9. Technological Innovations for the Sustainability Transitions from COP26 Perspective

Darja Piciga, Independent Expert in Sustainable Development, Slovenia &

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Policy mixes for systemic change

**Directionality, credibility**
- Visions and pathways
- Long-term targets
- Scale and speed
- Foresight

**Environment and sectoral policies, e.g.**
- Carbon pricing
- Strict regulation
- Removing barriers (e.g. subsidies)

**Industrial policy, e.g.**
- Specific visions
- Market creation
- Adoption subsidies
- Backing winners

**Environment and sectoral policies, e.g.**
- Carbon pricing
- Strict regulation
- Removing barriers (e.g. subsidies)

**Innovation policies, e.g.**
- R&D
- Experiments
- Network building
- New entrant support

**Coordination across sectors, scales**
- Policy coherence and consistency
- Mission-oriented innovation
- Polycentric governance
- Stakeholder platforms, networks

**Welfare, education policies**
- Compensating losers
- Offsetting inequities
- Retraining

**Low-carbon economy**

**Bio-economy**

**Blue economy**

**Circular economy**

**The European environment — state and outlook 2020**

Knowledge for transition to a sustainable Europe
COMMENT: We can't make Europe's systems of production and consumption sustainable by optimising existing systems. We need huge improvements in environmental efficiency. That means fundamental change in energy, food and so on.

<table>
<thead>
<tr>
<th>TABLE 17.1</th>
<th>Examples of sustainability innovations in the mobility, food and energy domains</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mobility</strong></td>
<td>Fuel-efficient petrol or diesel cars</td>
</tr>
<tr>
<td>Incremental technical innovation</td>
<td>Precision farming, food waste valorisation, integrated pest management</td>
</tr>
<tr>
<td>Radical technical innovation</td>
<td>Battery electric vehicles, electric bikes, alternative fuels, autonomous vehicles</td>
</tr>
<tr>
<td>Social or behavioural innovation</td>
<td>Permaculture, no-tillage farming, plant-based meat and dairy products, genetic modification</td>
</tr>
<tr>
<td>Business model innovation</td>
<td>Renewable electricity, heat pumps, passive houses, whole-house retrofitting, smart meters</td>
</tr>
<tr>
<td>Infrastructural innovation</td>
<td>Decentralised energy production (prosumers'), community energy, energy cafes</td>
</tr>
<tr>
<td>Energy</td>
<td>Insulation, energy-efficient appliances, efficient gas or coal-fired power plants</td>
</tr>
<tr>
<td><strong>Food</strong></td>
<td>Alternative food networks, organic food, dietary change, urban farming, food councils</td>
</tr>
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<td><strong>Energy</strong></td>
<td>Alternative food networks, organic food, dietary change, urban farming, food councils</td>
</tr>
<tr>
<td><strong>System innovation = new system</strong></td>
<td>Mobility services, car sharing, remanufacturing vehicles, bike sharing</td>
</tr>
<tr>
<td><strong>Partial system redesign</strong></td>
<td>Reforms to distribution systems, storage provision and better food waste management</td>
</tr>
<tr>
<td><strong>System optimisation</strong></td>
<td>District heating systems, smart grids, bio-methane in reconfigured gas grid</td>
</tr>
</tbody>
</table>

Source: VNMP (from Wiedmann et al., 1997)
COMMENT: We can't make Europe's systems of production and consumption sustainable by optimising existing systems. We need huge improvements in environmental efficiency. That means fundamental change in energy, food and so on.

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**Mobility**

- Incremental technical innovation
- Radical technical innovation

**Energy**

- Insulation, energy-efficient appliances, efficient gas or coal-fired power plants

