacts on the SDGs. However, we seek to minimize negative impacts and contribute positively to the goals, and to be transparent about our impacts.

Life cycle stage opportunities for reducing, reusing or recycling



Energy industry infrastructure in a circular economy perspective

- What is Industrial Infrastructure?
- Handling, mangement and recycling of steel materials from offshore process facilities and equipment
- End-of life management and recycling materials from solar PV USSE plants



What is industry infrastructure?

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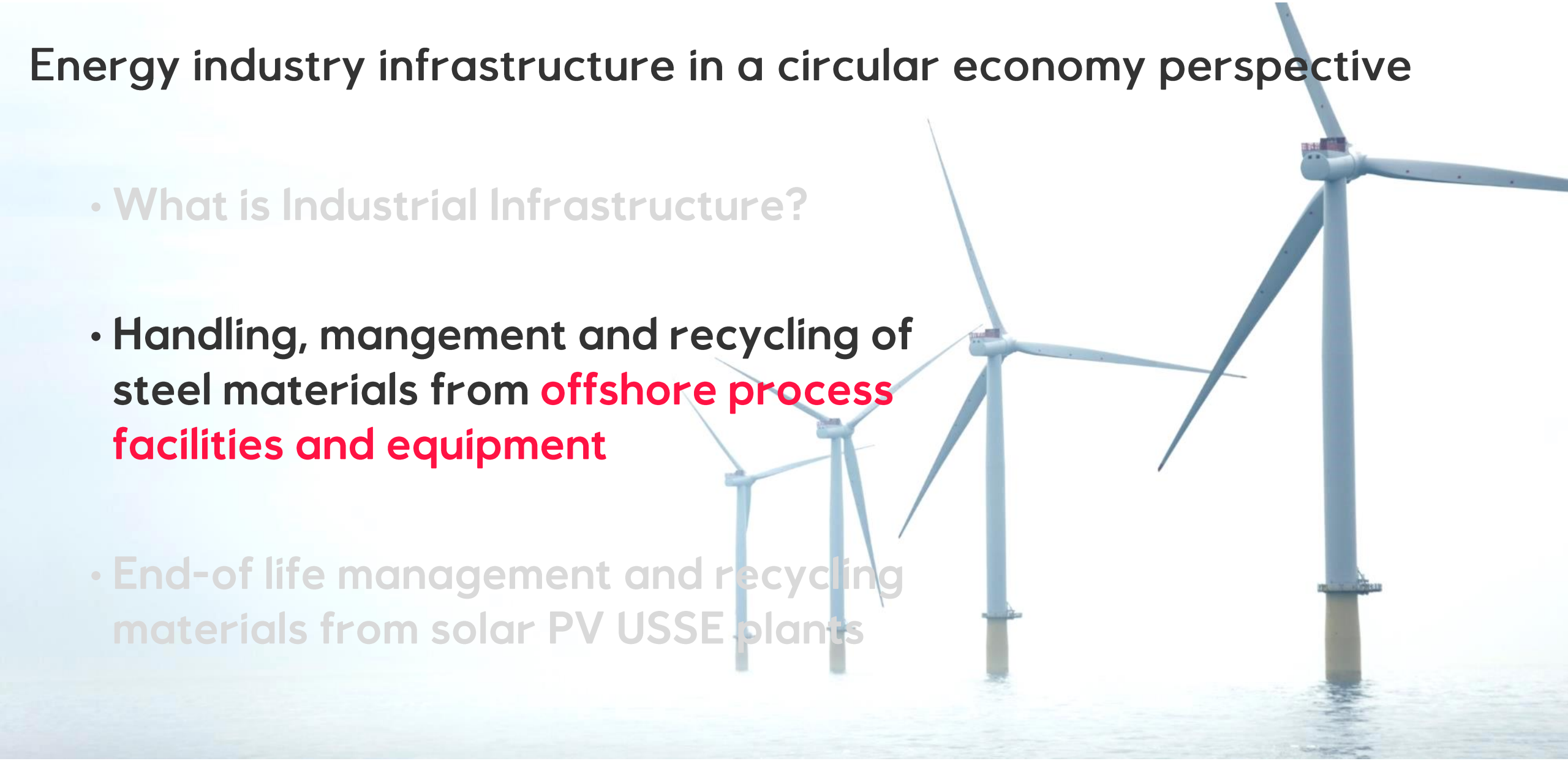


