# Smart Cities & Bio-based Economy

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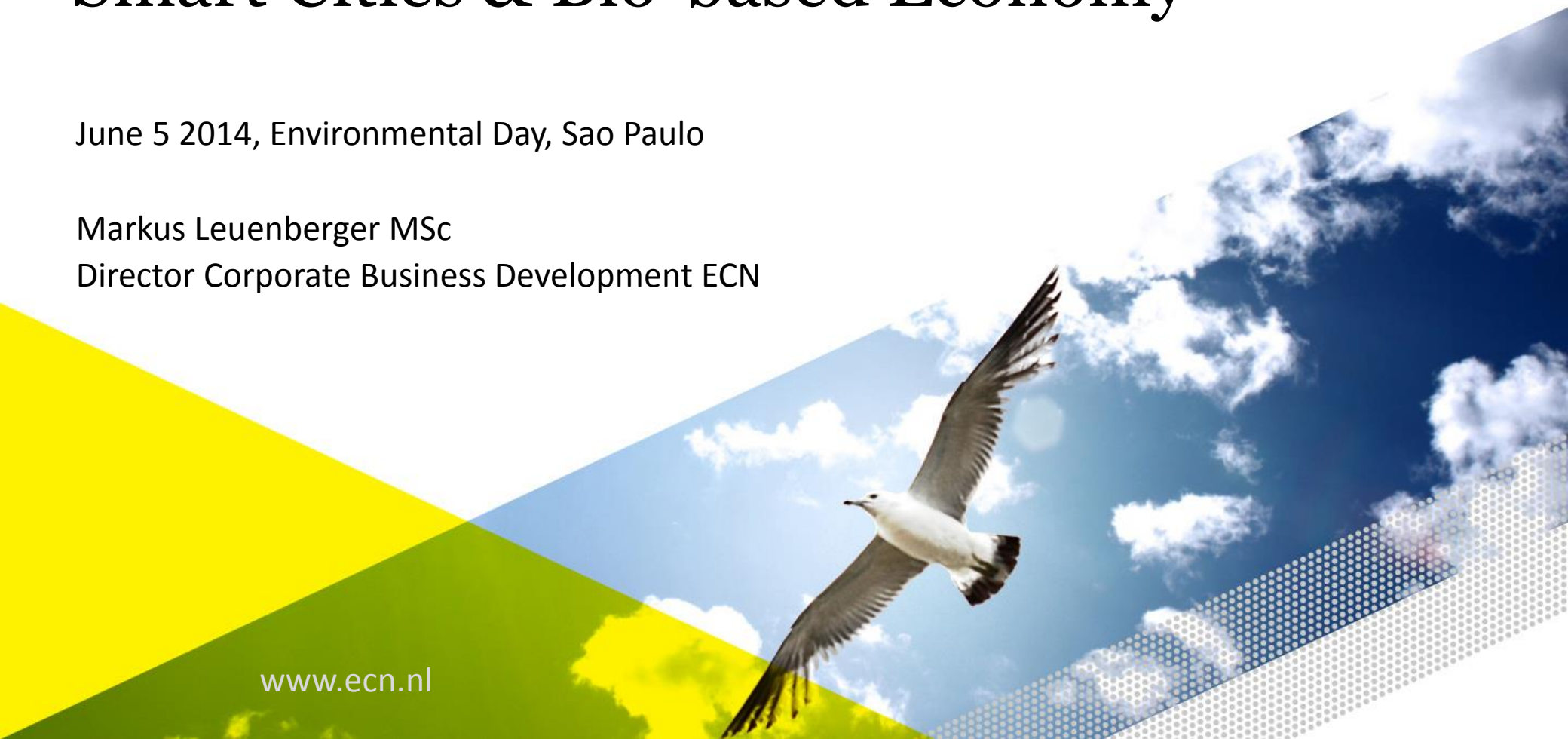
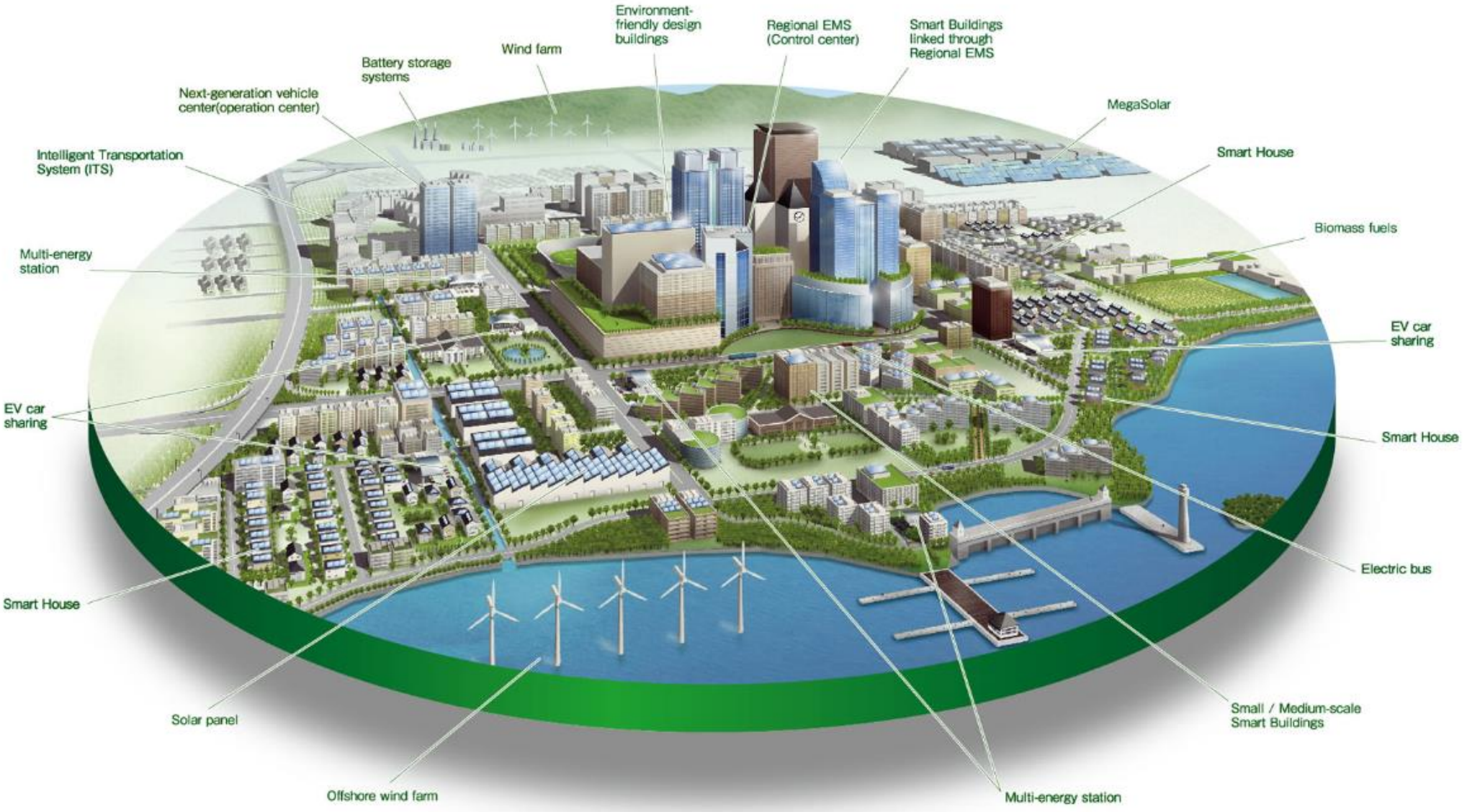


