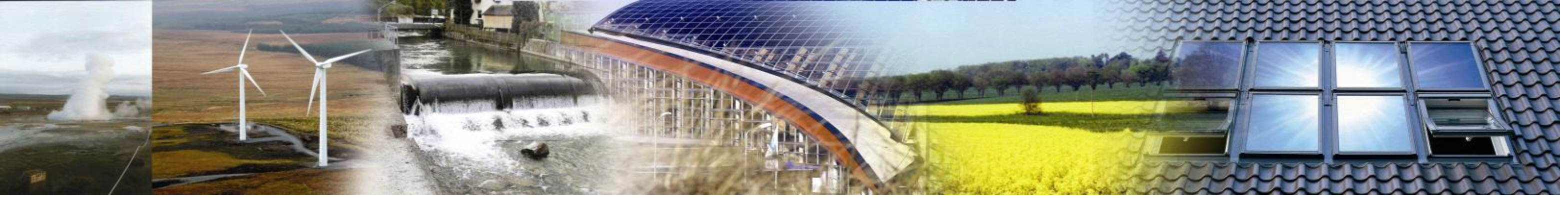


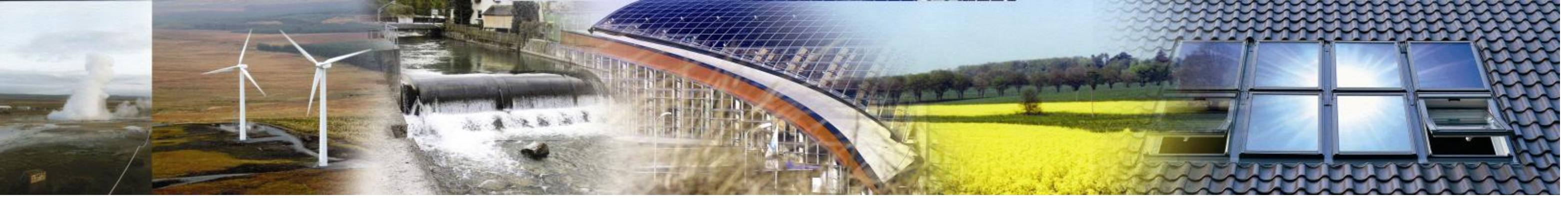
Implementation of NER300

- Boosting Innovative Renewable Energy Areas -

Josche Muth (Policy Adviser)

Rémi Gruet (Regulatory Affairs Adviser)

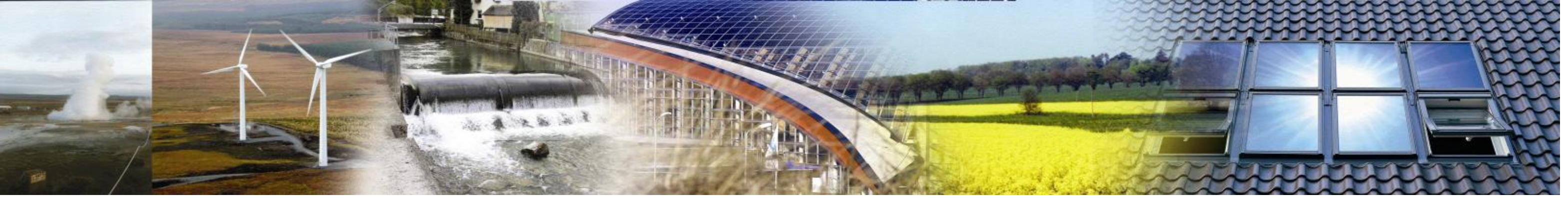
Stakeholder Meeting_Brussels_29th June 2009



EREC – European Renewable Energy Council

Umbrella organisation representing all RES sectors:

✓	**AEBIOM**	European Biomass Association
✓	**EBIO**	European Bioethanol Industry Association
✓	**EGEC**	European Geothermal Energy Council
✓	**EPIA**	European Photovoltaic Industry Association
✓	**ESHA**	European Small Hydropower Association
✓	**ESTIF**	European Solar Thermal Industry Federation
✓	**EUBIA**	European Biomass Industry Association
✓	**EWEA**	European Wind Energy Association
✓	**EUREC Agency**	European Renewable Energy Research Centres Agency
✓	**EU-OEA**	European Ocean Energy Association
✓	**EREF**	European Renewable Energy Federation
✓	**ESTELA**	European Solar Thermal Electricity Association
✓	**EBB**	European Biodiesel Board

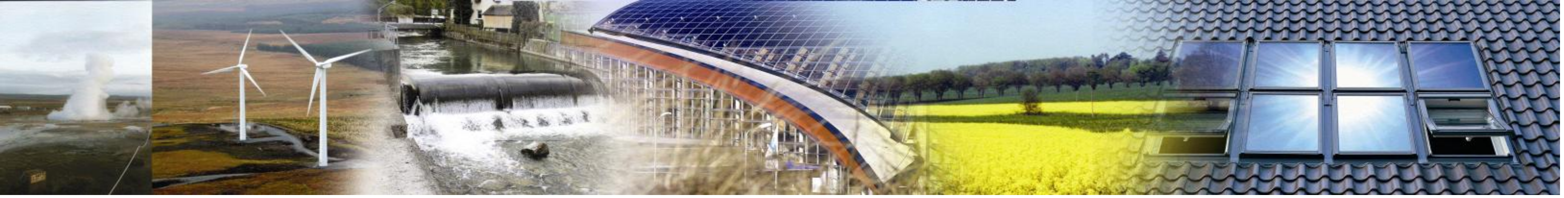


Outline

I. Presentation of Innovative Renewable Energy Areas

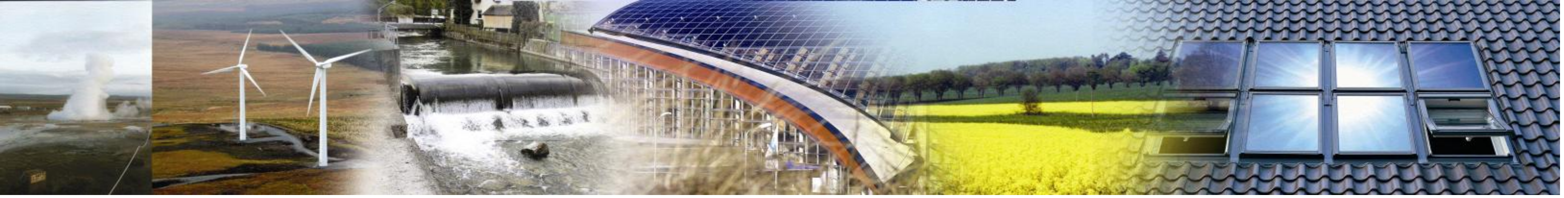
II. EREC's views on the NER300 Non-Paper

- Annex IAII : a good start in need of a good revision
  - Annex IAII should include upstream innovation
  - Scale of projects
  - (un)balance of funding allocation
- Going for upfront financing
- A claw-back clause is not needed
- Milestones during construction as a potential solution for early financing and compliance with Art 10a.8



Innovation Areas and Strategies

- 8 different sectors, each with a specific technology strategy
- All of the technologies presented below are innovative and should be included
  - EREC position paper, as well as sector-specific papers
  - All of them have been identified as priorities in the respective RE-sectors strategies for innovation
  - All have a strong replication/roll-out potential
  - All are at demonstration stage (pilot/research is done)
  - All will help reduce CO2 emissions, directly or indirectly
  - All will help achieve the 20%RES target by 2020



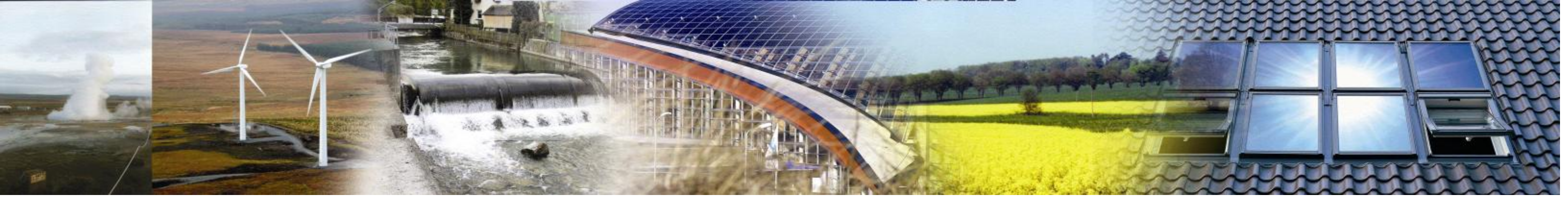
Innovative Biofuels Areas

- Cellulose to ethanol

Innovation: improved agricultural margins, reduction of cereal production costs and re-use of degraded land.
Objective: Pressure on land availability will be reduced significantly.