Statoil oil & gas decommissioining projects

TOGI template 2012

SPM-C loading buoy 2012

Statoil decommissioining projects

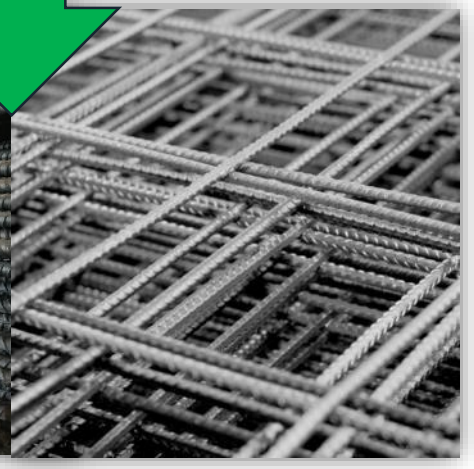
2/4-S Jacket 2014

B-11 gas booster platform 2015

Safe environment and working environment in the downstream value chain

- Acceptable working conditions
- Reliable detections methods for mercury components in atmosphere and on steel surfaces
- Sustainable and costeffective downstream treatment

Sustainable and safe recycling high quality steel from O&G industry



Recycling low contamiated, high quality steel from oil & gas industry

Goal:

- Full-scale pilot at Celsa Nordic in Mo i Rana.
- Better control of mercury level in the steel scrap.
- Providing better information in advance about contamination level in the scrap value chain.
- Providing information to all parties in the value chain.
- Contribute to a more sustainable recycle value chain of high quality steel from offshore facilities.

Desired outcome:

- A sustainable end-of-life management for low mercury contaminated steel scrap and equipment.
- Establishing a system where contractors treating the scrap, can control steel quality and mercury contamination throughout the value chain.
- Establishing a control system for reliable measurements of contamination.
- All parties can establish criteria for handling.

Equinor – SINTEF Molab Helgeland – NOROG – Celsa Nordic

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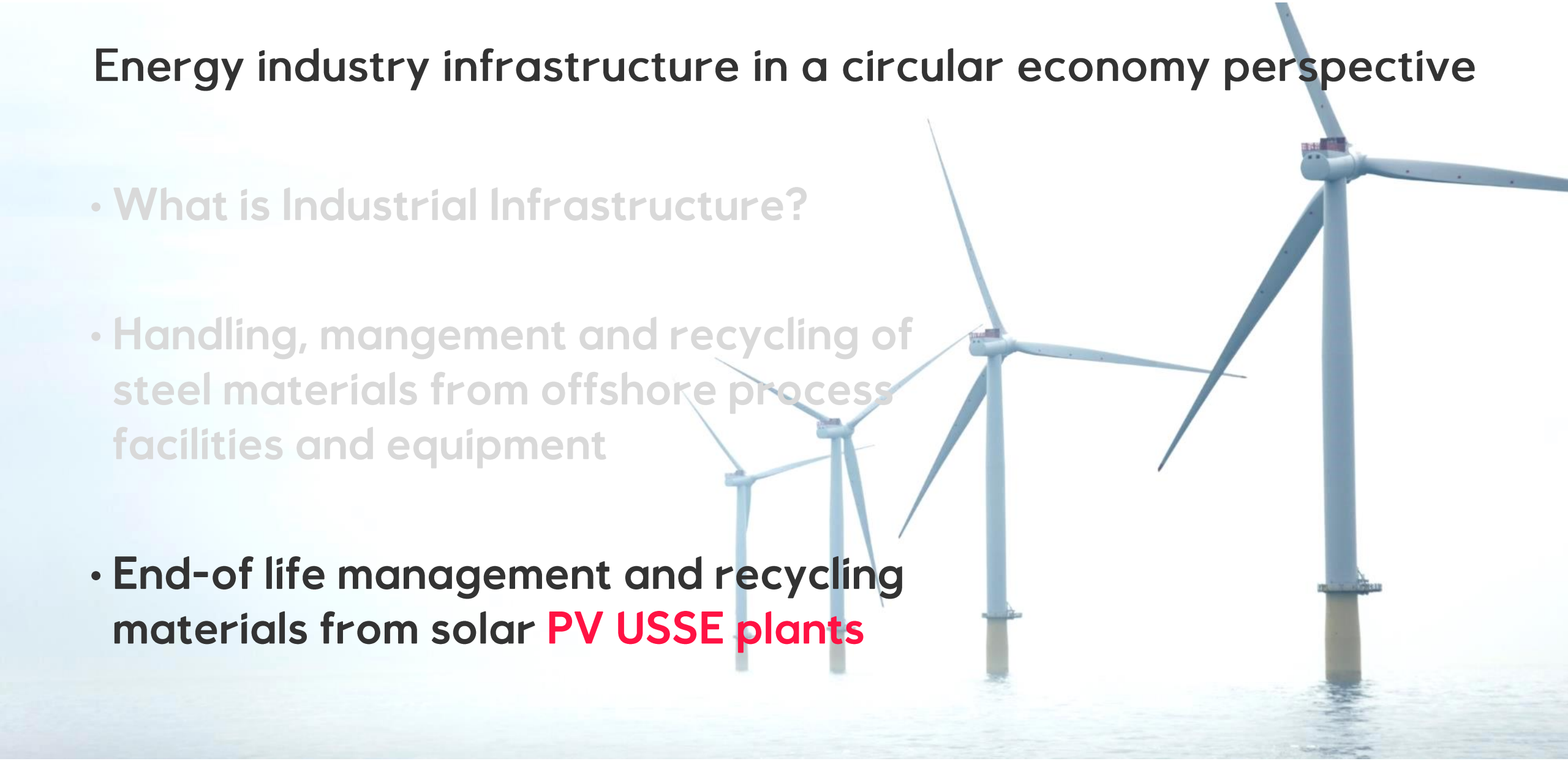


