Two sides of the flipcoin: Energy Transition & European Industry, Transport

German - Dutch integrated perspectives for Energy, Industry and Transport

DISCUSSION PAPER

DISCUSSION PAPER

Two sides of the flipcoin: Energy Transition & European Industry, Transport

German - Dutch integrated perspectives for Energy, Industry and Transport

Key requests

- Increase CO_2 pricing
- Clarify the CO_2 compensation models
- Clear policies for the 2030-2050 goals (ratificated by EU member states) are required

Readers

- Politics
- Parliament
- Associations
- Industry

Authors

Editorial board headed by Peter van Harten, Smart Industry Ambassador (NL) and Dr. Dominik Rohrmus, CTO LNI 4.0 (GE). There are 50 German and Dutch Experts from industry and energy sectors, education, politics, associations, etc. The authors affiliations are listed in the addendum.

Our "journey" (background of the document)

The document was initiated by digitalization talks of Dutch and German political and Industry platform stakeholders in October 2018 in Saarbrücken. This discussion continued at the Hannover Fair 2019 and yield to the foundation of a technical expert and networking group that meets regularly and writes this document.

- Timeline: November 2019 - First workshop in Eindhoven in partnership with the Energy Reinvented Community / March, June and September 2020 - expert feedback meetings

Disclaimer

We are aware that the state of the art continuously develops further on. This document is based on input from the expert and the meeting results as listed above.