- Algae based biodiesel

Innovation: High oil and biomass yields, widespread availability
Objective:
Absence of competition for land resources,
High quality and versatility of by-products,
Suitability for wastewater treatments and other industrial plants.



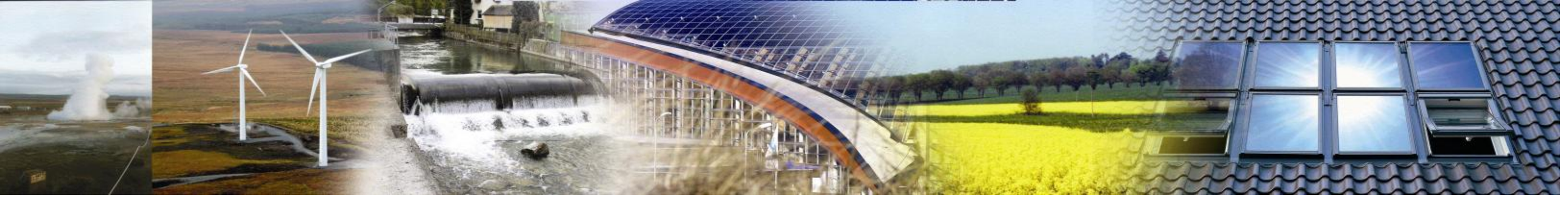
Innovative Biofuels Areas

- Jatropha based biodiesel

  Innovation:
  2^{nd} generation biodiesel from inedible vegetable oil
  Objective:
  contribute to local and rural development in underdeveloped countries,
  highly sustainable biodiesel

- Waste to biodiesel

  Innovation:
  GHG savings
  scaling up the collection of household/catering sector waste oils.
  geographical innovation (focus on Central and Eastern Europe for developments).



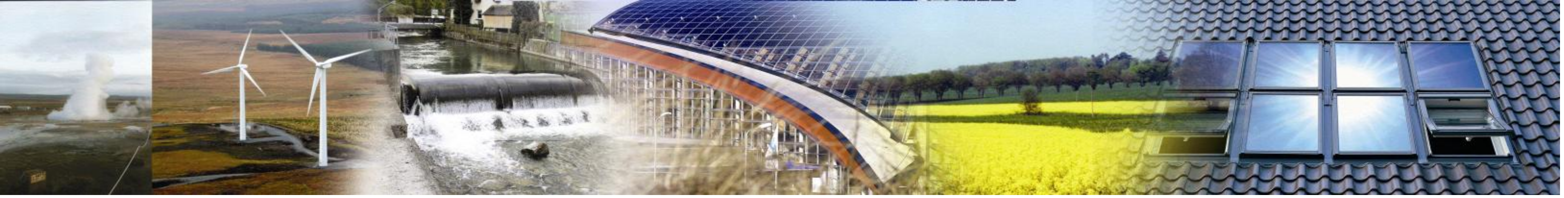
Innovative Biomass Areas

- Biorefineries

  Innovation: combined process which allows the use of otherwise unused waste or unused energy (for example, waste energy from conventional power plants).

- Biogas plants using waste or non-food energy crops

  New types of feedstock and/or feedstock management, or
  Improved anaerobic digestion process, or
  Improved use of energy produced (for example, improved use of heat as a by-product from electricity generation), or
  Better and cheaper upgrading technology to natural gas standards, or
  Biogas networks (for district heating or common upgrading facility.



Innovative Biomass Areas

- Microalgae production

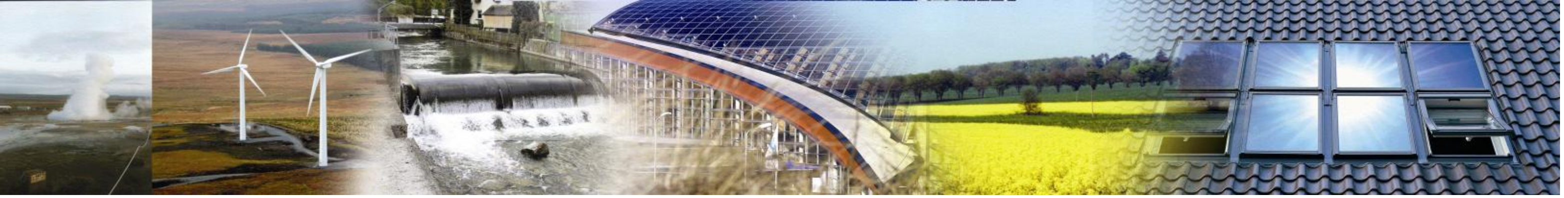
  Innovation: Algae production for bio-oil and thermal conversion using waste water.

- Combined biomass production and supply chain

  Innovation: Plantations of, for example, dedicated energy crops, to secure the raw material. Pellets and chips from it burnt in an innovative CHP (that can burn herbaceous plants) operated by municipalities and distributed to the final consumer.

- Gasification for power and CHP and polygeneration

  Innovation: higher conversion efficiency than conventional biomass plants.



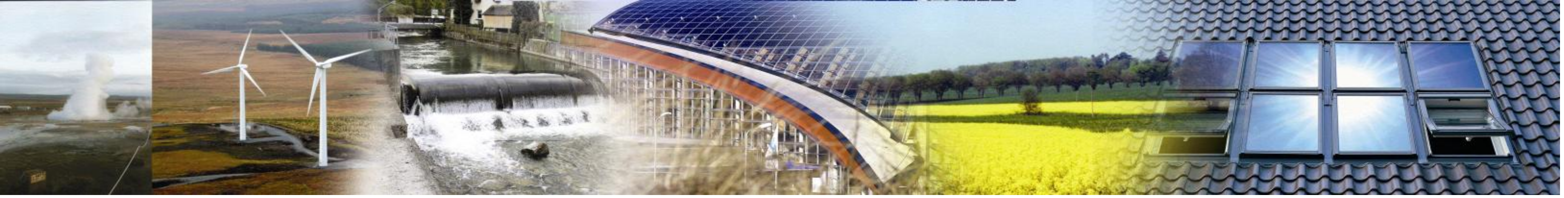
Innovative Biomass project types

- Gasification for syngas production

  Syngas production from lingno-cellulosic biomass
  Complementary development to the use of upgraded biogas as a vehicle fuel.
  Allows a higher yield per hectare than other liquid or gaseous transportation fuels.

- Agripellets production and use

  Agripellets contain more minerals than wood pellets from saw dust and they are not easy fuels to burn, therefore, innovation could be to improve combustion properties by additives and/or use them in specialized burners.



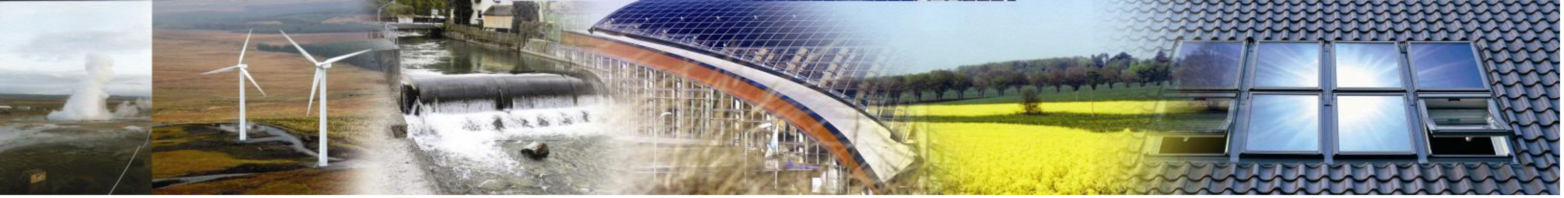
Innovative Geothermal Areas

- Enhanced Geothermal Systems (EGS)

  Create deep EGS heat exchangers independent of site conditions (geological and geographical); Upscaling EGS power plant size

- Low temperature electricity
  - Organic Rankine Cycle (ORC), or
  - Kalina Cycle

  Power generation from geothermal fluids at lower possible temperature, including hybrid solutions.



