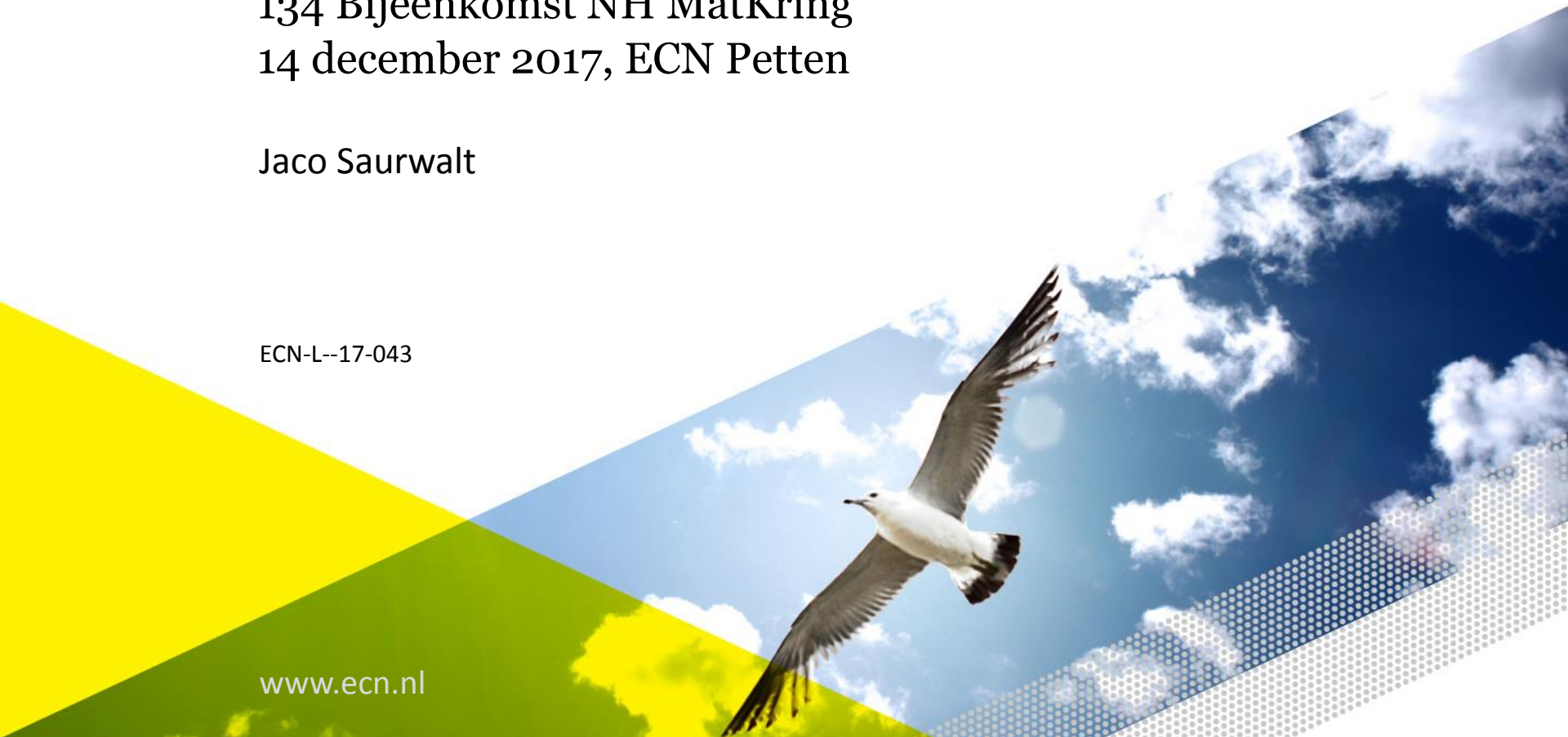
ECN
Your energy. Our passion.

ECN 2017

134 Bijeenkomst NH MatKring
14 december 2017, ECN Petten

Jaco Saurwalt

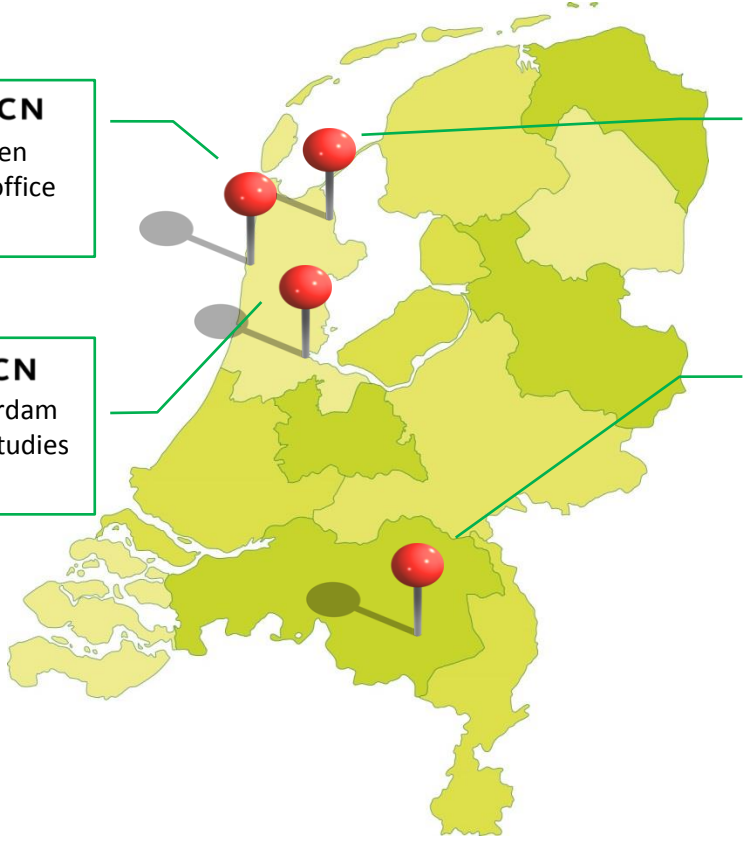
ECN-L--17-043



ECN locations in the Netherlands and abroad

ECN
Petten
Head office

ECN
Amsterdam
Policy Studies



ECN
Wind Energy
Test Site
Wieringermeer

ECN
Eindhoven
Solliance

ECN
ECN Asia

ECN's R&D programmes

Solar Energy

Policy Studies

Biomass

Energy Efficiency in Industry

Environmental Assessment & Energy Engineering

Wind Energy

WIND ENERGY

Our goals

- Reduce costs of offshore wind energy

- Support industry with state-of-the-art wind farm services

- Make Dutch industry more competitive through innovations

Our partners

- Wind turbine developers
- Developers and operators of offshore wind farms
- Installation and maintenance companies and suppliers
- Knowledge institutes

We invite you to become a partner in this programme.