**Discussion Paper**

The European environment — state and outlook 2020

Knowledge for transition to a sustainable Europe
<table>
<thead>
<tr>
<th>Discussion</th>
<th>Sensitive Intervention Points for Climate Neutral Strategies Detailed in this Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity and Just</td>
<td>Climate and Nature Aligned Debt Restructuring (debt for nature swaps and debt for</td>
</tr>
<tr>
<td>Transition</td>
<td>efficiency swaps) paired with international climate finance efforts through the</td>
</tr>
<tr>
<td></td>
<td>IMF and the World Bank</td>
</tr>
<tr>
<td>Rapid Emissions</td>
<td>Policy instruments to incentivise investment in clean energy technology with</td>
</tr>
<tr>
<td>Reduction</td>
<td>declining costs AND Ambitious Carbon (&amp; Deforestation) Border Adjustment</td>
</tr>
<tr>
<td></td>
<td>Mechanism, with ambition and equity measures such as international funding and</td>
</tr>
<tr>
<td></td>
<td>new timelines</td>
</tr>
<tr>
<td>Final 20% Hard</td>
<td>Public interventions for targeted investment in clean energy and green (rather</td>
</tr>
<tr>
<td>to Abate Sectors</td>
<td>than blue) hydrogen infrastructure paired e.g. Contracts for Differences (CfDs)</td>
</tr>
<tr>
<td>Nature, Land-use,</td>
<td>Redistribution of agricultural subsidies for climate, biodiversity and health</td>
</tr>
<tr>
<td>Agriculture</td>
<td>aims AND Scaled up Monitoring Verification and Reporting (MRV) for soil carbon</td>
</tr>
<tr>
<td></td>
<td>sequestration</td>
</tr>
<tr>
<td>Greenhouse Gas</td>
<td>Standardized accounting for GHG Removals AND Carbon Take Back Obligation, with</td>
</tr>
<tr>
<td>Removal</td>
<td>improved standards and separate measurement of removals</td>
</tr>
<tr>
<td></td>
<td>Green Loan Guarantee Programmes</td>
</tr>
</tbody>
</table>
RAPID EMISSIONS REDUCTION
Policy instruments to incentivise investment in clean energy technology with consistently declining costs

Recommendations - To primarily focus on four key technologies:

1. solar PV  2. wind  3. batteries  4. hydrogen electrolysers

FINAL 20%, CLIMATE NEUTRAL STRATEGIES FOR HARD-TO-ABATE SECTORS (CEMENT, STEEL, PLASTICS, TRUCKING, SHIPPING AND AVIATION)

Recommendations for Policymakers

- Supporting hydrogen technologies - targeted investment:
As a clean energy carrier hydrogen offers a range of benefits for simultaneously decarbonizing the transport, residential, commercial, and industrial sectors.
While industry players have already started the market introduction of hydrogen fuel cell systems, including fuel cell electric vehicles and micro-combined heat and power devices, the use of hydrogen at grid scale requires the challenges of clean hydrogen production, bulk storage and distribution to be resolved.

- Investment in research into design efficiency to reduce material intensity of production.
Hydrogen Valley - The Northern Netherlands


An urgent need to invest in R&D to scale GGR in order for it to be available when it is needed!

The range of proposed GGR techniques: biological approaches, such as afforestation, investment in marine ecosystems or soil sequestration, and engineered approaches, such as enhancing the rate at which certain minerals weather and devices that directly capture CO2 from the air.

Carbon Takeback Obligation (additional slide)
LARGE SCALE CALL
7 projects aiming to bring breakthrough technologies to the market in energy-intensive industries, hydrogen, carbon capture, use and storage and renewable energy were pre-selected for grant agreement preparations. (NOV 2021)

https://ec.europa.eu/clima/eu-action/funding-climate-action/innovation-fund_en

SMALL SCALE CALL 2020
OCTOBER 2021

https://cinea.ec.europa.eu/document/download/2c19b1c3-7787-4d82-8f0e-0a016081b90b_en
Blindspots of net-zero strategies and how to address them

- CIRCULAR ECONOMY

- NEGATIVE EMISSIONS TECHNOLOGIES (NET):

https://cop26euseidevents.app.swapcard.com/event/eu-side-events-cop26/planning/UGxhbmbm5pbmdfnz11Mzk2

New European Bauhaus

https://europa.eu/new-european-bauhaus/index_en
What has happened?

Peak emissions masked by construction boom 2004 - 2008

Decoupling of GDP growth and emissions

Main technologies driving the reduction 2008 - 2020:
- Energy efficiency and renewable energy in buildings
- Efficient coal in TPP Šoštanj
- Carbon sequestration in forests
- Solar power
- ETS

Main technologies driving the reduction 2020 - 2030:
- Solar power
- Electric vehicles
- Energy efficiency and renewable energy in buildings
- Coal phaseout
- Adaptation in forests

Unambitious 2013 - 2020 target based on incumbent technologies and trends

Rapid emission reduction by upscaling already available technologies

Final hard to achieve 20%?
Nature, land use and agriculture for climate neutrality

Key concerns:
- Rediscover traditional technologies (sustainable forestry, organic farming) and lessons learnt
- New approaches (e.g. ecosystem services, remote sensing)
- Mitigation effect at risk without vigorous adaptation
- Precondition: sustainable land tenure, addressing the rights of local and indigenous people
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**ADDITIONAL SLIDES**
# Criterion for discussing Sensitive Intervention Points