Innovative Ocean Energy Areas

- Wave Energy
  - Wave take off system

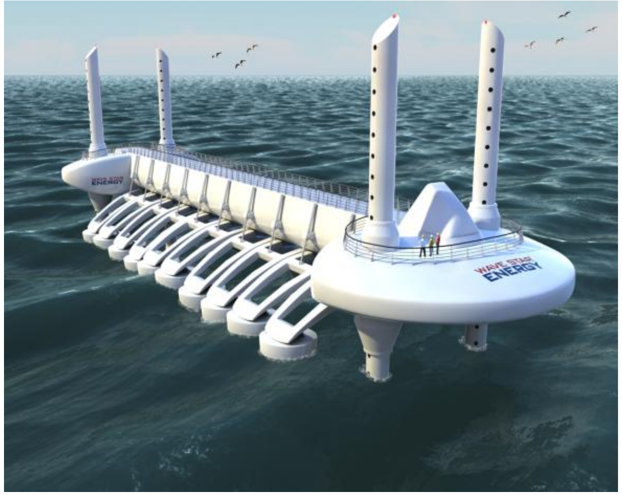
    Use of new materials (for mass scale production) and a totally new power conversion principle. A mooring new system design.

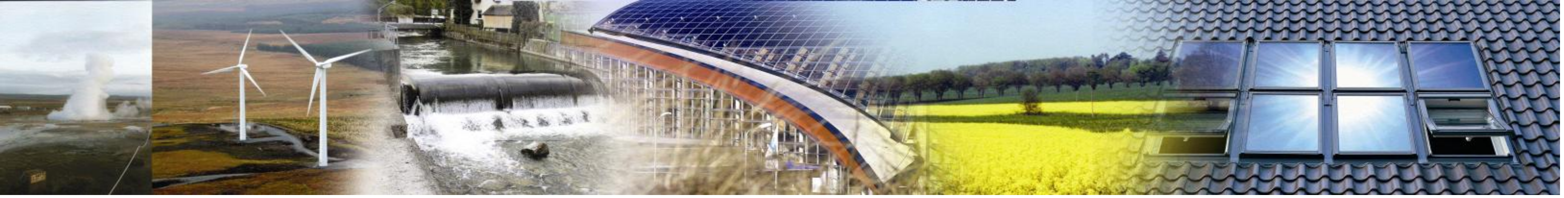
  - Wave structural anchors

    Novel advanced anchoring solution, of type to be drilled into seabed remotely.
    Low cost and high operability in a remote anchoring solution.

  - Wave structural materials

    Vertical movement converter in its final stage
    but not yet documented in the North Sea
    or the Atlantic

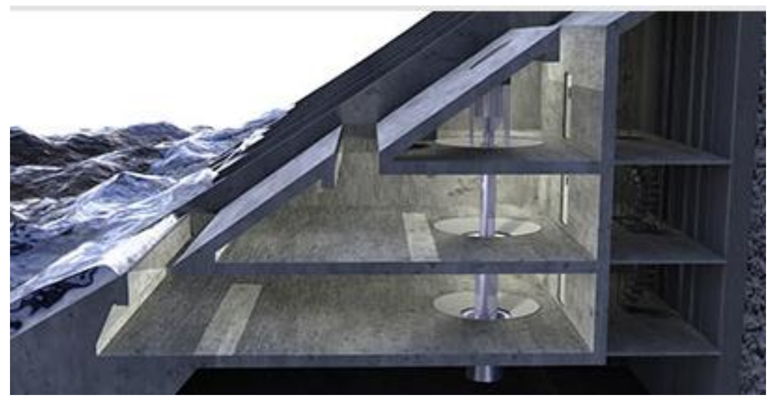




Innovative Ocean Energy Areas

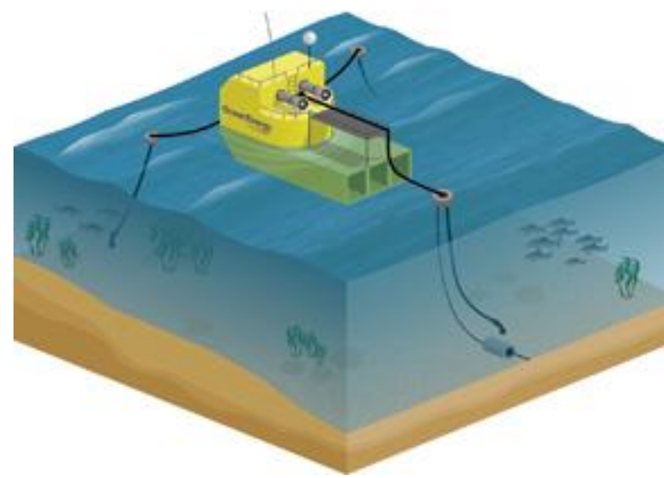
- Wave Energy
  - Wave structural design

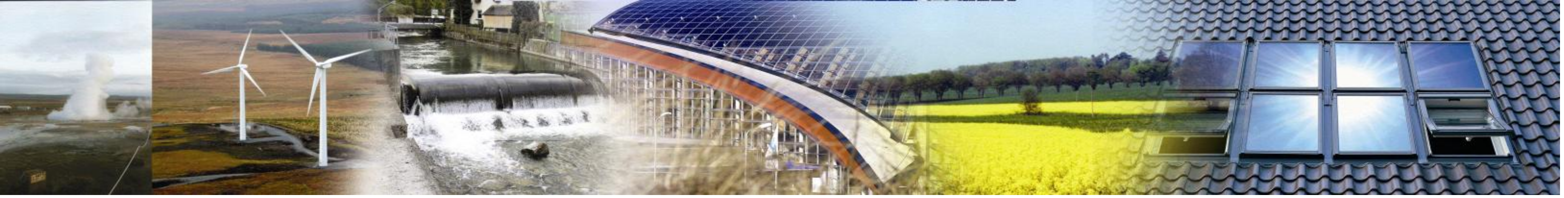
    Device implementation in breakwater structures



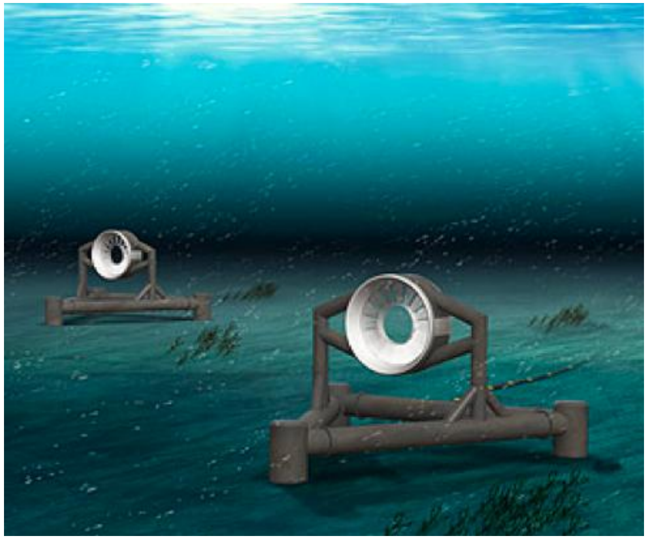
  - Wave upscale/commercial scale

    Large scale production of electricity from a floating Oscillating Water Column (OWC) device. Well proven in Shore based devices, but never in an open sea environment





Innovative Ocean Energy Areas



- Tidal Current Energy
  - Tidal Structural take off

    Novel designs for subsea power

    conversion and transmission systems
  - Tidal Structural anchors

    Challenge: nature of the useable locations and the

    extraordinary forces to be performed from the structures.

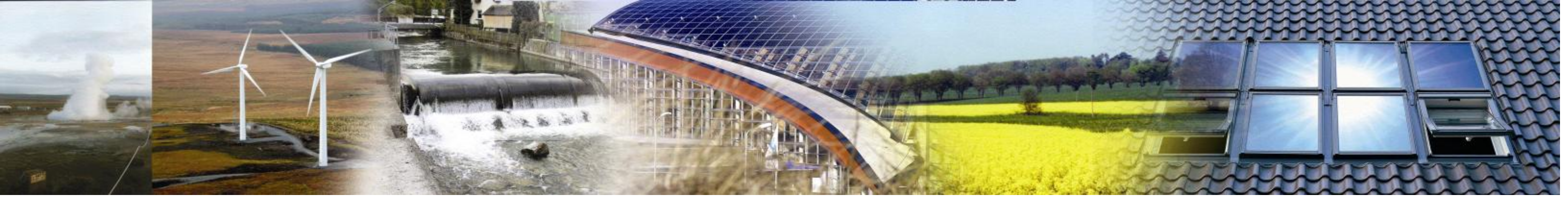
    Innovation: appropriate support structures, which

    minimizes the quantities and provides a liable and durable element.
  - Tidal maintenance

    Specialised vessel for maintenance which allows low cost operation procedures at

    minimum risk

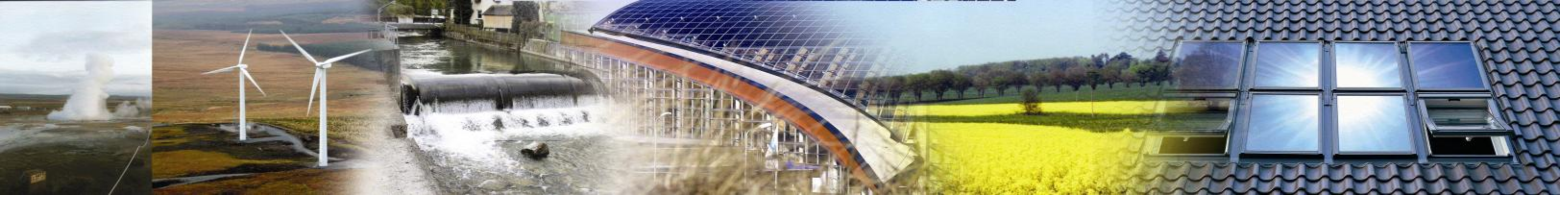
    No such equipment available on the offshore market to date



Innovative Ocean Energy Areas

- Hybrid wind-wave floating offshore structure
- Full-scale testing and interconnection

  Innovative techniques for placing devices in tidal streams or wave conditions which will allow developers to collect data which is paramount to their devices reaching full scale production stage.