Offshore wind

Bottom fixed[1]	Floating[1]

In operation

Sheringham Shoal	Dudgeon	Arkona[2]	Hywind Scotland
UK	*UK*	*Germany*	*UK*
317 MW	402 MW	385 MW	30 MW

Non-sanctioned opportunities

Dogger Bank	US East Coast	Baltyk I[3] II & III	Hywind Tampen
UK	*USA*	*Poland*	*Norway*
3.6 GW	~4 GW	~2.5 GW	88 MW

Solar

In operation

Apodi[4]
Brazil
162 MW

Under development

Guanizul 2A[4]
Argentina
117 MW

Sustanable and innovative end-of-life management of Solar PV

Circular economy and the classic waste reduction principles (reduce, reuse, and recycle) **must be applied to PV panels**.

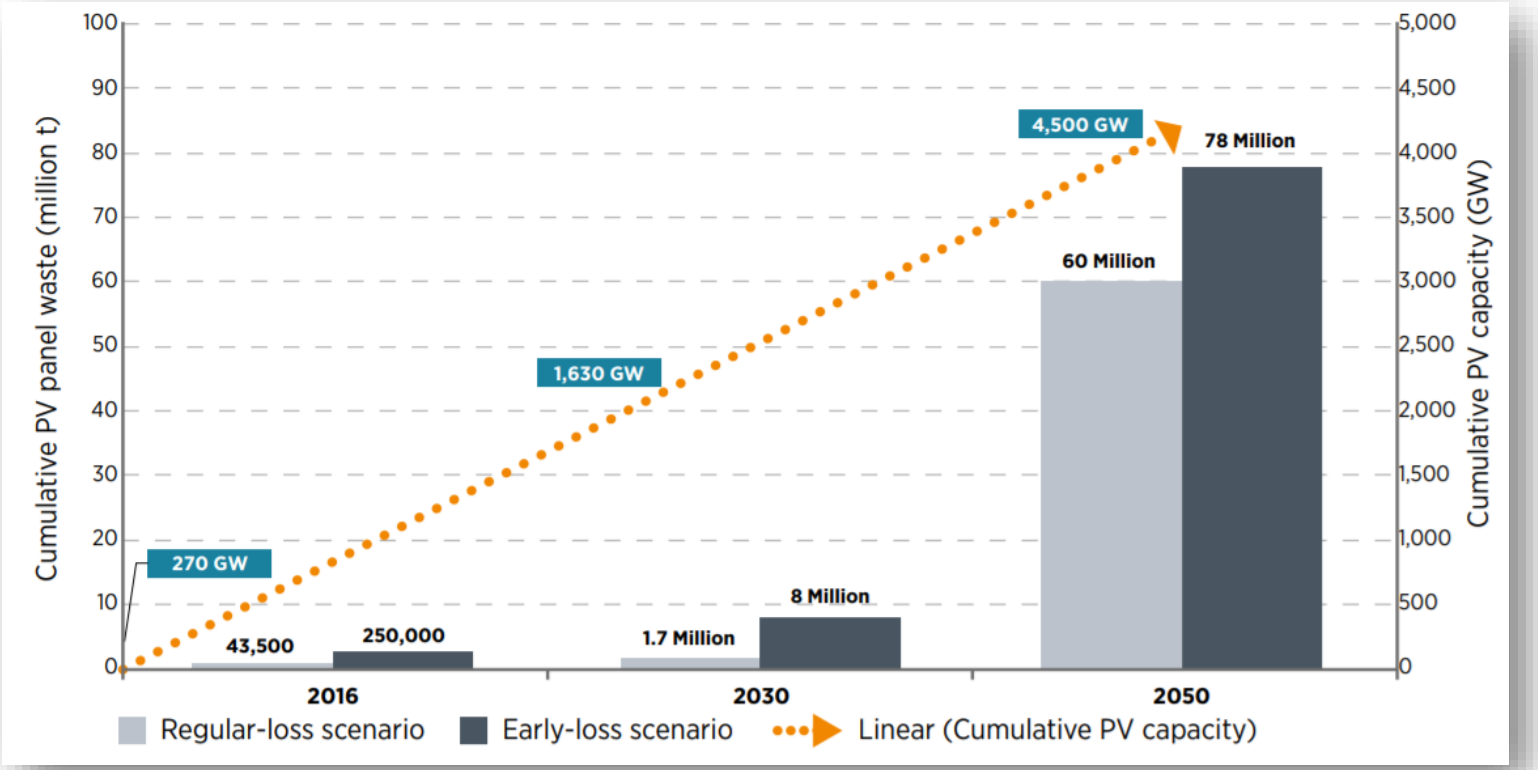
The emerging PV recycling industry will need trained staff with **specific skills and knowledge of recycling processes.**

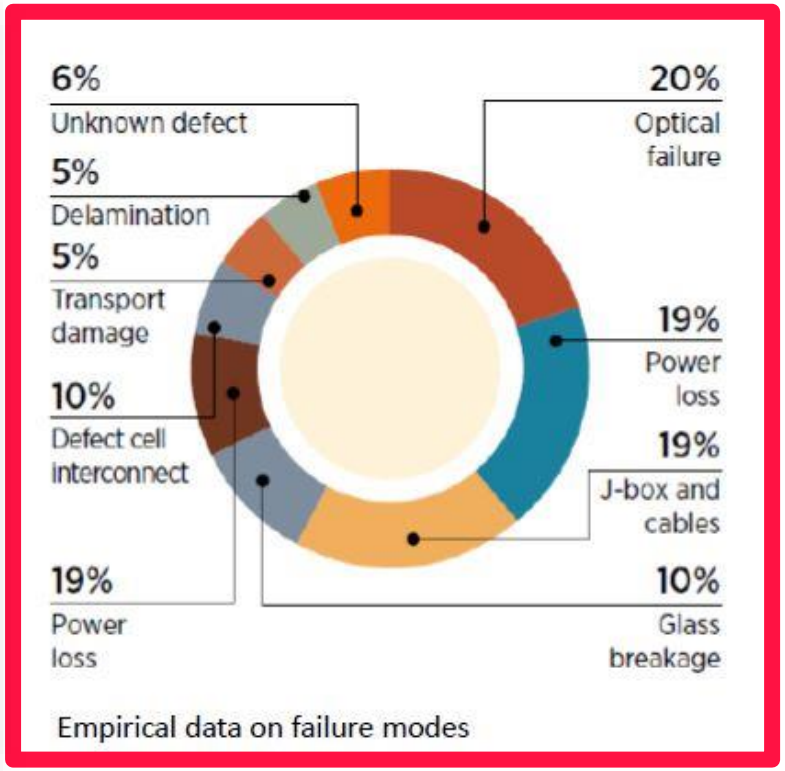
A PV end-of-life management will enhance the integration of different stakeholders like PV suppliers and consumers, as well as the waste sector.