Peter van Harten,
Dominik Rohrmus
and Jan Prins

Organizing partners and participants at the Brainport Industries Campus

smart industry

LNI4.0 LABS NETWORK INDUSTRIE 4.0

Brainport Industries

Energy Reinvented Community

DGMK

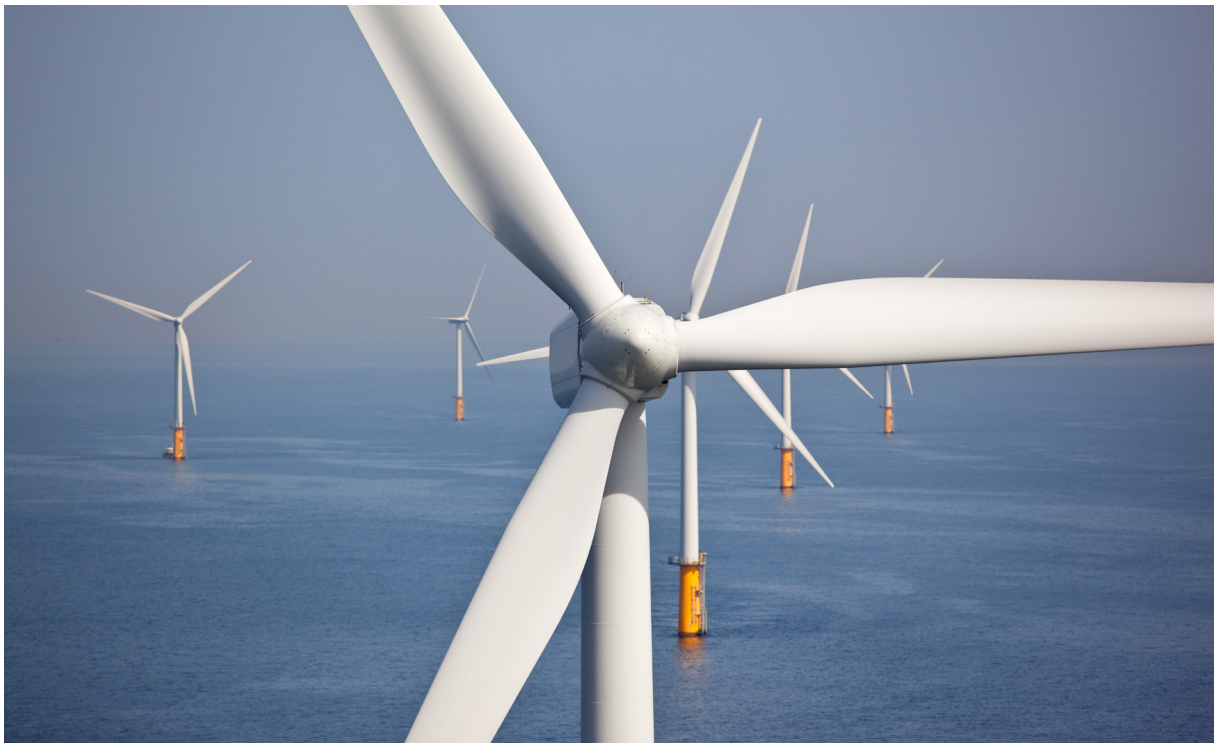
PLATTFORM INDUSTRIE4.0

Mission statement

The mission of the Dutch-German cooperation is to prepare a roadmap for the energy transition combined with the industry digitalization initiatives (Industry 4.0). The roadmap is based on the digital platform economy principles that are described in the five Internet of Things (IoT) steps as referred to in chapter 5 and targets the dramatic reduction of CO_2. This is the motivating driver for this cooperation and the goal for the requests to the politics.

All aspects that influence the transition (how) like regulatory and incentive decisions, CO_2 taxation, CO_2 circularity and the autarkic infrastructure IoT element that falls into our scope must and will be addressed in the future updates of this document. The exploitation of this transition process in form of harmonized standards is a necessary step. The project financing to create the roadmap and to realize the activities must be discussed with the stakeholders.

Stakeholders like industrial partners and R&D from the energy and industry sectors as well as the testing and experimentation labs like the FieldLabs and the Kompetenzzentren 4.0 do collaborate on creating a roadmap that integrates the various viewpoints. Important aspects are the integrated elements of the high-tech industry, the renewable energy and storage technologies like hydrogen including the consumers and the cross-domain data developments like GAIA-X.



Management summary

1. Goals

- New: Climate Change is the driver for a new economy
- Existing: Become more circular and CO_2 neutral
- Call: Reduce CO_2 dramatically
  - Incentives for best in class
  - Incentices for ecosystem

2. Covid-19 Impact

- CO_2 priorities can be made possible
- Possibly positive CO_2 impact

6. Next steps

5. What needs to be done?

- Change the mindset
- Clear politics on 2030-2050 climate goals
- Create a common vision and architecture
- Enable new financing models
- Testing and experimenting to find out!

Energy transition & European industry

our joint minds and ideas mapped out

3. Main Challenges

- We face several complex challenges
  - CO_2 pricing is too low
  - Legacy systems and brown field installations
  - Society acceptance
- Different developments
  - Per country
  - Per region
  - Per sector (sector-coupling)

4. Opportunities

- Chemical Industry
- Mobility / Traffic
- Energy and Infrastructure
- Local production approaches

1. Goals

1.1. New: Climate Change is the driver for a new economy

All industries need to lower their CO_2 footprint dramatically.
Energy consumption reduction seems to be unrealistic.
There is a huge opportunity for the high-tech sector to design, develop and produce solutions to lower the CO_2 footprint of all involved sectors including the supply from the energy sector. The conditions for the transitions need to be set. There is the chance to jointly act on high-tech industry and energy.

1.2. Existing: Become more circular and CO_2 neutral

Current grid operators are incentivized for providing capacity, not circularity.
A new vision and a roadmap needs to be developed around technology, platforms, and skills.
An important technical aspect of circularity is that CO_2 is viewed as a valuable feedstock source (CO_2 utilization). This perspective opens a new vision on the topic.
Global data economy player, so called Hyper-Scalers, might enter these markets. If so, they will enter from a different direction, i.e. from the data and scaling based viewpoints. This could create a game changing situation in Europe. This involves several sectors, from transport and industry to energy.
Examples for circularity and CO_2 neutrality exist in Europe. See the Renewable Energy Directive (RED II) and local rules like the "Energie akkoord" or the project 6-25 in the Netherlands.

1.3. Call: Reduce CO_2 dramatically

The global CO_2-footprint of any sector must be reduced dramatically. Exemplarily, for transport the global trend that more people require more transport needs to be newly designed, controlled and optimized with new approaches, e.g. direct transport as a "base service" in modern urbanity. A mainstream of the European societies suggest that the fossil fuel price and the CO_2 price should be coupled in order to reduce the CO_2 emissions.