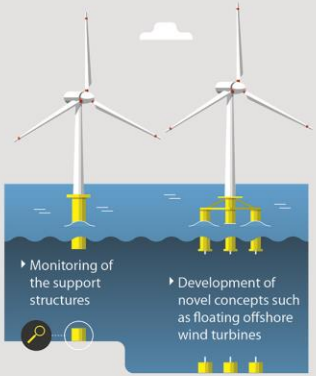
Would you like to know more?
ecn.nl/windenergy
Tel.: 088 515 4115

ECN's integrated approach to offshore wind farms in seven research lines

ECN

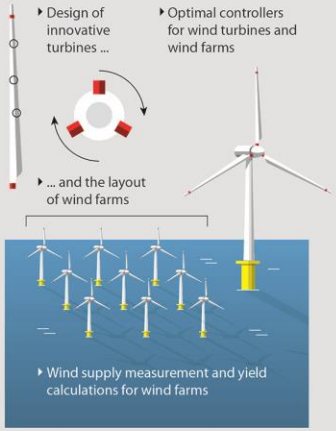
Support structures

- Improvement of support structures through an integrated approach



Optimisation of wind power stations

- Design of innovative turbines ...
- Optimal controllers for wind turbines and wind farms
- ... and the layout of wind farms



Electrical infrastructure and connection to the electricity grid

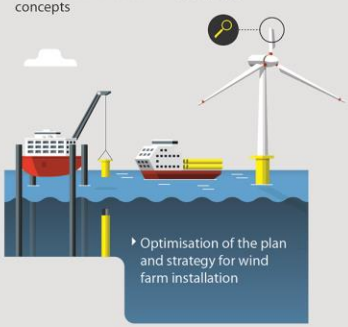
- Development of future-proof offshore electricity grids

Offshore wind and the environment

- Research focused on the social and spatial integration of offshore wind

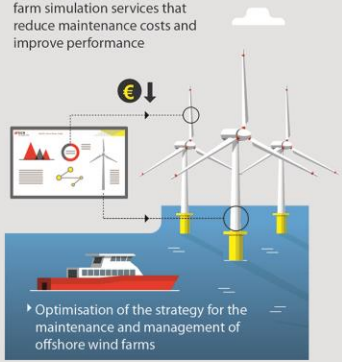
Transport, installation and logistics

- Evaluation and identification of innovative installation concepts
- Monitoring and prediction of damage to turbines



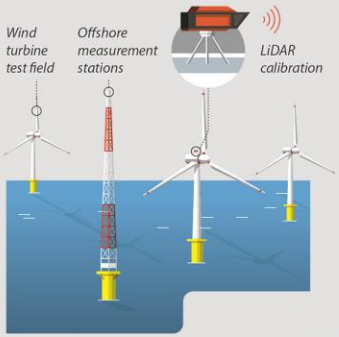
Operations and maintenance

- Development of advanced wind farm simulation services that reduce maintenance costs and improve performance



Facilities and experiments

- Provision of research facilities such as:



ecn.nl


80% of
North Sea wind
farms uses
ECN know-
how

SOLAR ENERGY

Our goals

- Reduce production costs to

  0,3-0,4 €/Wp

  for large-scale manufacture of PV panels that have a guaranteed service life of 30 years starting from 2020 and which can be widely used (e.g. PV integrated in buildings and infrastructure)

- Strengthen the Dutch solar energy sector, leading to the creation of

  10.000 jobs

  x 1.000

  Turnover of 4 billion in 2020

Our partners

- Manufacturers of solar cells and panels
- Suppliers of equipment and materials for producing solar cells and panels
- Developers of PV applications
- Knowledge institutes

We invite you to become a partner in this programme.

Would you like to know more?

ecn.nl/solarenergy
Tel.: 088 515 4761

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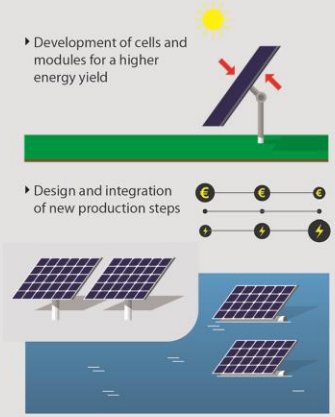
Solar Energy Research Lines

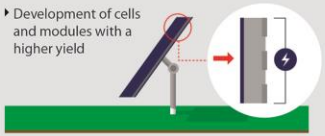
Bifacial cells and modules

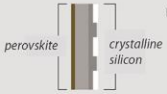
- Development of cells and modules for a higher energy yield
- Design and integration of new production steps



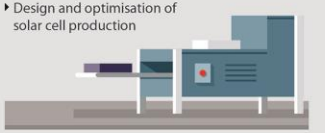
Back-contact cells and modules and hybrid tandems

- Development of cells and modules with a higher yield



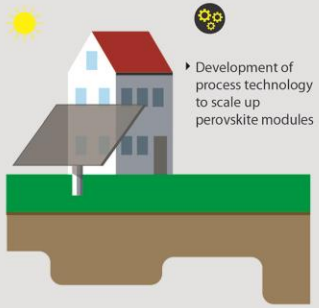


- Development of hybrid tandem solar cells consisting of a top and bottom cell
- Design and optimisation of solar cell production