IRENA 2017

Apodi, Brazil Photo: Eqionior

Sustainable and innovative end-of-life management of solar PV





Empirical data on failure modes

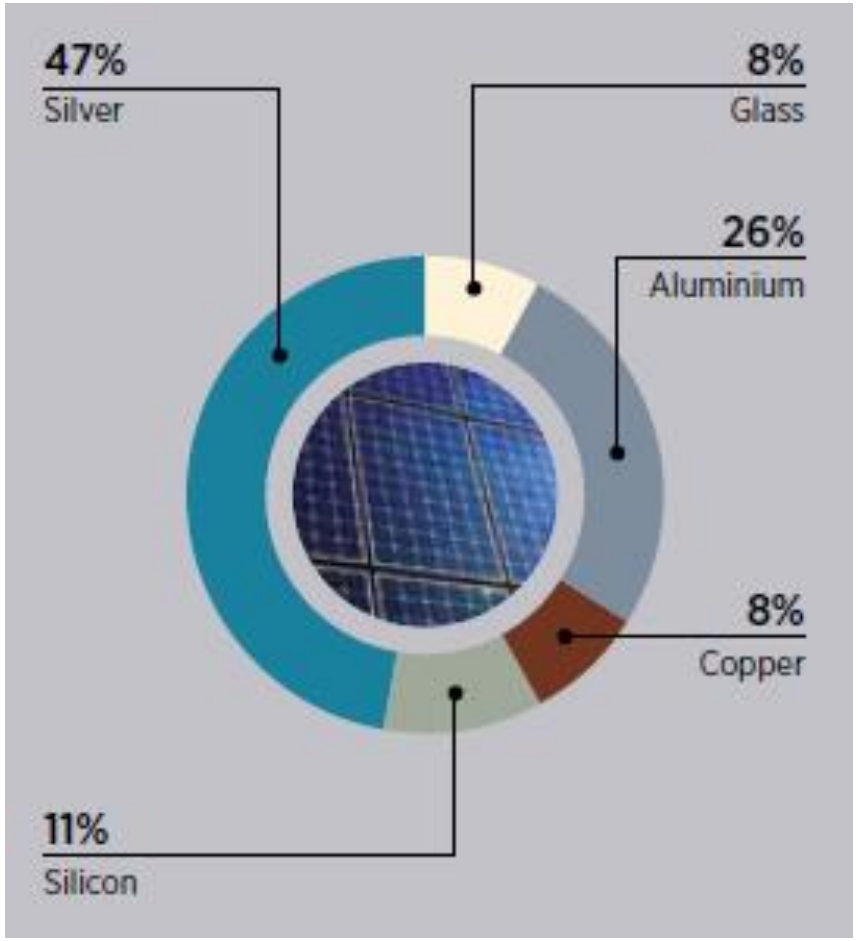
Source: www.irena.com

Sustainable and innovative end-of-life management of solar PV

Solar PV has a huge potential in recycling.

IRENA estimates that 60-80 million tons of waste could be recycled into $2 billion new panels and represent $15 billion of total value in raw materials

The best time to be a solar panel recycler would be much earlier than 2050.



Source: IRENA

Sustainable and innovative end-of-life management of solar PV

Silver recovered from PV panels also has significant potential value.