However, the future CO_2 pricing models and the future financing models are still unclear. Thus, creating new business models or business cases with the target of CO_2 reduction cannot be developed in a sustaining mid-to-long-term way. This would require long-term political and financial stability. It would immediately activate private equity, which is available, but the market cannot solve this topic alone without the mentioned clarity (exemplarily, the "Prinsjesdag NL" – Budget 2021 – PWC CO2 Pricing for the industry address this topic).
New digital platforms putting CO_2 in their center are (yet) seldom. Exemplarily, for traffic-based emissions some regions need to compensate for emissions.
Hence, it must become clear how fossil fuels will be taxed when fossil fuels become cheaper and cheaper.

National incentive regulations should support new large-scale investments and the energy trading:

- Incentives for best in class
- Incentives for ecosystems

The EC Green Deal and the European Vision on IT-security, AI, Data Sovereignty and Plattform Economy (e.g. GAIA-X, interoperability, Industry 4.0, etc) need to play a key role in the call to reduce CO_2 emissions.
The important role of energy storage (small and large scale) is hereby another enabling technology.
Generally, the breaking of barriers among sectors is necessary.

2. Covid-19 Impact

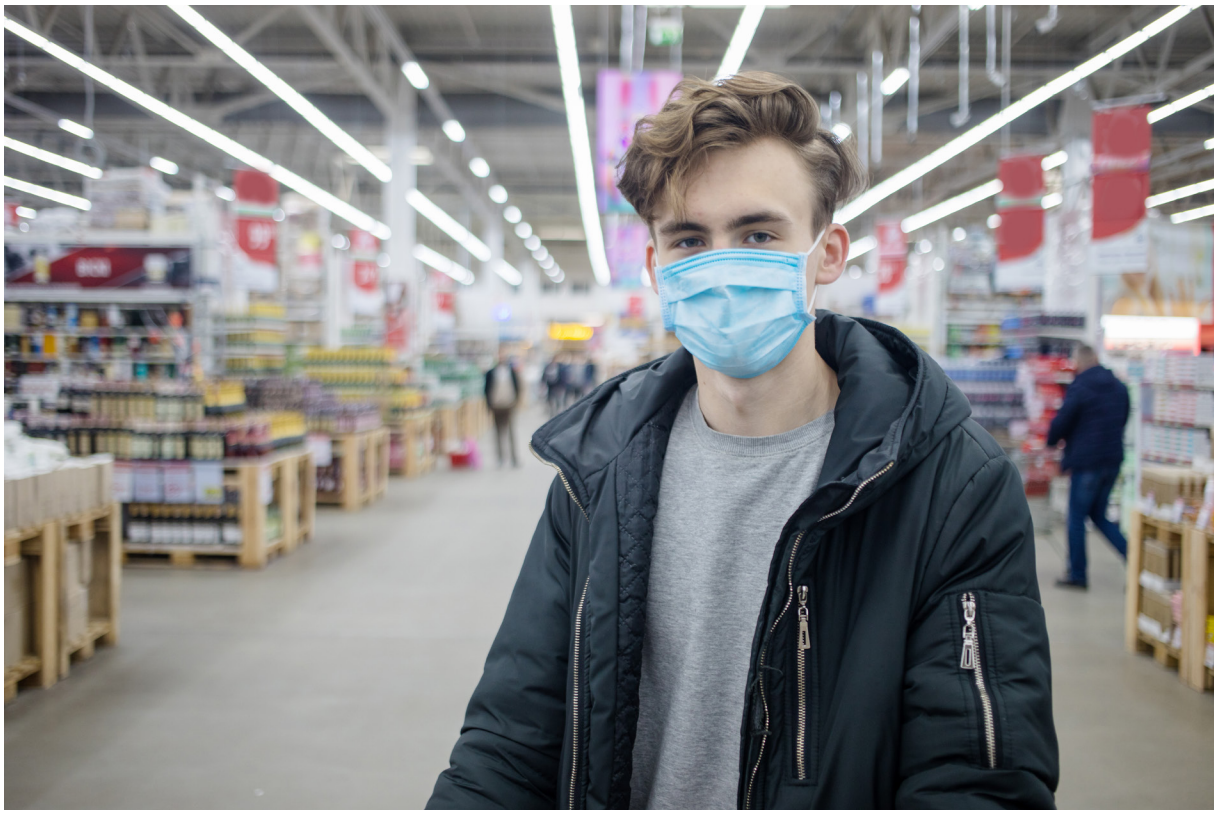
The Covid-19 pandemic situation showed in Europe that new priorities can be made possible.
The impact is on:

- The funding of the EU Green Deal and the Covid Recovery Fund
- The capacity to invest
- The outsourcing of certain economic sectors due to a changed landscape
- Innovation roadmaps

Positive impact in the understanding of this document are:

- More online
- Less traditional means of transportation
- More local supply chains
- Robustness of production might increase

Negative impact (when using fossil fuels) is the increased electricity consumption.



3. Main Challenges

We face complex challenges:

- Energy consumption reduction seems to be unrealistic
- Limited amount of time for solutions
- Paradigm shift from high-tech to data-driven industry
- Internationally fast changing landscape
- Civil blockades in some European countries may stop new technology installations
- Low productivity in some parts of Europe
- Transformation of existing brown-field installations
- Urban areas and the countryside systems may have very different requirements, e.g. in the transport sector

We need to collaborate. In particular since the headquarters of some companies are located outside the EU and decisions may be based on different criteria.
One basis is the Dutch-German Industry Agenda from 2019.

3.1. Different Developments

3.1.1. Per Country and Region

Parts of the renewable energy for Europe will be imported from abroad. Examples could be solar energy (via hydrogen) from North Africa and the Middle East, wind energy from South Argentina and Chile. China may export globally renewable synthetic fuels and hydrogen.

3.1.2. Per Sector

Sector coupling is an highly relevant topic. Several different markets need to be differentiated like end-user markets or industry and transport areas. There's enough technology and knowledge existing but it differs depending on the markets. High-tech storage technologies for large scale (both electrons and molecules) are the most required technologies.

3.2. CO_2 Pricing is too low and CO_2 compensation models unclear

- Different sectors need to work together, e.g. sector-coupling is necessary, which is a challenge by nature
- The Paris Agreement CO_2 model exists, but it is not implemented in all countries and it is not a law.
- Due to the missing CO_2 compensation models the financing models for each sector are unclear:
  - Industry
  - Energy
  - Transport
  - Infrastructure