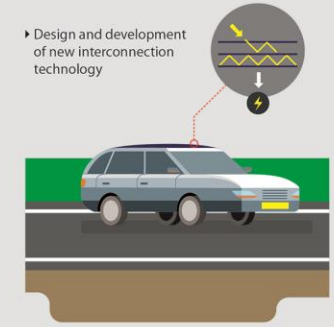
Perovskite solar cells and modules

- Development of perovskite solar cells with a high yield and a high stability
- Development of process technology to scale up perovskite modules



Enabling technology for thin-film PV

- Application of coatings and nanostructures for better light management
- Design and development of new interconnection technology



PV applications

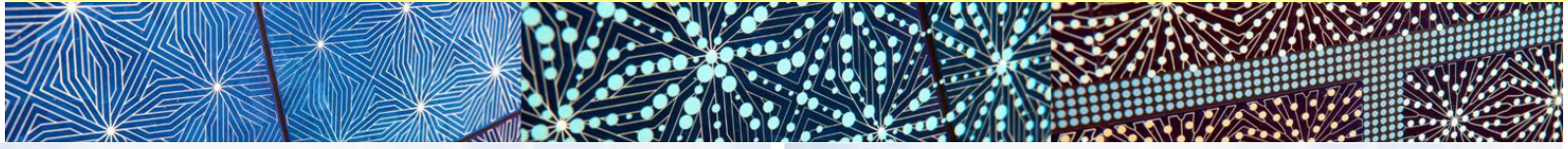
- Development and testing of PV components (e.g. junction boxes, transformers) and services
- Development and testing of modules with higher shadow tolerance
- Design and development of translucent thin-film modules as construction elements
- Design and demonstration of free-form PV modules with retention of energy yield

YINGLI SOLAR

TEMPRESS
AMTECH GROUP

> 15 million
Panda modules have been sold so far

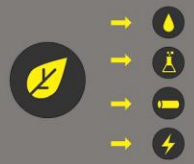
PV integratie



BIOMASS

Our goals

- Develop knowledge and technology to convert biomass thermochemically and/or through catalysis into fuels, chemicals, materials, electricity and heat



- Reduce cost of electricity and heat generated from biomass to

Our partners

- Technology suppliers
- Producers of biomass and biomass waste streams
- Companies active in the biomass logistics chain
- Producers of biobased products (fuels, chemicals, materials and energy)
- Knowledge institutes

We invite you to become a partner in this programme.

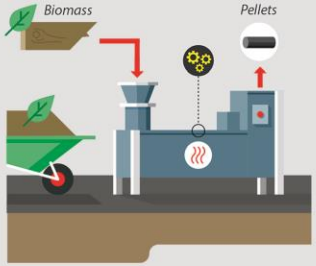
Would you like to know more?
ecn.nl/biomass
Tel.: 088 515 4148

ECN

Biomass Research Lines

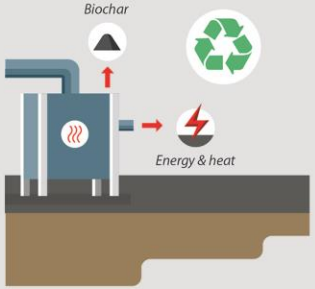
Biomass pre-treatment

- Support the market introduction of dry torrefaction technology
- Development of wet torrefaction technology



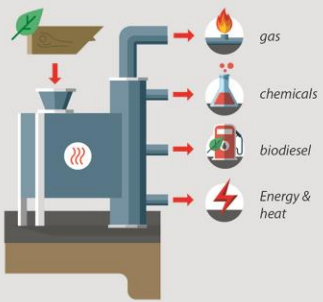
Resource-efficient use of residues

- Development of technology to obtain energy and products from biomass, e.g. biochar
- Development of concepts for the recycling of waste streams and for biomass cascading



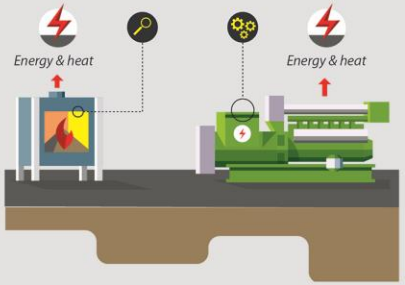
Biomass gasification

- Support the market launch of green gas production based on ECN technology
- ☒ Development of processes to produce biofuels and chemicals



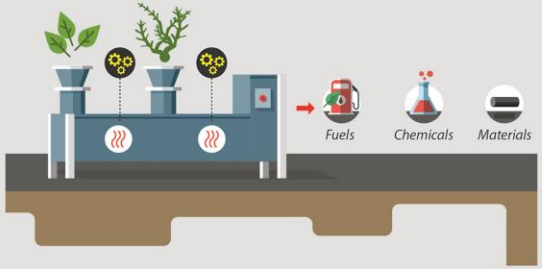
Biomass combustion

- R&D support for generating electricity and heat from 100% biomass and for biomass co-firing
- Development of combined heat and power generation in bio-refineries



Biorefinery concepts

- Development of fractionation technology for lignocellulosic biomass (e.g. Organosolv)
- Upgrading of biomass fractions (cellulose, hemicellulose and lignin) into platform chemicals and intermediate products, e.g. via pyrolysis



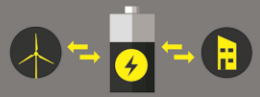

The first
MILENA
biomass
gasifier has
been built in
India

STORAGE AND INTEGRATION OF RENEWABLE ENERGY

Our goals

Integrate renewable electricity into the energy system by:

- Developing technology for the storage of energy and for aligning supply and demand



- Developing revenue models and policy instruments for the integration of renewable energy in the energy system, based on an analysis of the energy system

Our partners

- Technology developers
- Energy service providers
- Knowledge institutes

We invite you to become a partner in this programme.