Based on an estimate of

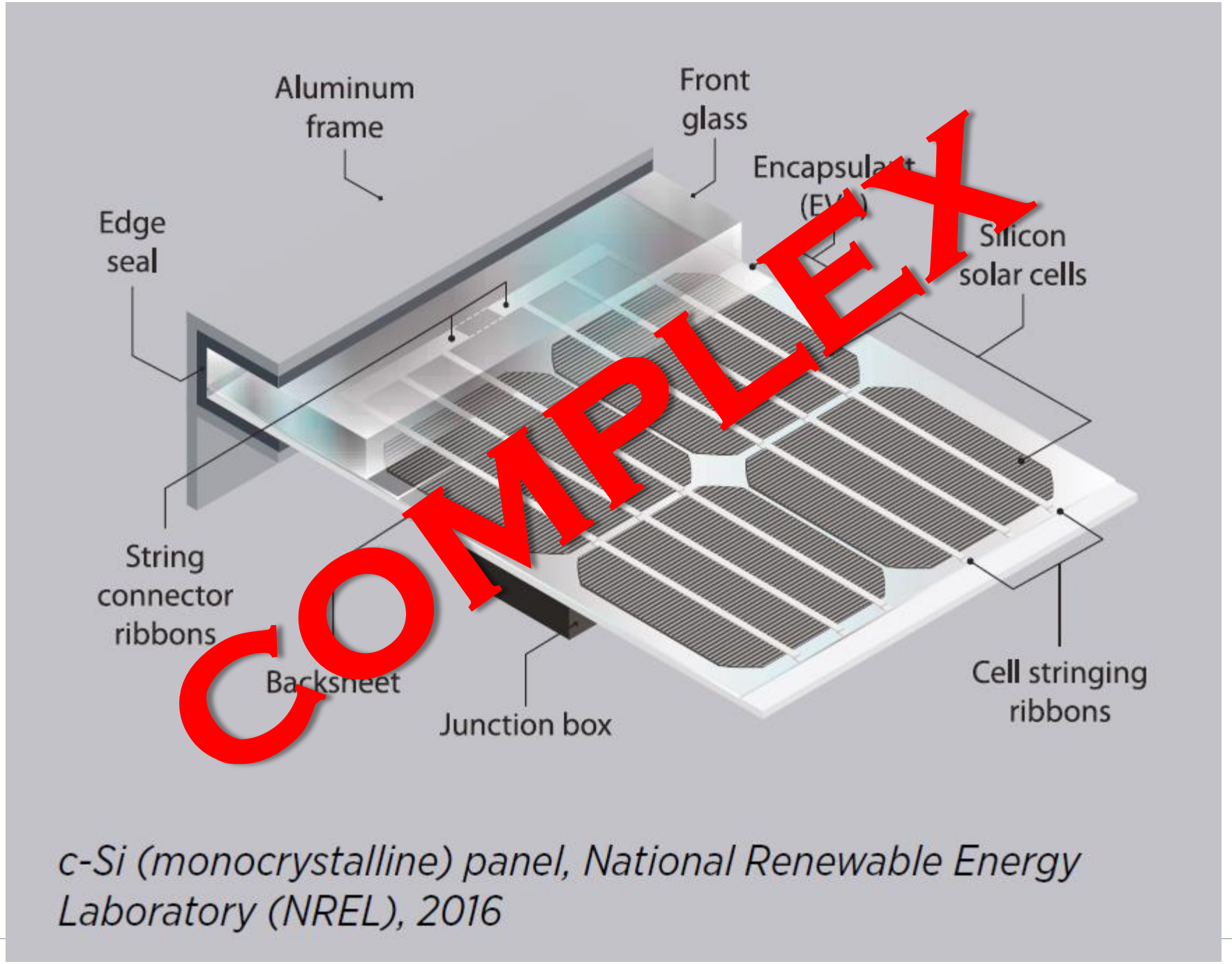
90 tons recovered in 2030

at a current market price (April 2016) (Europäischer Wirtschaftsdienst, 2016),

the value of recovered silver is estimated at **$50 million**.

This is enough to produce 50 million new panels.

IRENA 2016



c-Si (monocrystalline) panel, National Renewable Energy Laboratory (NREL), 2016

Sustainable and innovative end-of-life management of solar PV

Goal:

- **Mapping/identify sustainable innovative technologies**
- **Evaluation of sustainable and innovative technologies for full-scale recycling of PV panels.**
- **Explore circular economy business opportunity for Equinor in recycling solar PV panels.**

Outcome:

- Meet the need for valuable material recycling and recovery when decommissioning solar PV panels from USSE plants.
- Prevent toxic exposure from decommissioning solar PV panels by innovative end-of-life management and recovering valuable materials.
  Reduce need for mining and exploration for materials used in solar PV.
- Innovative end-of-life management could turn PV wastes into sustainable resources.

Key takeway:

Thank you for listening