Innovative Photovoltaic Areas

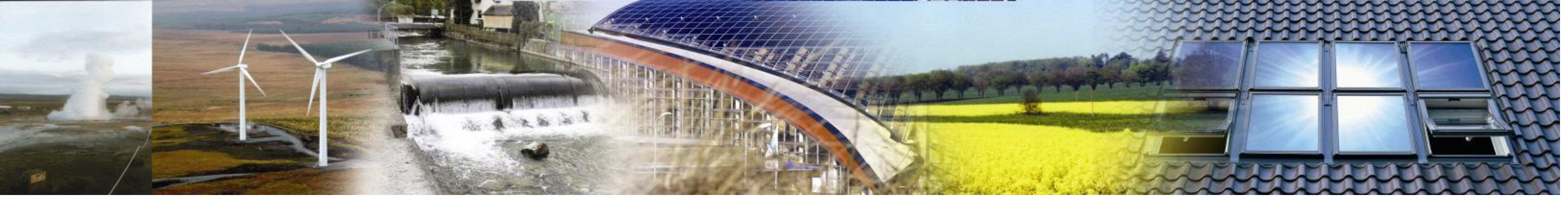
- Technology enablers
  - Improved manufacturing of cells and modules
  - Crystalline Silicon (c-Si)

    New wafer and cell processing reduces material losses (e.g. new wiring saw). New cell designs will help to reduce material usage (thinner cells) and increase efficiency.

  - Thin Films (including CIGS, silicon Thin films and CdTe)

    New concepts need to be designed in order to allow faster deposition rates onto much larger areas.

    New or improved Transparent Conductive oxide (TCO) layers, more stable and with a higher quality, are to be developed in order to obtain the required efficiency increase.



Innovative Photovoltaic Areas

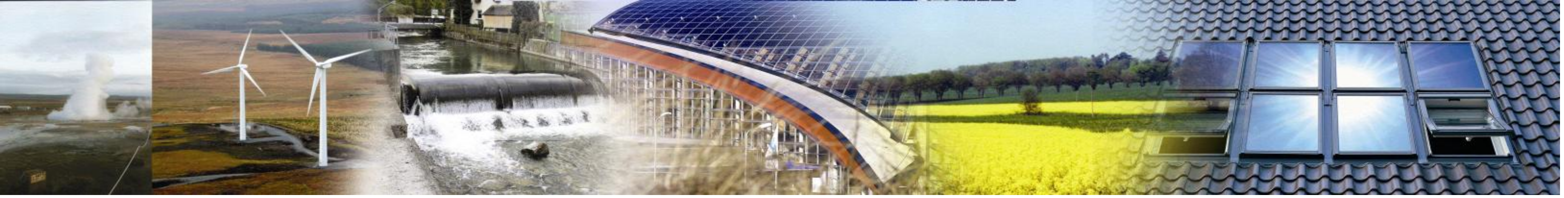
– Concentrated PV (CPV)

Higher optical efficiencies, at a lower cost and presenting stable long term reliability.

CPV, Photo credits: Isofoton

- Material development for encapsulation and interconnection

  The development of new low-cost materials with long lifetimes and easy module-integration features will provide much longer PV module lifetime, thus reducing significantly its Energy pay back time (EPBT) and therefore the PV Generation cost.



Innovative Photovoltaic Areas

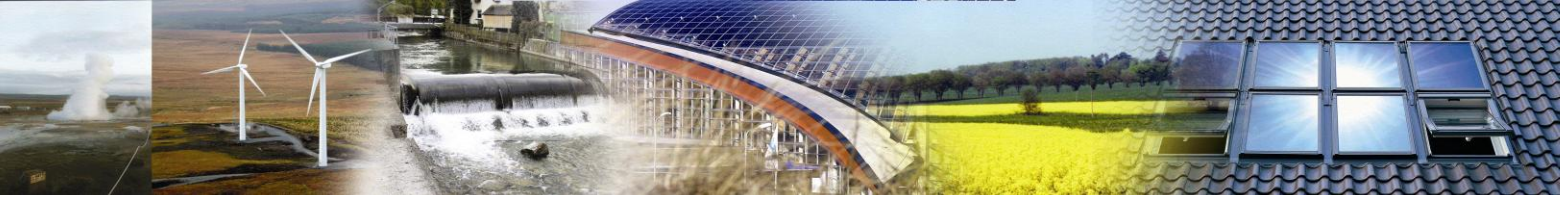
- Power generation and demonstration power plants
  - Large PV power plants

    Emerging PV technologies such as CPV, CIGS, silicon Thin Films, presenting limited field experience up to now, will be demonstrated at a large scale.

  - Building integrated PV (BIPV)

    Innovative installations methods needed to significantly reduce the cost of BIPV projects (in which the building material is replaced by transparent PV modules, PV-roof tiles, flexible PV membranes, etc.).

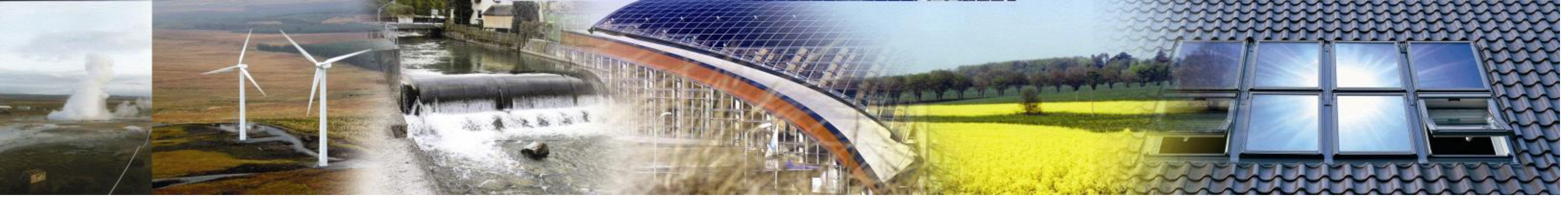
    Solutions need to be found in order to mitigate high module temperatures, and design more adaptable and flexible modules in order to fulfill requests from architects and building related regulators.



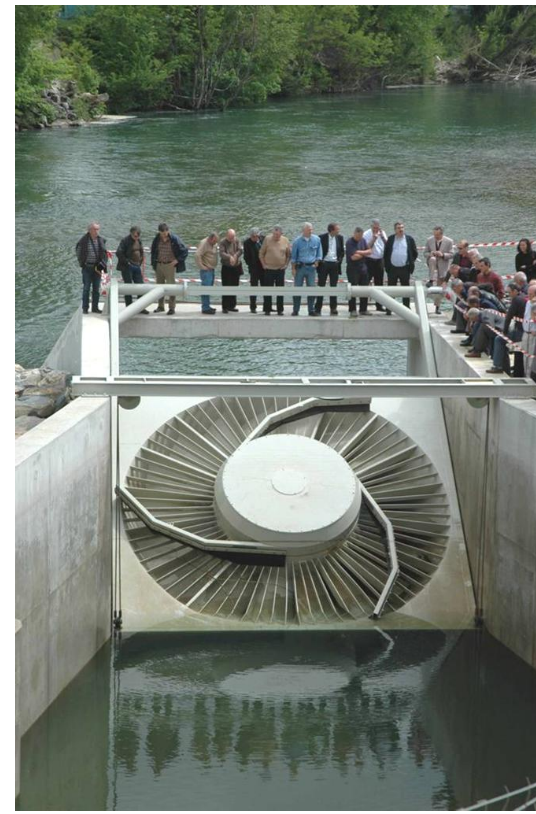
Innovative Photovoltaic Areas

– Distributed PV power generation

  Demonstrate the feasibility of a large deployment of PV at the level of a region/city and optimize its impact on the electricity networks