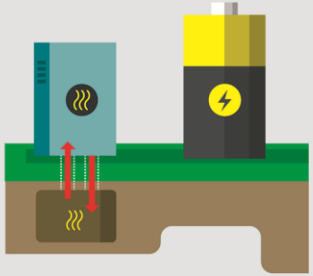
Would you like to know more?
ecn.nl/system_integration
Tel.: 088 5154296

ECN

Storage and Integration of Renewable Energy Research Lines

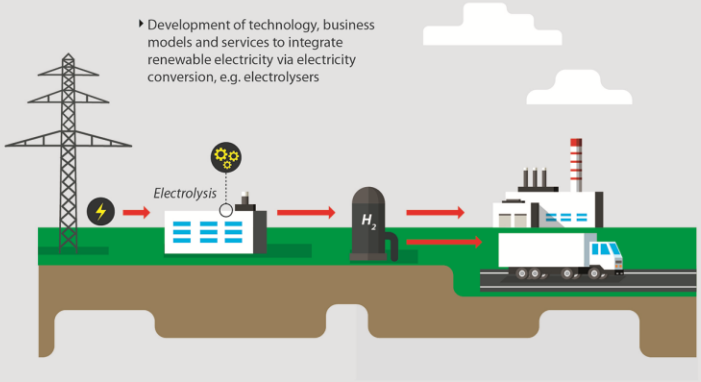
Energy storage

- Research on materials and systems for the compact storage of electricity (e.g. batteries) and heat



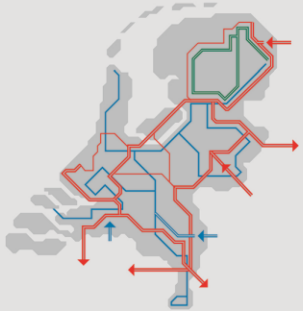
Electricity conversion

- Development of technology, business models and services to integrate renewable electricity via electricity conversion, e.g. electrolysers



Optimisation of energy infrastructure

- Optimisation of the transport infrastructure for electricity, heat and gas



Design of energy systems

- Development of transition paths towards future regional and international energy systems
- Identification of the economic, social and spatial aspects of the energy transition

ENERGY AND INDUSTRY

Our goals

Make energy use in industry more sustainable through innovation:

- Energy savings of at least 2% per year

- Reduce industrial CO_2 emissions to zero, e.g. by replacing fossil raw materials with sustainable alternatives

- Develop new electrical processes for industry so that it becomes more sustainable and new business can be created

Our partners

- Technology suppliers & engineering firms
- Materials suppliers
- Energy-intensive industries
- Knowledge institutes

We invite you to become a partner in this programme.

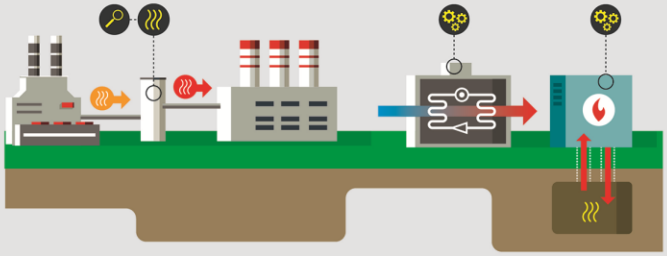
Would you like to know more?
ecn.nl/energy_efficiency
Tel.: 088 515 4148

ECN

Energy and Industry Research Lines

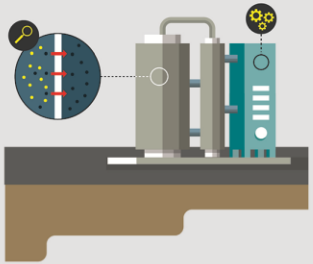
Industrial heat

- Recovery and conversion of residual heat from industrial processes
- Research on the supply of renewable heat to industry, as an alternative to gas
- Development and testing of industrial heat pumps
- Development of technology for industrial heat storage



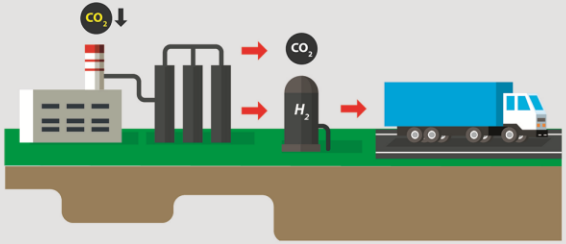
Liquid separation & conversion

- Research on separation technologies (e.g. membranes) for liquid streams and the recovery of valuable components
- Development of chemical reactors for gas/liquid reactions



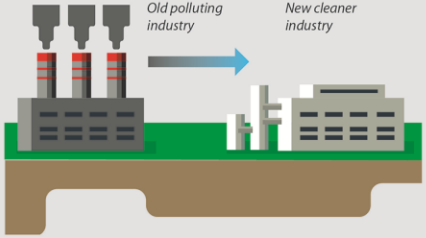
Gas separation, treatment & conversion

- Development of sorption technology to reduce industrial CO_2 emissions
- Development of membrane reactors for hydrogen production
- Conversion of industrial waste streams into chemicals and transport fuels



Industrial integration of renewable electricity

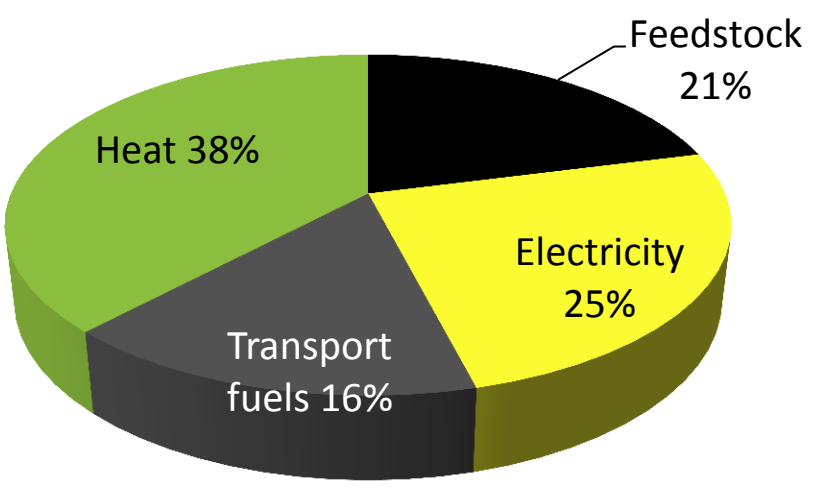
- Development of processes to produce chemicals and fuels with the help of electricity, e.g. hydrogen
- Development of technology to flexibly convert renewable electricity into heat