www.ecn.nl

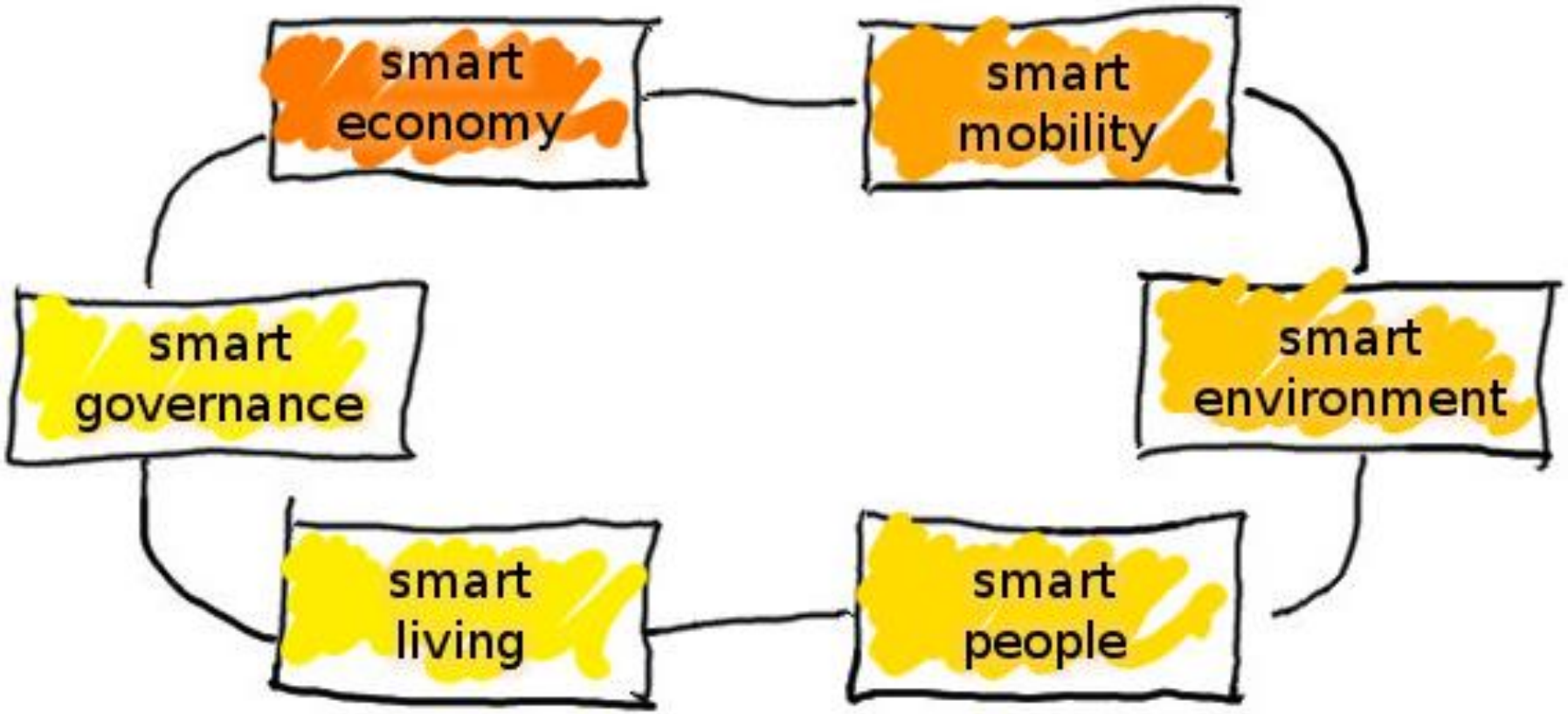

Environment-friendly design buildings
Regional EMS (Control center)
Smart Buildings linked through Regional EMS
Wind farm
Battery storage systems
Next-generation vehicle center(operation center)
MegaSolar
Intelligent Transportation System (ITS)
Smart House
Biomass fuels
Multi-energy station
EV car sharing
EV car sharing
Smart House
Electric bus
Smart House
Small / Medium-scale Smart Buildings
Solar panel
Offshore wind farm
Multi-energy station

# Why Smart Cities?

- > 60% of world population will live in cities in 2030 (OECD)

- Challenging the quality of life:
  - Resources: Air / Water / Waste / Energy / Living space / Spatial Planning
  - Innovation:
    - Infrastructure (smart grids),
    - Mobility (seamless mobility, multi-modal systems)
    - Energy (efficient cooling, collective systems)
    - ICT (data infrastructure, consumer information)
  - Multi-disciplinary policy making
    - Combining spatial, energy, mobility, water, safety etc.