Innovative Small Hydropower Areas

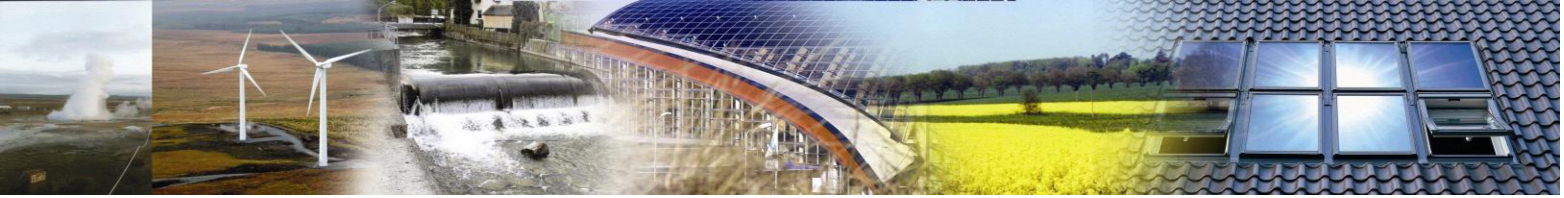


- Hydro pumped storage

    Retrofit high altitude reservoirs used for artificial snow making for ski slopes for dispatchable electricity production. Design of a new type of turbine for small pumped storage.

- New environmentally and fish friendly technological solutions (e.g. VLH)

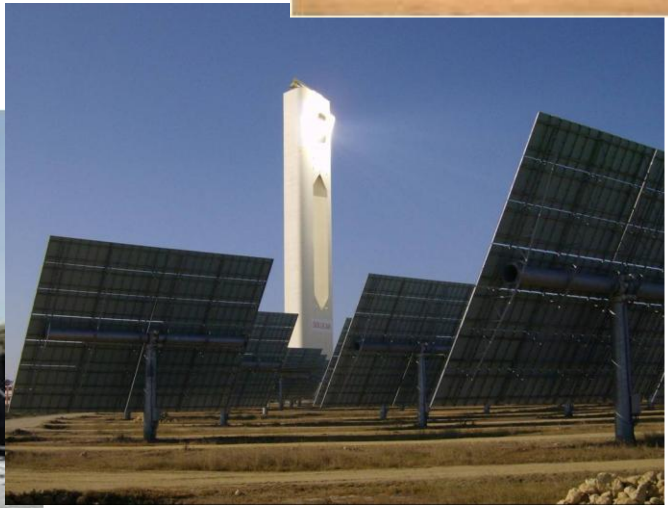
    VLH designed specifically for very low head sites.
    Fish friendliness allowing salmons migrating downstream. Very low mortality rate of eels (up to 95 % rate of survival).
    Installed in existing sites (old mills, weirs, abandoned power plants) under water with no visual impact, noise or vibration.

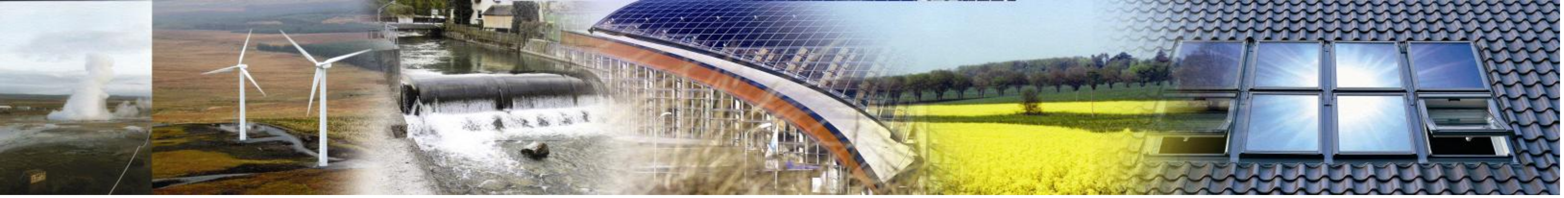


Innovative Solar Thermal Electricity Areas

4 Main Technologies

- Parabolic Trough Plants
- Central Receiver Plants (Tower Plants)
- Linear Fresnel Systems
- Dish Stirling Systems





Innovative Solar Thermal Electricity Areas

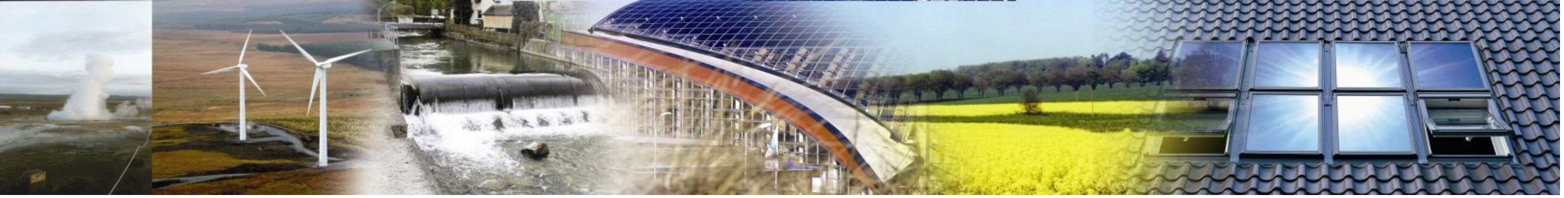
- Parabolic Trough Power Plants: Improvements on components

  Might provide substantial investment reduction and/or performance increase to be able to reduce the cost of electricity around 10% in a first step.

- Hybrid Combined Cycle power plant with biomass and Parabolic Trough solar field

  Innovation: The concept itself.

  Storage and dry cooling system can be implemented.



Innovative Solar Thermal Electricity Areas

- Direct Steam Generation for line concentrating solar collectors

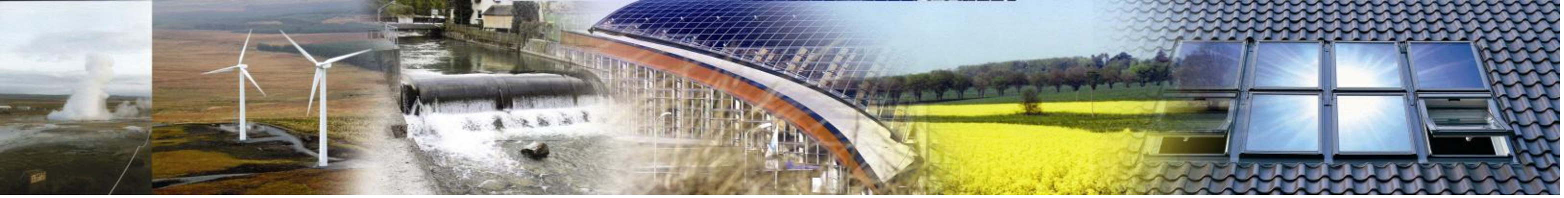
  Innovation: Increase the direct solar steam temperature from today's 400ºC to 500ºC

- Pressurized Air Central Receivers for a solar powered combined cycle High Temperature Pressurised Air

  Innovation: Develop a commercial scale pressurized air receiver and adapt a commercial gas turbine to accept the pressurized air from this receiver

- High Temperature Steam Generation in solar Central Receiver Plants

  Innovation: Develop a commercial scale superheating section for central receiver systems, to generate steam above 100bar pressure and 540ºC.



Innovative Solar Thermal Electricity Areas

- Compact Linear Fresnel Reflector plant: developing large scale plants and DSG

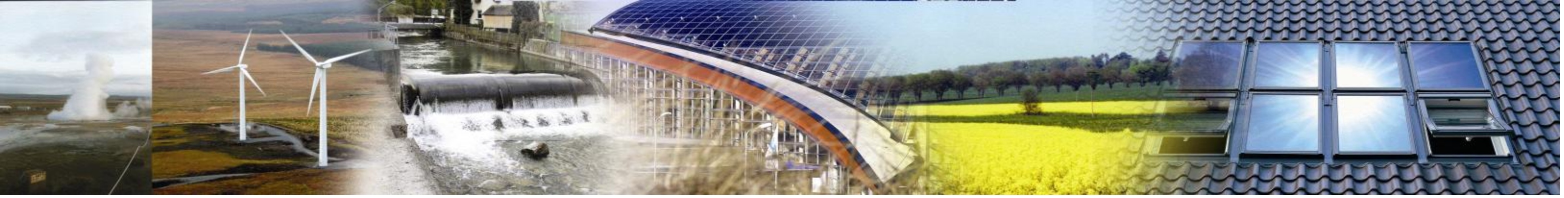
  Innovation: The concept itself at a large scale size as well as the Direct Steam Generation process undertaken.