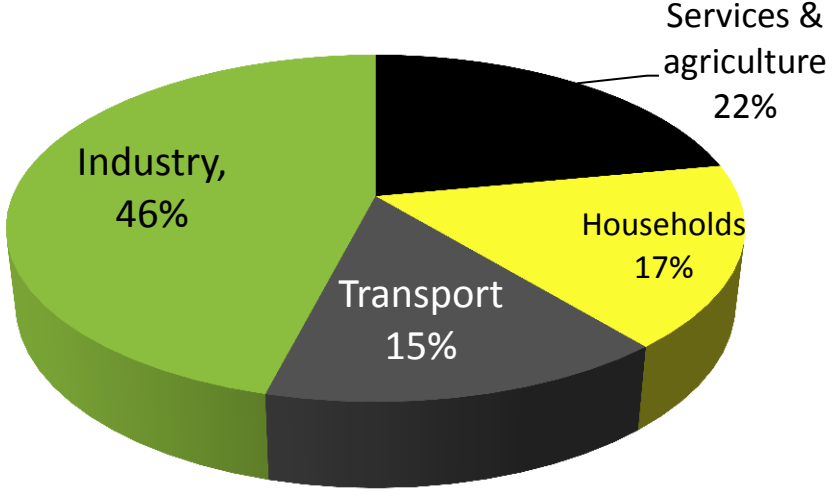
Putting things in perspective

Dutch Energy use

In the Netherlands (~3300 PJ)