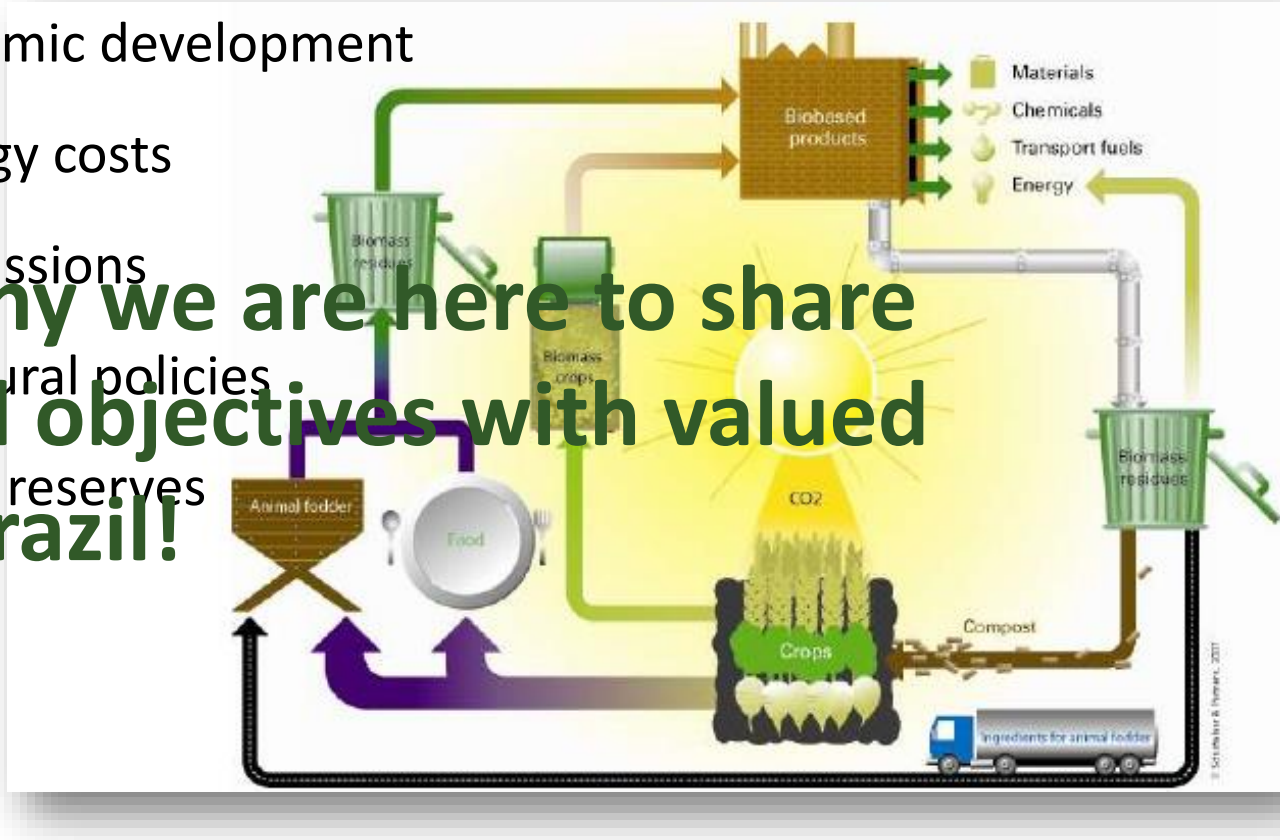
# Smart Cities require integrated approach