- Cost Effective and dual fuelled Stirling Parabolic Dish

  The main challenge is to reduce the overall cost, figure out optimised layouts and to get dispatchable power using a hybrid Stirling engine while maintaining the already highest solar to electric efficiency.

- Dual electricity-water plant

  Innovation: The dual concept itself as decoupled concepts as i.e. reverse osmosis systems could be easily fed by the electricity produced by a solar power plant.

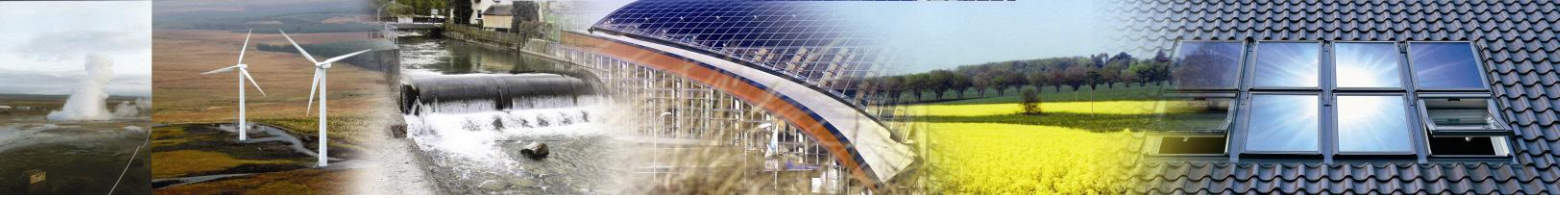


ERCE

Innovative Wind Energy Areas

Offshore Wind systems of greater capacity

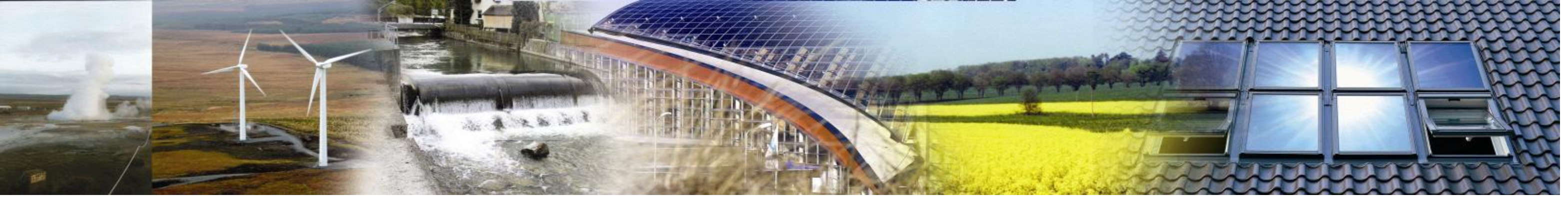
- State-of-the-Art:
  - 3 MW to 3.6 MW turbines
- Recent developments: 5 MW
- Innovation in timeframe of NER:
  - ≥ 6 MW turbines
- Objective :
  - Harvest more, stronger,
  - more stable winds



EREC

Offshore Specific Turbines

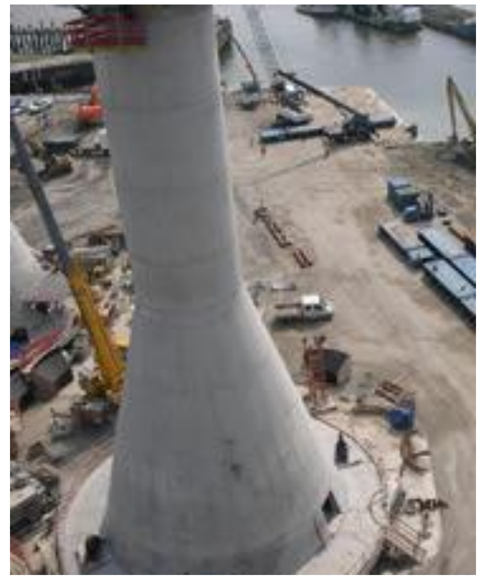
- State-of-the-art:
  - Onshore turbines used offshore
- Objectives
  - Address offshore-specific stresses, i.e. corrosion, insulation, waves and wind combined loads
  - Improve reliability, availability
- Innovation examples
  - Design for static and dynamic loads
  - Direct-drive turbines
  - Doubled systems
  - External air generator cooling

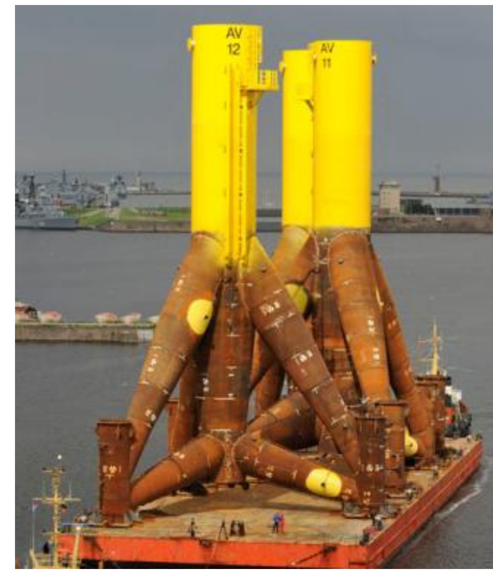


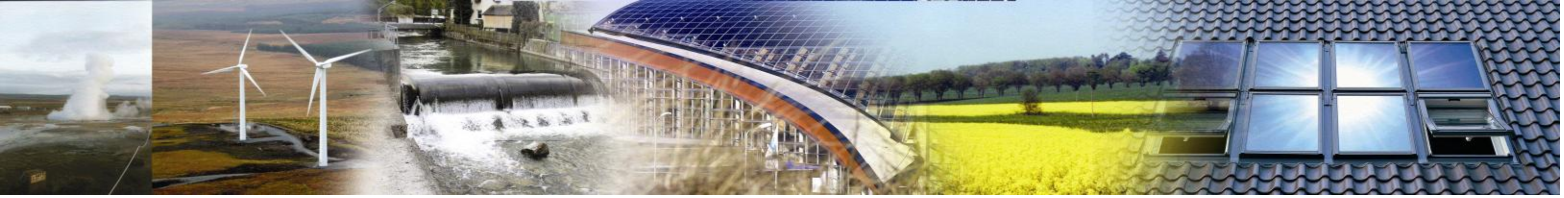
EREC

Substructures for deeper waters

- State-of-the-Art: monopile
- Innovation: 20-50m depth
  - Gravity based
  - Jackets
  - Tripods
- Objective of innovation:
  - Farms in deeper waters
  - Further from shore (visual acceptance)
  - Steep continental shelf
  - Reduce costs, stackability, standardisation







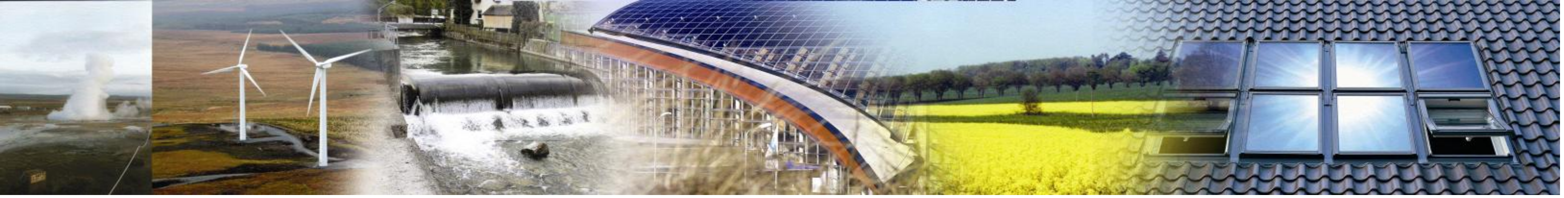
Floating turbines

Objective: Deeper waters, past the 50m barrier

Anchored Platform

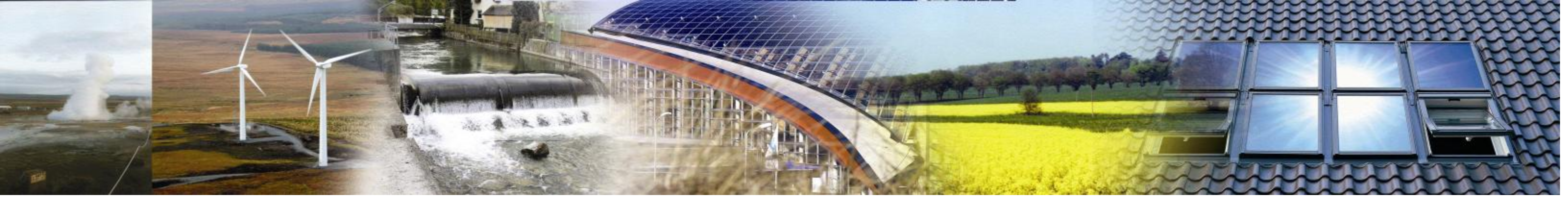
Anchored no platform

Tension-leg Platform



Complex terrain and extreme conditions

- Comprises
  - Mountainous areas
  - Forested areas
  - Cold climates
- Objective:
  - open new markets,
  - reach new wind ressources e.g. use in nordic countries
- Innovation
  - specific turbine designs