Functions

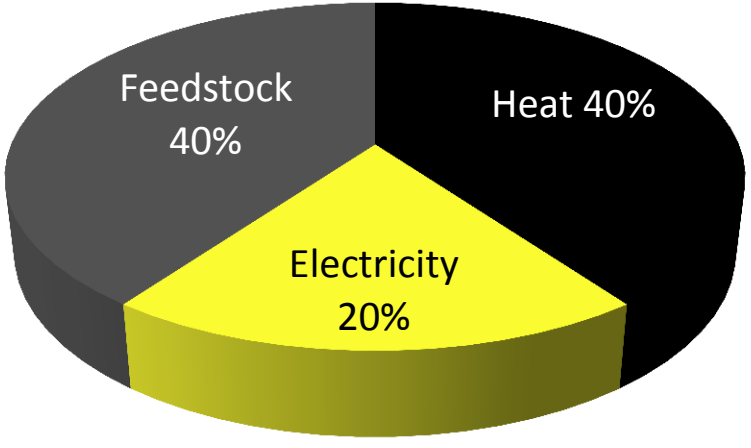


Sectors

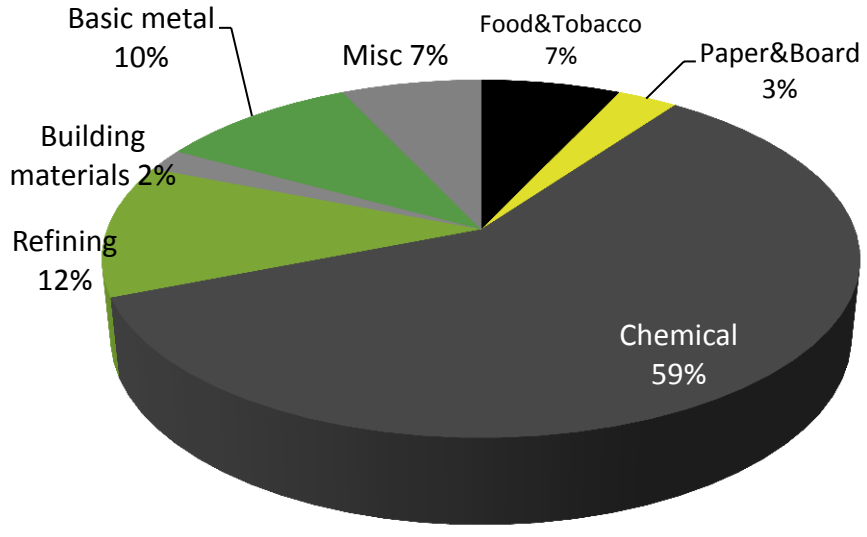
Putting things in perspective

Dutch Energy use

Dutch Industry



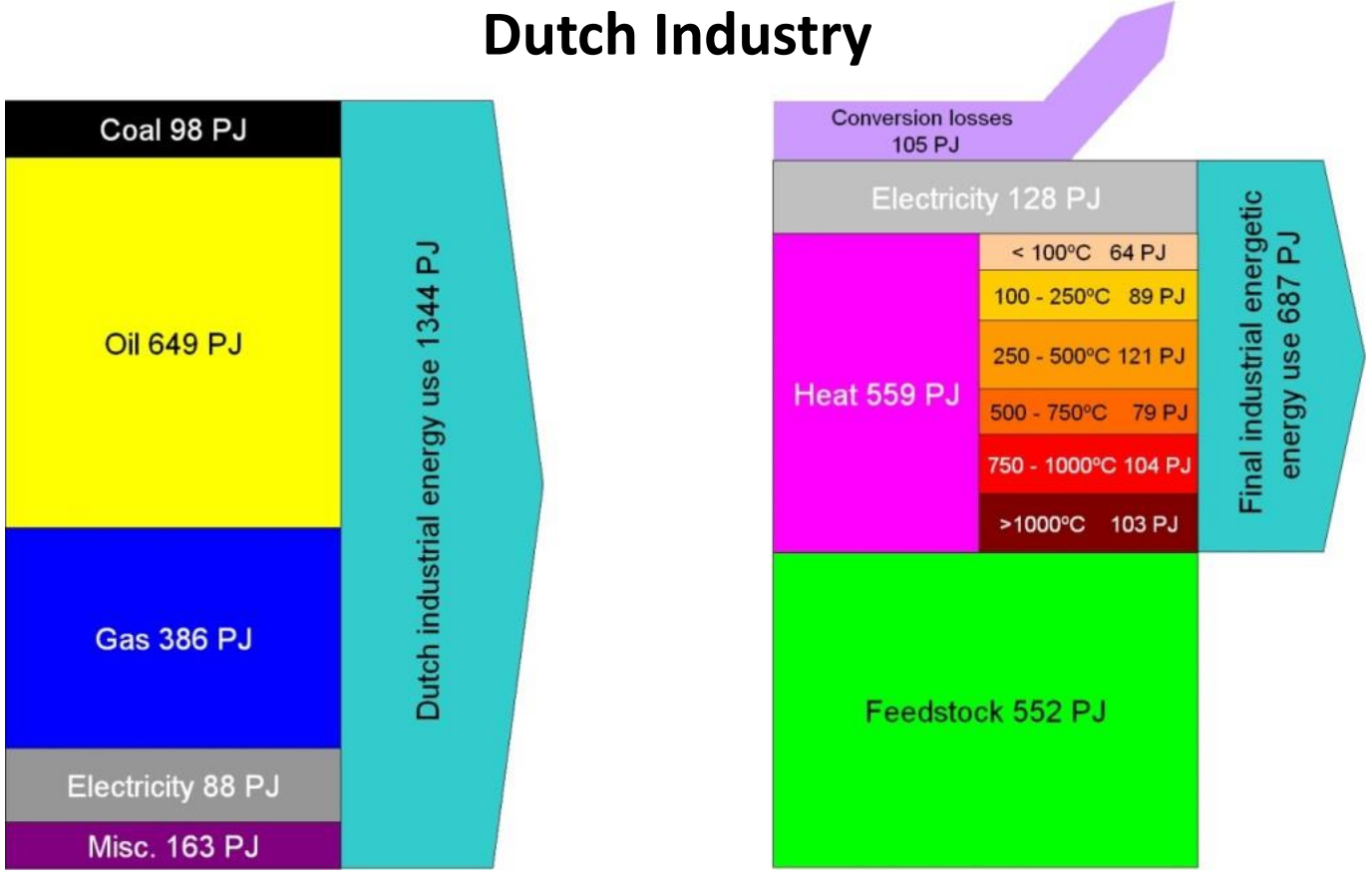
Functions



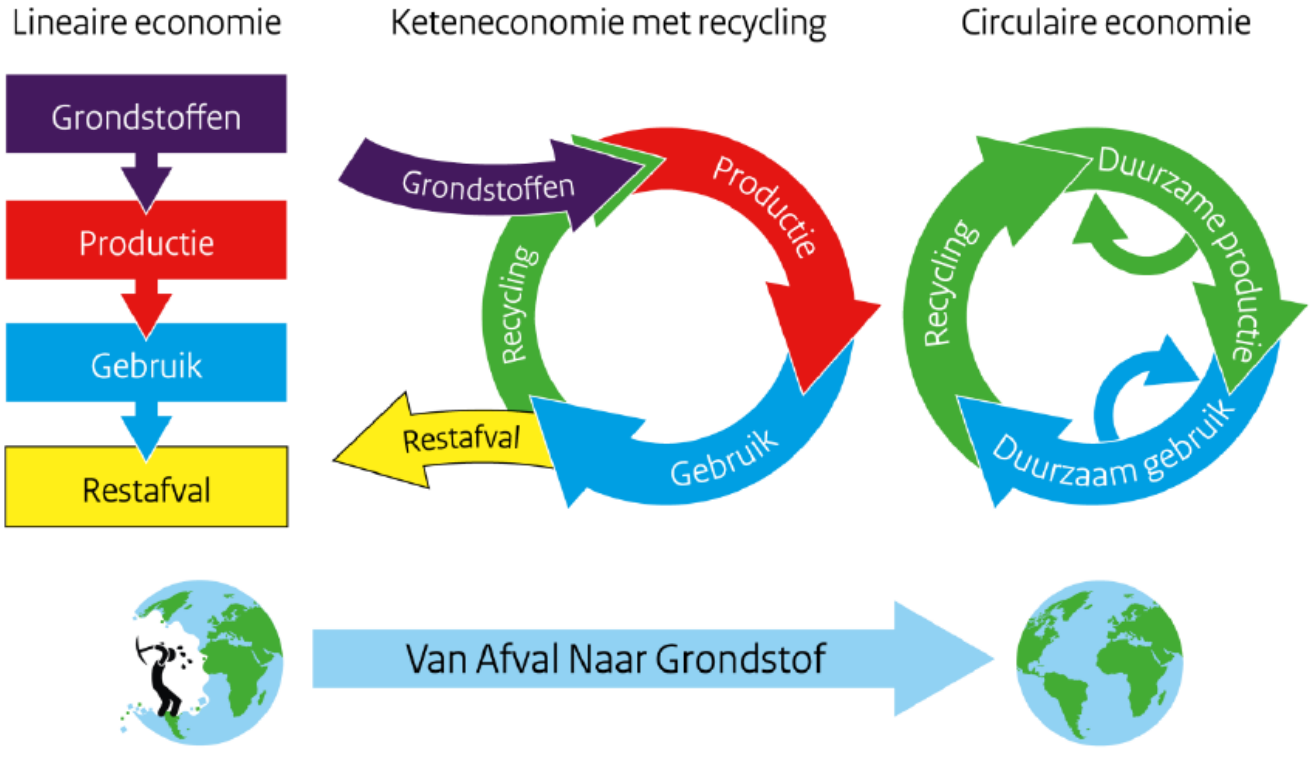
Sectors

Putting things in perspective

Dutch Energy use



Energie is een middel in een keten
Het gaat over energie en grondstof huishouding