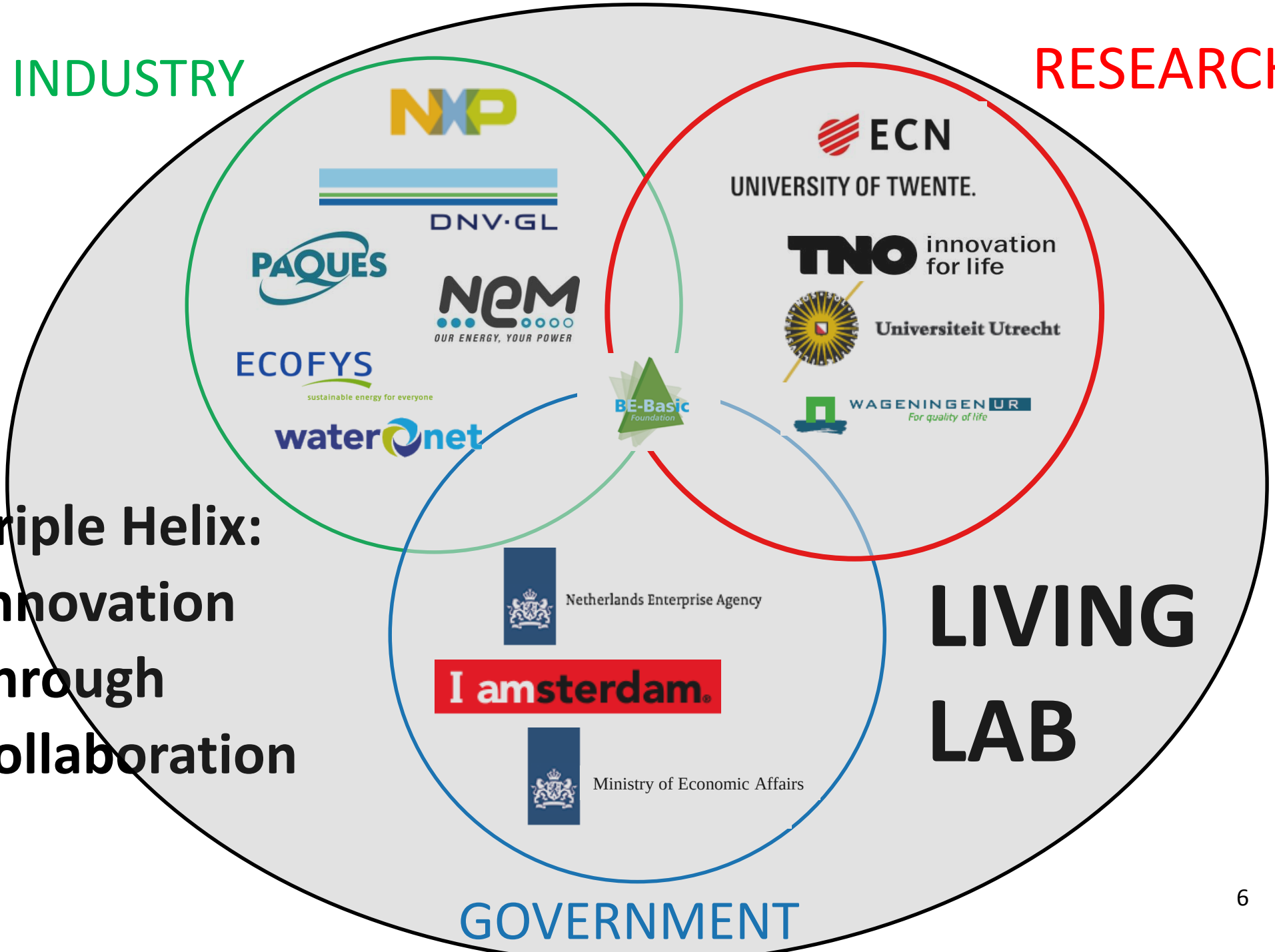


# Why Bio Based Economy?

- Innovation and economic development
- Energy security; Energy costs
- Reduction of CO2 emissions
- Regional and Agricultural policies
- Replacement of fossil reserves

**… which is why we are here to share learnings and objectives with valued partners in Brazil!**




INDUSTRY
RESEARCH
NXP
DNV·GL
PAQUES
NEM
OUR ENERGY, YOUR POWER
ECOFYS
sustainable energy for everyone
waternet
ECN
UNIVERSITY OF TWENTE.
TNO innovation for life
Universiteit Utrecht
WAGENINGEN UR
For quality of life
BE-Basic
Foundation
Netherlands Enterprise Agency
I amsterdam.
Ministry of Economic Affairs
GOVERNMENT
Triple Helix:
Innovation
through
collaboration
LIVING
LAB

**Mission:**

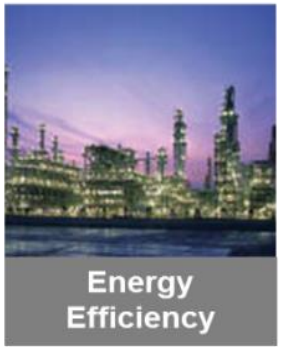
With and for the market, we develop knowledge and technology that enable a transition to a sustainable energy system

# At ECN, this is where we focus our energies…

- ECN: Energy research Centre  of the Netherlands since 1955; non-profit
- Over 500 staff in seven research areas; global scope
- Main think tank for Dutch government on energy and climate
- Unique combination: strategic policy adviser and technology developer of sustainability