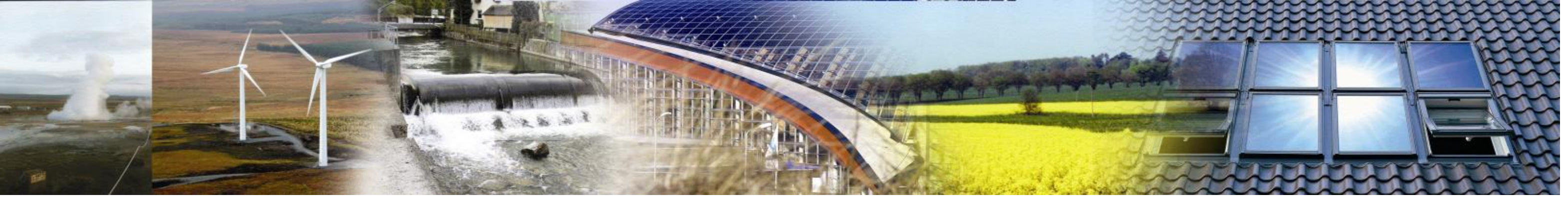


EREC

Upstream innovations

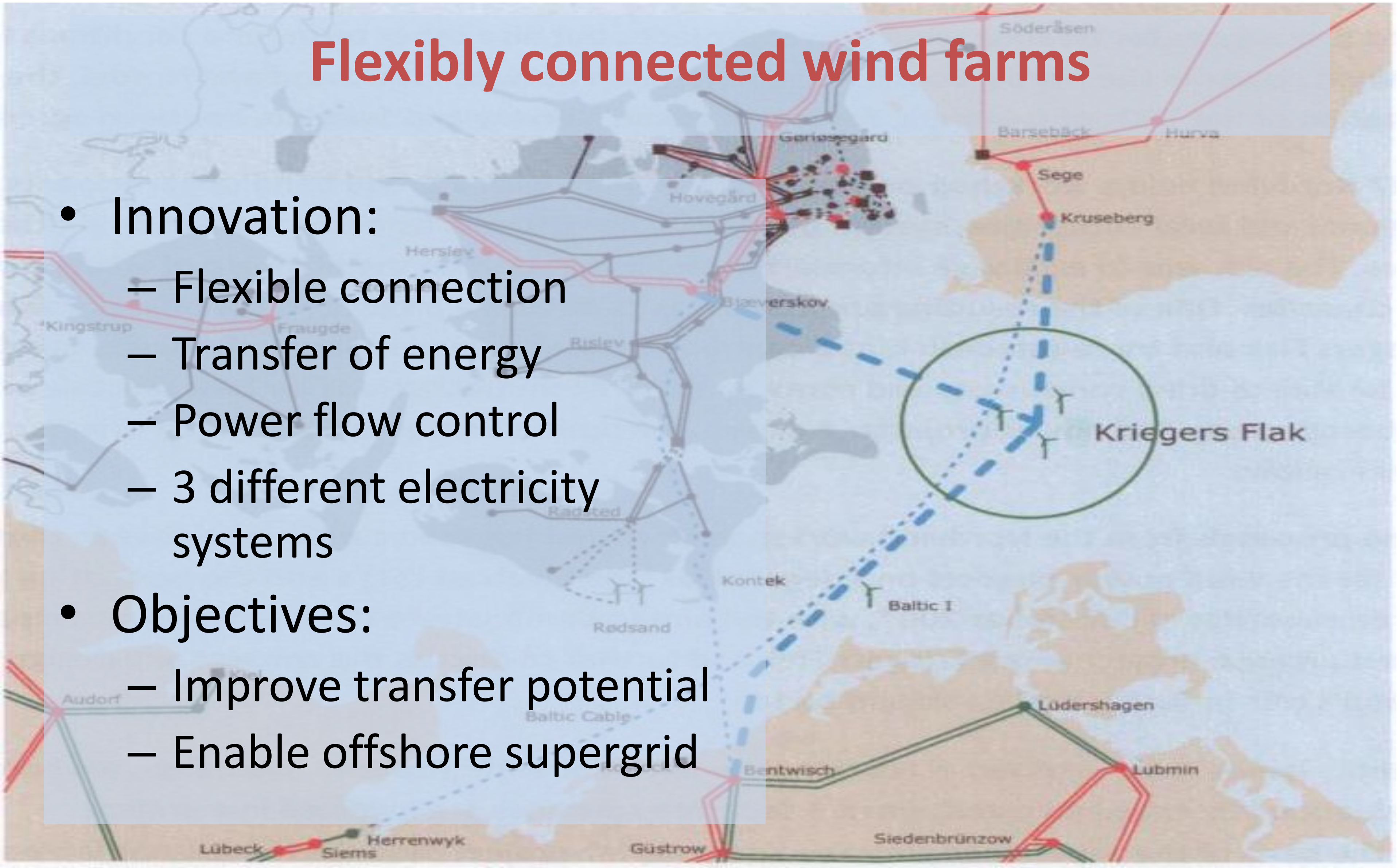
- **Installation and operation systems**
  - Installation Vessels
    - Deeper sea jack-up barges
    - Improve installation speed through more carriage
    - Reduce costs
  - Offshore access systems

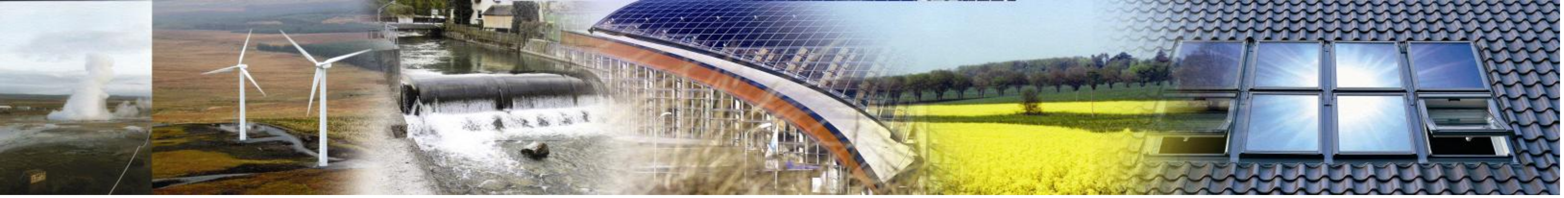
- **Robotised manufacturing**
  - Improve productivity, reduce costs, standardise products



Flexibly connected wind farms

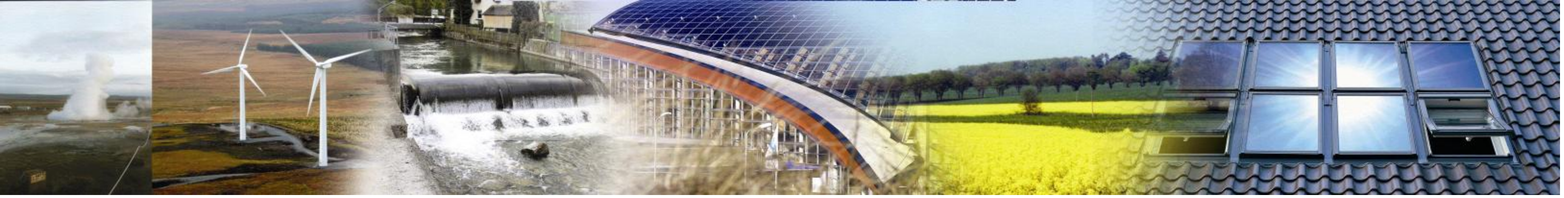
- Innovation:
  - Flexible connection
  - Transfer of energy
  - Power flow control
  - 3 different electricity systems
- Objectives:
  - Improve transfer potential
  - Enable offshore supergrid