## Timing

Is this SIP required to:

- Halve GHG emissions by 2030
- Start this decade in order to halve GHG emissions again by 2040
- Start this decade in order to remove GHG from the atmosphere by 2050

## Impact

Will this SIP:

- Reduce GHG emissions by at least 1GT by 2020; or
- Reduce GHG emissions by at least 1GT/y by 2040

## Practicality

Is the actor or group capable of taking this action; how effective will resistance be; and how robust and ready is the system and the technology? Think –

- Politically
- Economically
- Technically

## Risks

What is the level of risk associated with this SIP. Think –

- Reversibility – how easily could it be reversed, and the benefits lost or worse
- Trade-offs – doing this SIP harms other better options.
- Unintended consequences — that would substantially offset the benefit of this SIP
GREENHOUSE GAS REMOVAL (GGR) FOR CLIMATE NEUTRALITY

An urgent need to invest in R&D to scale GGR in order for it to be available when it is needed!

The range of proposed GGR techniques: biological approaches, such as afforestation, investment in marine ecosystems or soil sequestration, and engineered approaches, such as enhancing the rate at which certain minerals weather and devices that directly capture CO₂ from the air.

Carbon Takeback Obligation:

Figure: Key interactions for a carbon takeback obligation. CO₂ is recaptured and stored, through a mixture of CCS at industrial point sources and direct air capture. Regulation and verification of storage is only required between government and the fossil fuel industry, with costs of storage passed onto consumers of fossil fuels.
SMALL SCALE CALL 2020 IN A GLANCE

- 32 projects cover 14 different sectors and 12 Member States + Norway and Iceland
- France, Spain and Sweden have the highest number of selected projects

- Solar energy
- Wind energy
- Biofuels and biorefineries
- Renewable heating/cooling
- Iron and steal
- Non-ferrous metals
- Pulp and paper
- Chemicals
- Glass, ceramics and construction material
- Hydrogen
- CO2 transport and storage
- Refineries
- Intra-day electricity storage
- Other energy storage

*cross-border projects are also included on the map

https://cinea.ec.europa.eu/document/download/2c19b1c3-7787-4d82-8f0e-0a016081b90b_en
GOAL 9: SUSTAINABLE NATURAL RESOURCE MANAGEMENT

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Source</th>
<th>Izhodiščna vrednost</th>
<th>Ciljna vrednost za leto 2030</th>
<th>EU Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilised Agricultural Area</td>
<td>Euros tat</td>
<td>23,7 % (2016)</td>
<td>&gt; 24 %</td>
<td>40 % (2013)</td>
</tr>
<tr>
<td>Biochemical Oxygen Demand in Rivers</td>
<td>mg O₂/l (2015)</td>
<td>1,05 &lt; 1</td>
<td>2,19 mg O₂/l (2012)</td>
<td></td>
</tr>
<tr>
<td>Ecological Footprint - 20 %</td>
<td>gha/person (2013)</td>
<td>4,7</td>
<td>3,8</td>
<td>4,9 gha/person (2013)</td>
</tr>
</tbody>
</table>

GOAL 8: LOW-CARBON CIRCULAR ECONOMY

<table>
<thead>
<tr>
<th>Kazalnik</th>
<th>Vir</th>
<th>Izhodiščna vrednost</th>
<th>Ciljna vrednost za leto 2030</th>
<th>Povprečje EU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material productivity</td>
<td>Euros tat</td>
<td>1,79 SKM/kg (2015)</td>
<td>3,5 SKM/kg</td>
<td>2,19 SKM/kg (2015)</td>
</tr>
<tr>
<td>GDP per Total Greenhouse Gas Emissions</td>
<td>Euros tat, ARSO</td>
<td>2,9 SKM/kg CO₂ ustreznik</td>
<td>Povprečje EU v letu 2030</td>
<td>3,3 SKM/kg CO₂ ustreznik (2015)</td>
</tr>
</tbody>
</table>

Projected effects of mixes of selected policy measures on EF reduction in Slovenia by 2030 (national environmental agency):
- Sustainable forest management in terms of providing a carbon sink and adapting to climate change: -7.1%
- Introduction of PV panels on buildings and other built-up areas, in connection with electo-mobility and diffuse storage in batteries: -9.3%
- Development of public passenger transport, multimodal centers and the cycling network to reduce the EF of daily migrations: -8.2%
Etc.