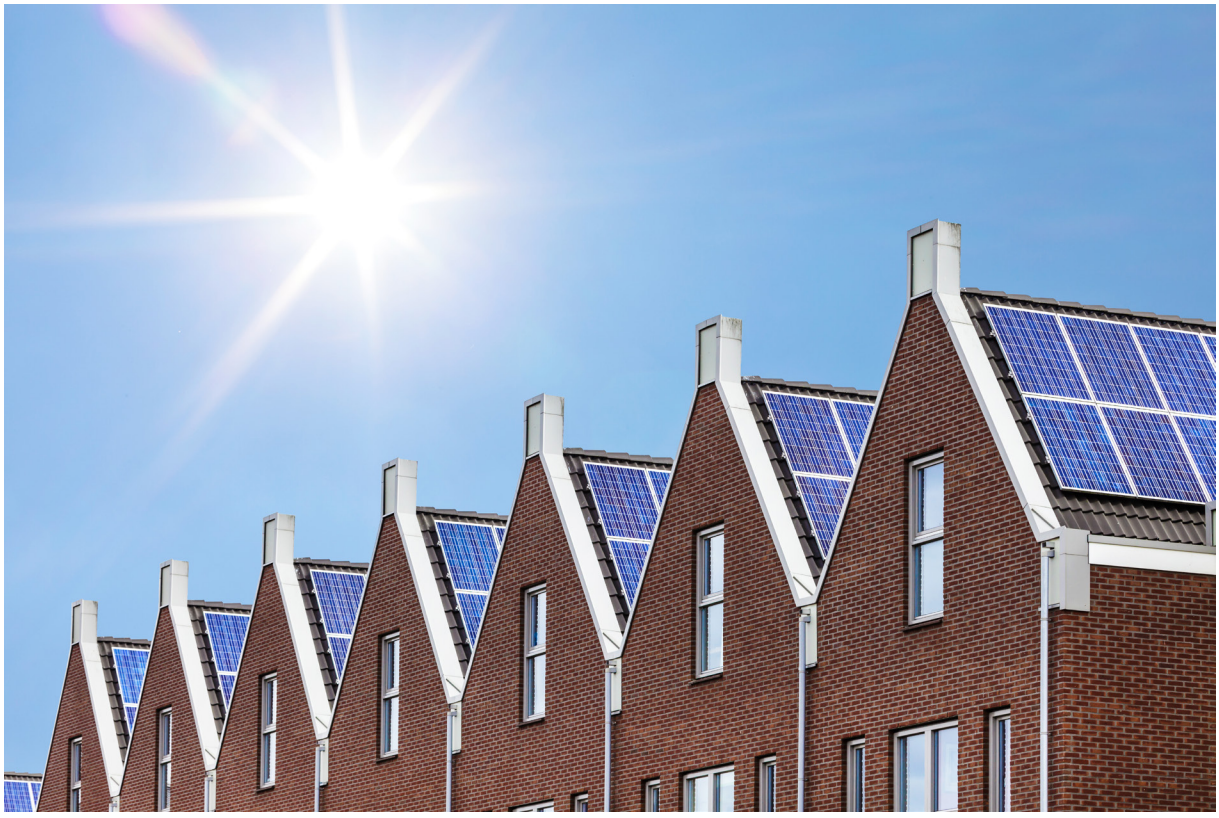
3.3. Legacy systems and brown field installations

- Existing equipment is still there for decades (amortization times are up to 30 years).
- The brown field installations have a value! Hence, an integration with the new technologies is highly necessary. The future impact of new technologies is here partially unclear. Clear is that further electrification and digitization will take place.
- A transition model is needed, which includes the heavy players and the existing infrastructure, their service and the maintenance.

The risk exists that these players will lobby for a delay or other measures than needed, e.g. a market attractive (!) ecosystem around CO_2.

3.4. Society acceptance

- Honest communication and information is needed to get everybody on board. It is necessary to involve the message from:
  - Demonstration/strikes
  - Creative legal actions and lawsuits in the discussions.
- Close collaboration with national associations like the Energy Reinvented Community, DGMK, Metaal Unie, FME, VDMA, ZVEI, VDI, etc is very necessary.
- Individual questions like “why do I use a car” or “why do I use individual transport” are part of this acceptance process.



4. Opportunities

The following aspects have been discussed during several workshops with the experts in these areas:

- Chemical Industry
- Mobility / Traffic
- Energy and infrastructure including more "local production approaches"

Below is an extended list of issues related to these three areas, which are not sorted or ranked but just listed:

- Focus in the past was mostly on large scale operations. What does that mean for future setups?
- The transformation of brown-field installations is essential and means CO_2 saving opportunities
- There is a market need for secure decentralized (e.g. transport, plants) energy generation and networks
- The infrastructure will be hybrid based on distributed technologies
- Connected technologies, integrating different domains, e.g. smart cities, smart traffic, smart energy systems, smart data centers, smart power management, etc. are key elements of the solutions
- New business models, financing schemes and payment models will become important, e.g. equipment leasing or product solutions as a service
- There is more need for more specialized chemicals which will be produce closer to the customers in smaller series
- More efficient multi-model mobility solutions will arise
- E-charging of electrical cars
- Smart Grid will be multidirectional and specific to regional needs and demands
- Private market / heating / local communities will be more interconnected
- Producing heat decentrally, combined in heat networks
- Cross-sectorial coupling must include production, transport incl. maritime, food and beverage, agriculture, harvesting
- CO_2 as feedstock for other sectors
- Storage technologies may be the most important cost factors:
  - power to X
  - hydrogen and batteries - are these fuels or feedstock?
  - green ammonia
- Heat?, Data? The connection between production and storage needs to be further developed. This may become a European USP
- For all this norms, standards and useful regulation is needed, as well as multi-vendor interoperability (e.g. Asset Administration Shell), security and data technologies supporting the platform economy, e.g. GAIA-X and IDSA
- Technologies like Digital Twin and Blockchain can help to enable the transition
- Artificial Intelligence is needed to support this transition
- Open source systems shall be the solutions to target for

5. What needs to be done?

5.1. Change the mindset

Foster testing and experimentation (like FieldLabs or Kompetenzzentrum 4.0) to answer the questions on technologies, investment, infrastructure and business modelling with low-risk. Emphasize even more the close linkage of R&D and industry and realization.