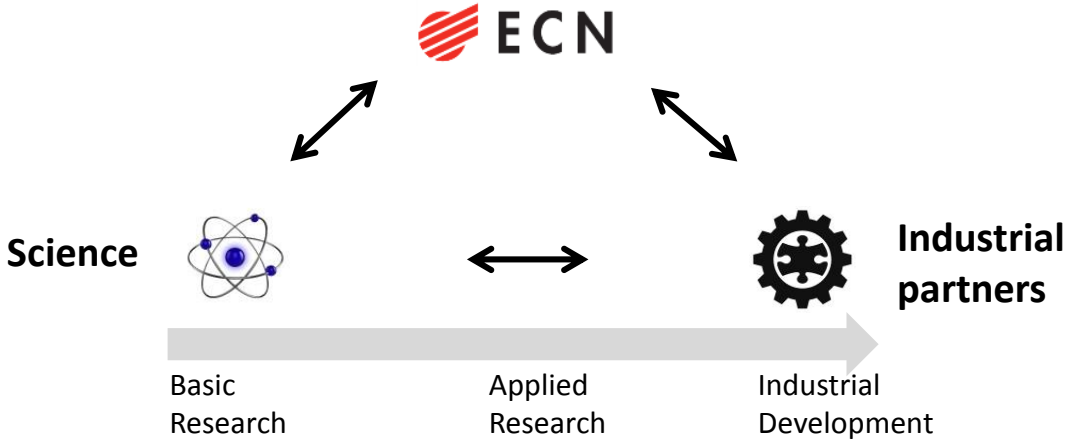








# ECN: bridging science and corporate innovation



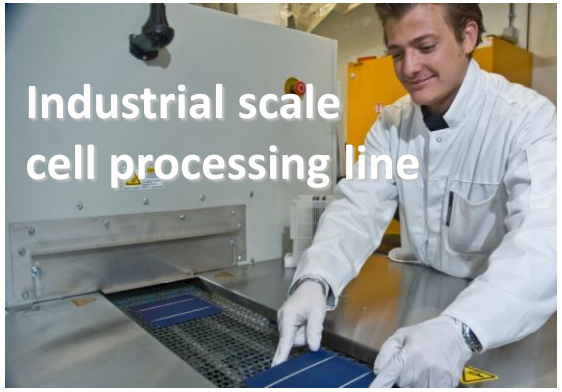

## What we do

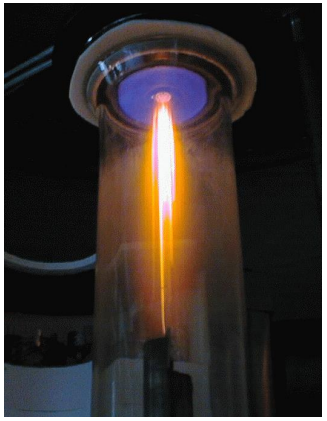
- Problem Solving
- Technology development
- Studies & Policy Support

## How we can work with you

- Consultancy & Services
- Contract R&D
- Tech development & Transfer
- Joint Industry Projects

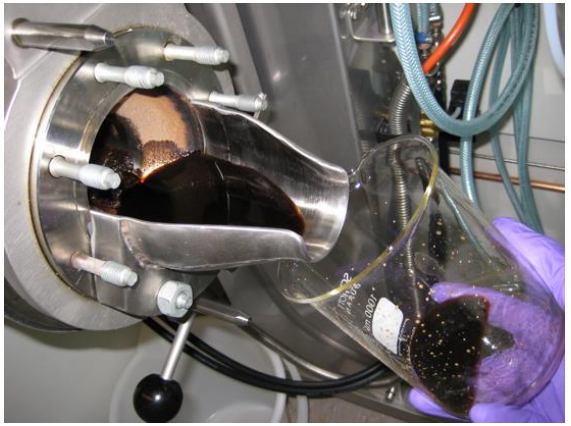
# World-class test facilities



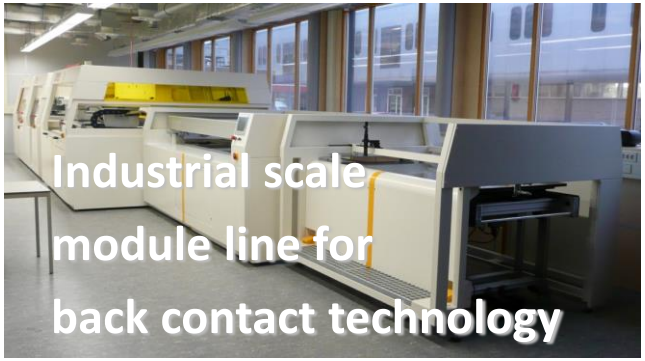



Combustion Simulator

Tar removal



Biorefinery (Organosolv)