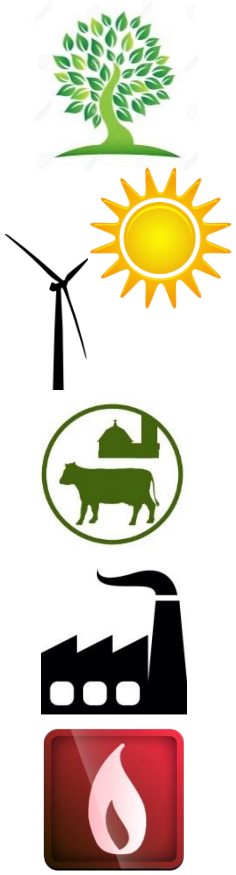


Programmalijn Gasscheiding, behandeling en conversie

Grondstoffen

Efficiënt gebruik van grondstoffen en energie

Producten en markten



Biomassa

Waterstof uit elektrolyse

Biogas

Industriële reststromen

Aardgas

FOCUS programmalijn

Zuivering, scheiding en omzetting

CO_2 afvangst

Hergebruik van nevenproducten

Waterstof

Methaan

Ammonia

Methanol

DME

Propeen

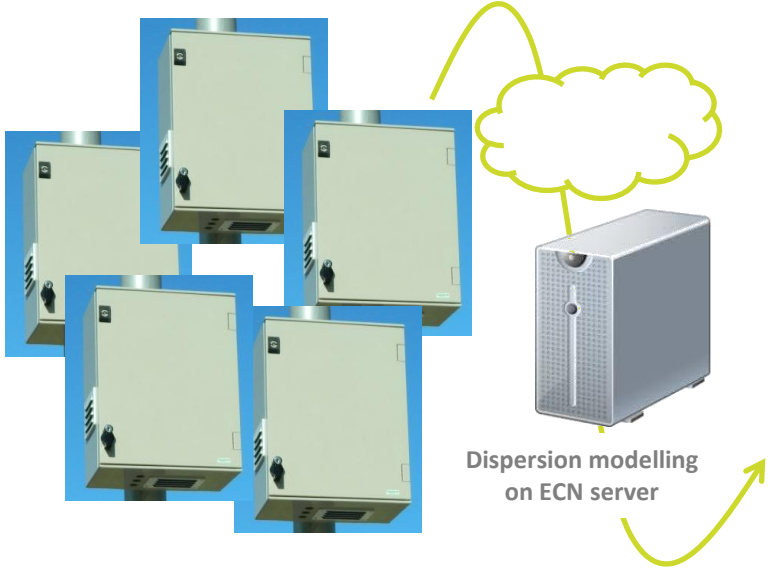
Materials

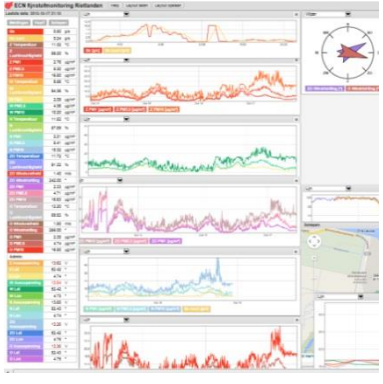
and all the questions you (should) ask yourself

ECN Dust Monitoring Service offers real-time information

A network of sensors produces real-time, on-line data on concentrations and sources