5.2. Clear politics on 2030-2050 Climate Goals

A roadmap (based on different scenario) needs to be designed:

- Which level of global warming to be accepted by societies in Europe?
- Younger generations require less fossil based transport systems. They request from societies to provide and utilize less CO_2-emitting technologies and systems.
- At the moment the energy sector is led by a small group and hence, competition is partially lacking.
- Increasing general energy pricing due to regulatory measures is a real threat for the competitiveness of the high-tech industry and other sectors and industries.

Example: Hydrogen bares high potential. Process and energy industries rely on it. It supports decarbonization. Large scale electrolysis is required to produce enough H2. The German H2 strategy paper gives a clear perspective. NL-GE H2 programs started for testing and execution.
The "Growth Letter of the Dutch Government" is another example.

5.3. Create a common Vison and Architecture

- It is not completed by the Green Deal.
- Build a Technology and Skills/Upskilling roadmap (AI, etc).
- Government need to facilitate the transition process (TNO, Fraunhofer, etc.).
- Standardization, normative and regulatory measures in all domains are necessary to ensure seamless and low-cost interoperability and sustainability of the new solutions and operations. Examples are the Asset Administration Shell and GAIA-X.

5.4. Enable new financing models

- The European regulations learned during the COVID-19 times how to speed-up complex processes.
- We need more flexible regulations.
- Too many approvals are commonly necessary. We need to change this.

5.5. Testing and experimenting to find out!

- Testbeds: due to the complexity of the transition process test environments and experimentation fields are highly needed
- Joint FieldLabs activities: TNO, FiledLabs, Kompetenzzentren 4.0, LNI 4.0, etc.
- Define possible European projects

6. Next steps

The overall goal is to develop a roadmap that fulfills the mission statement. This roadmap will incorporate Industry 4.0, IoT and Energy aspects from one persepctive. Industry 4.0, testing and experimentation beside the standardization are important elements of this roadmap. The following aspects describe important elements:

- Use Cases: funding for projects out of our initiatives. The situation changed since March 2020. The EC financing schemes open opportunities for industry and energy. Use Case examples are listed in the Annex chapter. Security and risk management are pre-conditions for the broad acceptance of the transition.
- Green Deal with tangible actions, outlined from perspectives in chapter 1
- Standardization is important for both energy and industry. It must be emphasized by EC project financing.
- EU perspectives beyond NL-GE are necessary

To be further discussed are the following aspects:

- Organization: Is the foundation of a legal entity useful? Is the financing of further activities beside the ongoing actions?
- This discussion paper is written as an input for the ministries of economic affairs. With them the dicussion will be continued according to the key requests from the document summary, i.e. CO_2 pricing and compensation models.

7. Annex

Disclaimer

A joint overview of best practices and projects of the 50 co-authors is given below.
Please note that the list is neither classified nor ranked nor complete and will undergo changes.