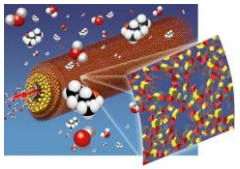



ECN Test Site


Material and Blade Test Centre

# Examples of technological break-throughs

- New type of solar cells
- Most efficient gasifier world-wide
- New heat pump
- Blade root spoiler increasing the efficiency of a wind turbine
- Membranes delivering >50% energy savings

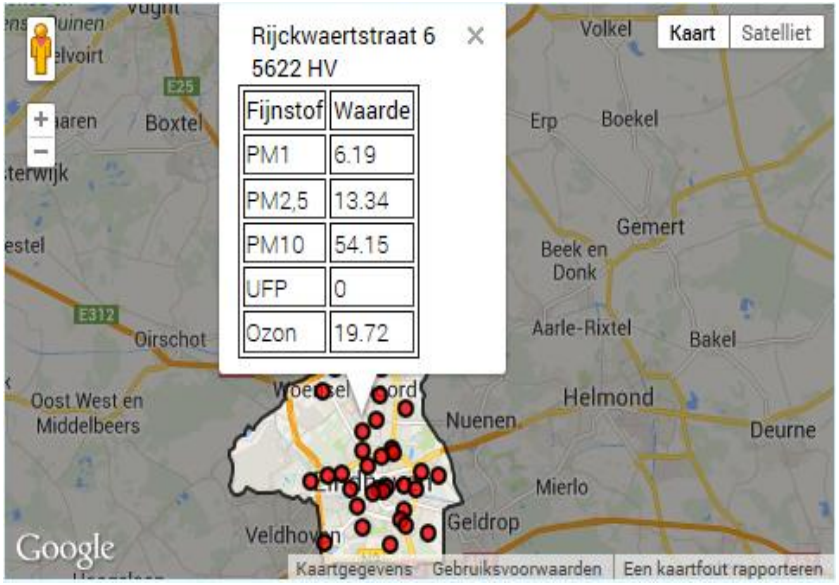



www.hybsi.com

# National & international collaboration

# Example: Air Quality Monitoring

## Real-time monitoring




www.aireas.com

## AiREAS / Innovative Air Monitoring

- $PM_1$-$PM_{2,5}$-$PM_{10}$ (30 locations)
- Ultra fine dust (6 locations)

AiREAS

Universiteit Utrecht
Institute for Risk Assessment Sciences
ECN
Provincie Noord-Brabant
EINDHOVEN
PHILIPS
Imtech
UNIVERSITEIT TWENTE.
ITC

# Example: Building integrated PV

- Focus on PV “from and beyond the module”
- Physical integration:
  - Building integration
  - Prefab solar roofs & facades
  - Integration into infrastructure
  - PV & greenhouses
  - Applications of flexible PV
- Electrical integration:
  - System design and performance optimisation
  - Concepts for high penetration
  - Performance monitoring
- Reliability and lifetime:
  - Materials and components for extreme conditions
  - Installation and maintenance

# Examples: Industrial Energy efficiency

- Liquid separation with membranes instead of or in combination with distillation


- Re-use of waste heat in industrial processes. Waste heat of 50-120 °C is upgraded to 200 °C.

- Energy efficient separation of liquids with HIDiC technology (Heat Integrated Distillation Column)

# Behavioural insights

- Raised interest in behavioural aspects of energy and climate solutions:
  - Public perception of energy technologies and innovation (e.g. shale gas, hydrogen)
  - Public attitudes towards institutions and policies;
  - Irrationality in human decision making

- Smart (healthy) cities: how to arrange the learning process to economies scale?

- Understanding the ‘human factor’? We can help.

# Co-creation: partner in energy-innovation

Collaboration & join forces

Realise concrete projects

Complementary assets

Trust and dialogue

# Obrigado pela sua atenção!
# Thank you for your attention!

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