Sensor network → Data submission & processing → Data publication



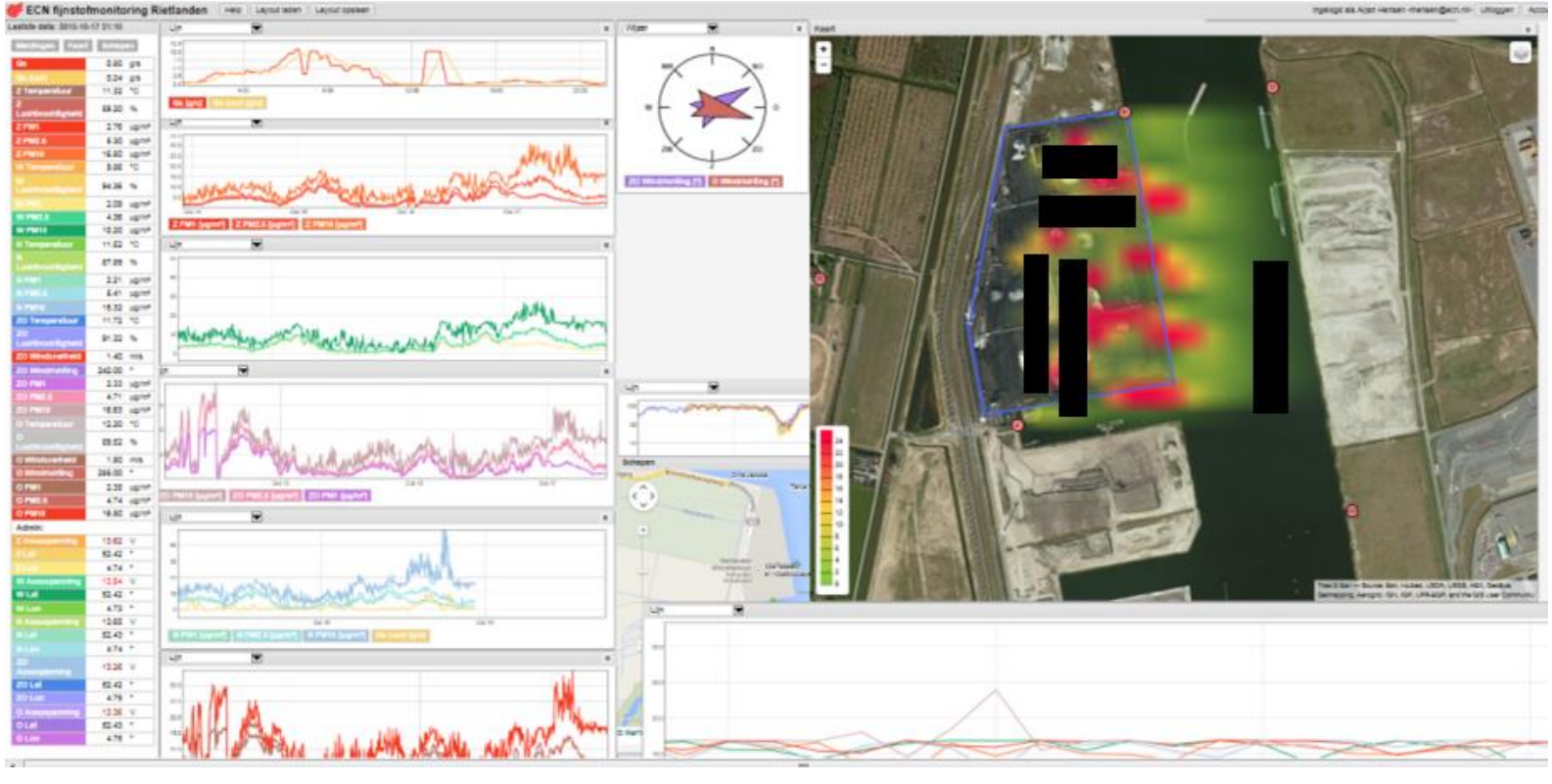


Functionalities

- Real-time dust concentration values
- Source localization
- Alarm function when user-defined threshold is exceeded
- (Optional) cumulative emission reporting (incl. emission factors)

Comprehensive, easy and secure web-based interface

Interface screen shot



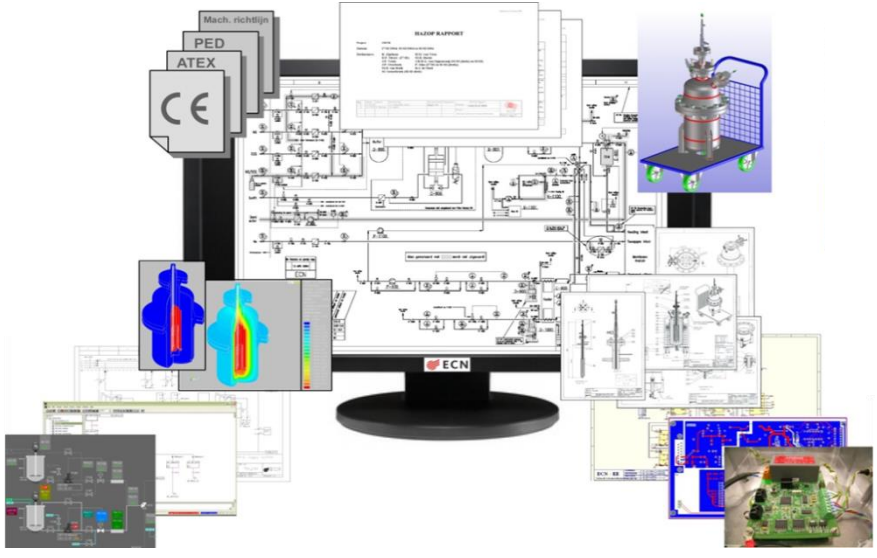
ECN offers all capabilities necessary to turn a concept into a working test installation

Multidisciplinary team…

- Process engineering
- Mechanical engineering
- Electrical engineering
- Software engineering
- Materials science

…covers the entire engineering process

- Specification (SRS)
- Process and system design (Aspen)
- Safety and risk analysis (HAZOP/FMECA)
- Regulatory compliance
  (CE: Machine directive / PED / ATEX / EMC)
- Detailed engineering (3D-CAD, ANSYS)
- Procurement & realization
- Commissioning & acceptance (FAT, SAT)

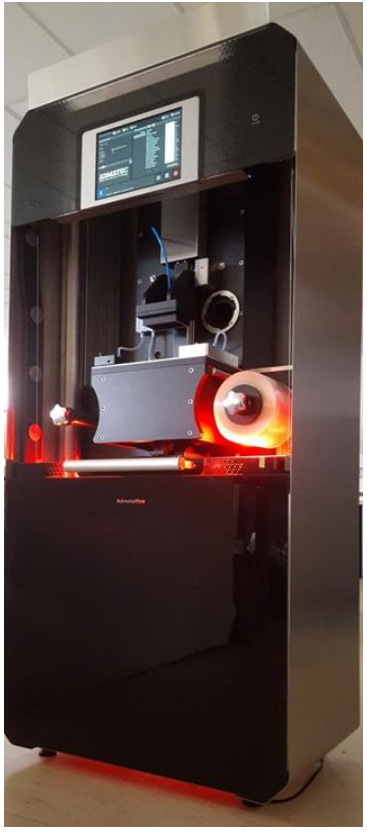


AdMetalFlex Presented on AMUG,

March 19 – 23, 2017, in Chicago, Illinois

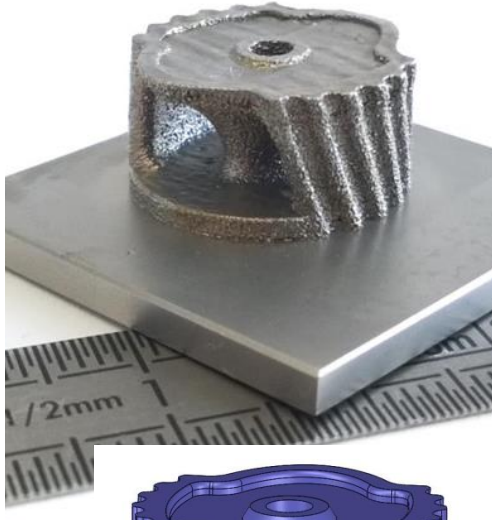
ADMETALFLEX 130

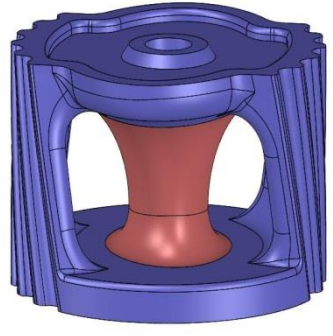
prints high quality metal materials



LaserFlex Conflux at a Glance

- Low internal stress build-up during densification, resulting in low residual stress and improved resolution.
- Homogenous micro structure, resulting in high quality material properties without annealing.
- Safe and environmentally friendly operation, with precise powder handling.
- Multi and / or functional graded material build-up in one build process
- Not sintered powder easily re-usable





Intro tot het onderwerp

Thank you for your attention!

ECN
Your energy. Our passion.

Ir. Jaco Saurwalt MBA
Director
Environment & Energy Engineering

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