- World Energy Outlook 2019 – Analysis - IEAWorld Energy Outlook 2019 - Analysis and key findings. A report by the International Energy Agency. https://www.iea.org/reports/world-energy-outlook-2019
- https://www.iea.org/reports/sustainable-recovery
- https://www.data-infrastructure.eu/GAIAX/Navigation/EN/Home/home.html
- https://enzuid.nl/docs/Green-chemistry-new-economy.pdf
- European Institute for Technology Climate-KIC, https://www.climate-kic.org/
- ENSURESEC, End-to-end Security of the Digital Single Market's E-commerce and Delivery Service Ecosystem, https://cordis.europa.eu/project/id/883242
- +CityExchange, https://cityxchange.eu/
- sustainKMU: Mitarbeiterzentrierte Qualifizierung und digitale Assistenz zur Steigerung der Energie- und Ressourceneffizienzeffizienz in KMU (https://www.digital-energy.nrw/)
- ASUP: Anwenderorientierte Smarte Umweltinformationssysteme in Praxis (https://www.asup-projekt.de/)
- GaNEsHA: Optimierte Nutzung der Verkehrswege und der Verkehrsmittel (https://www.ganesha-mobility.de/)
- SIDATE: Sichere Informationsnetze bei kleinen und mittleren Energieversorgern (https://www.wineme.uni-siegen.de/projekte/sidate/)
- INNOLAB: Living Labs in der der Green Economy: Realweltliche Innovationsräume für Nutzerintegration und Nachhaltigkeit zum Themenbereich Mobilität (https://www.innolab-livinglabs.de/)
- SmartLive: Nachhaltige Innovationsentwicklung im Living Lab für Smart Home/Smart Energy (https://www.wineme.uni-siegen.de/projekte/smartlive/)
- Living Lab Energy & Environment: Neue Visualisierungsformen für Echtzeit-Stromverbrauchsdaten im betrieblichen und privaten Bereich sowie möglichen Energiesparmaßnahmen (https://www.wineme.uni-siegen.de/projekte/living-lab-energy/)
- S-Mobil 100: Entwicklung einer Plattform zum Erhalt und Förderung der Mobilität Älterer (http://smobil.infoware.de/sehrmobil/)
- InfoStrom: Lernende Infrastrukturen im Krisenmanagement am Beispiel der Stromversorgung (https://infostrom.wineme.fb5.uni-siegen.de/)
- Spider: Entwicklung eines Smart-Meter-Gateways zur sicheren Powerline-Datenkommunikation im intelligenten Energienetz (https://www.spider-smartmetergateway.de/deutsch/projekt/projekt.html)
- https://www.government.nl/ministries/ministry-of-economic-affairs-and-climate-policy/documents/parliamentary-documents/2019/04/05/letter-to-parliament-progress-of-implementation-of-offshore-wind-energy-roadmap-2030
- https://www.government.nl/ministries/ministry-of-economic-affairs-and-climate-policy/documents/parliamentary-documents/2019/04/05/letter-to-parliament-progress-of-implementation-of-offshore-wind-energy-roadmap-2030
- https://www.government.nl/ministries/ministry-of-economic-affairs-and-climate-policy/documents/publications/2020/04/06/government-strategy-on-hydrogen
- https://www.pwc.nl/en/insights-and-publications/tax-news/pwc-special-budget-day/taxplan-2021-co-2-levy.html
- https://annahenrik-my.sharepoint.com/:f:/g/personal/anna-henrik_annahenrik_onmicrosoft_com/EsjaiAdqOpJGrCpugeoDgNsB1DZwjfHe79HEcIe8yF7_Ag?e=VPNrP9
- https://www.linkedin.com/posts/michaela-niss_weenergizesociety-activity-6714517247185965057-DMmI

8. Addendum

Author affiliations

ABN AMRO
Arcadis Netherlands
ARENA 2036
Brainport Industries
Contour Group
Damen Shipyards
Duiker Combustion Engineers
ebn
Energy21
EUTEC European Technology Chamber
FDC - System
INNOPAY
IOTA Foundation
Kuwait Petroleum North-West Europe
Kuwait Petroleum Research & Technology
Laboratory for Machine Tools and Production Engineering WZL of RWTH Aachen
Labs Network Industrie 4.0
LBBW Landesbank Baden-Würtemberg
ORTEC
PHOENIX CONTACT
Pon Holdings
Province of Noord-Brabant
psps business abroad
Q8
ROCSOLE Ltd
ROSEN Group
Royal Dutch Shell
Shell
SICK
Siemens
Smart Industry
Tilburg University - JADS
TNO
TUDelft
tue
University of Siegen, Kompetenzzentrum Mittelstand 4.0
VDL Energy Systems bv
Volkswagen
Welotec
WIK
WIKA Alexander Wiegand