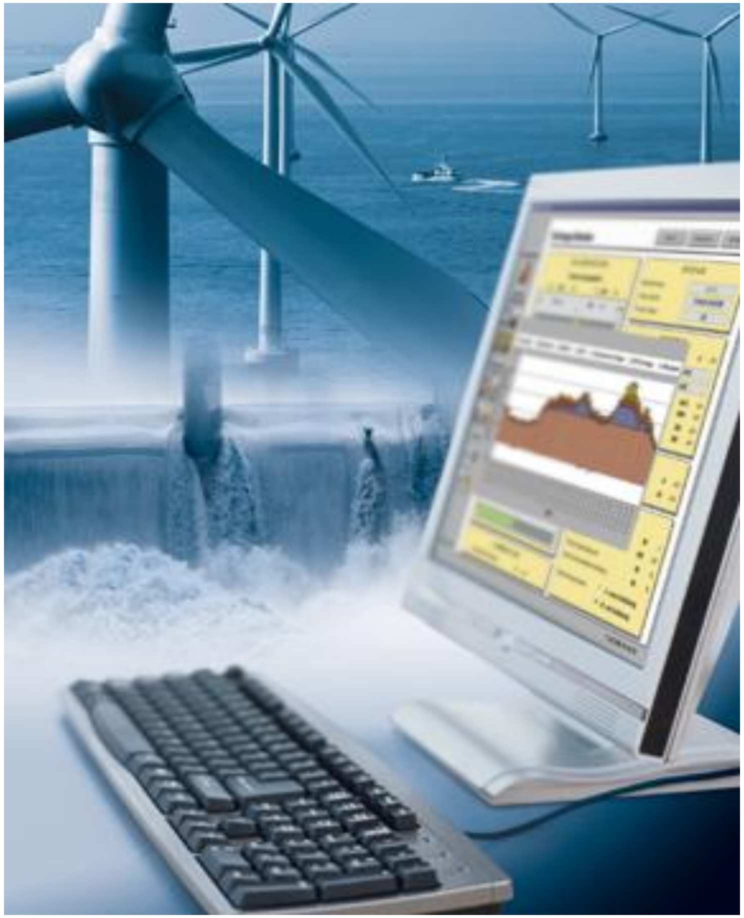
HVDC multi-terminal offshore solutions

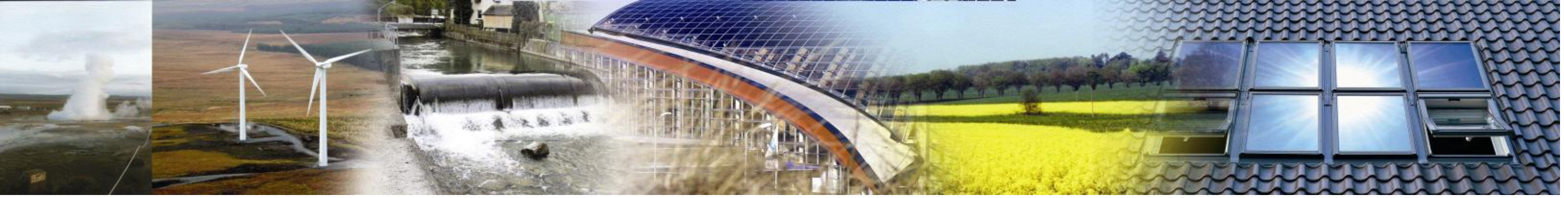
- State-of-the-art: HVAC connected to shore
- Innovation: HVDC-VSC
- Objective:
  - Reduce costs over long distances
  - Enable « plugging » of offshore wind farms directly on HVDC lines
  - Trading between markets



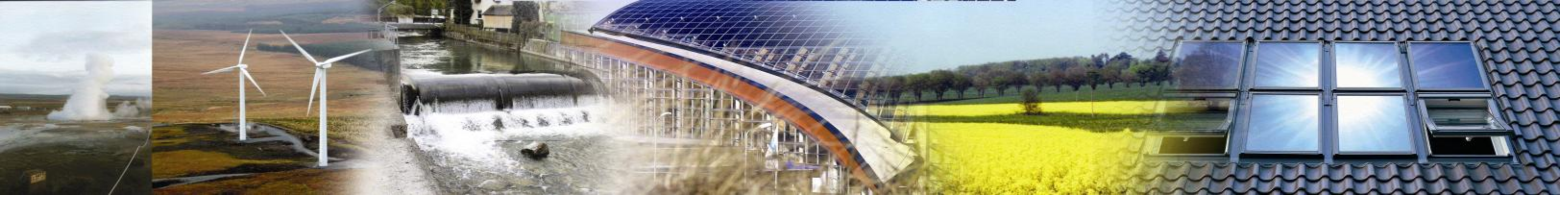
System operations / Virtual Power Plants

- IT Technology:
  - Clusters of turbines/REs linked together
- Objectives:
  - More accurate prediction of production
  - Increase grid-integration
  - Streamline operation



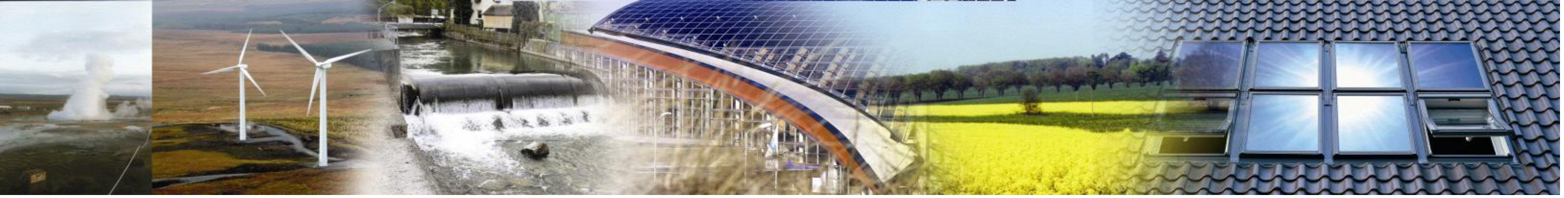


Opinions and possible solutions EREC on the Draft-paper



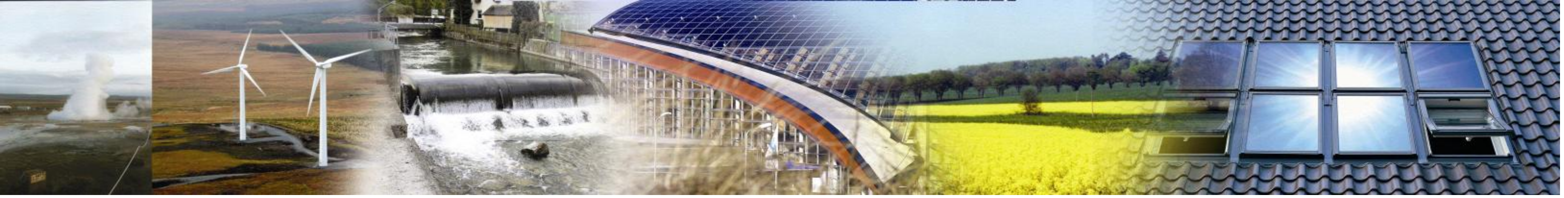
Annex I A II: a good start in need of a good revision

- The positive list has turned into a restrictive list
- Some areas with good potential are not included
- Some areas in the list are unrealistic:
  - 20MW turbines will not be at prototype stage by 2014
- EREC believes that all categories present in its position paper, should be included.



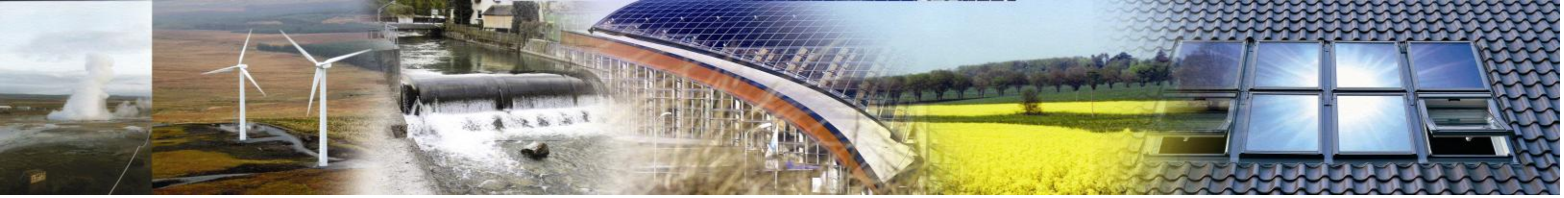
Annex IAII should include upstream innovation

- Upstream innovation is completely absent
- Bottlenecks are often upstream in processes
- Due to always evolving technologies, there is a need for new upstream capacity
- Production or installation of more and newer products will result in more CO_2 savings, earlier in time
- As such, EREC considers that upstream innovation does comply with “verified avoidance of CO_2-emission”
- Including these categories or not is a political decision not a legal one



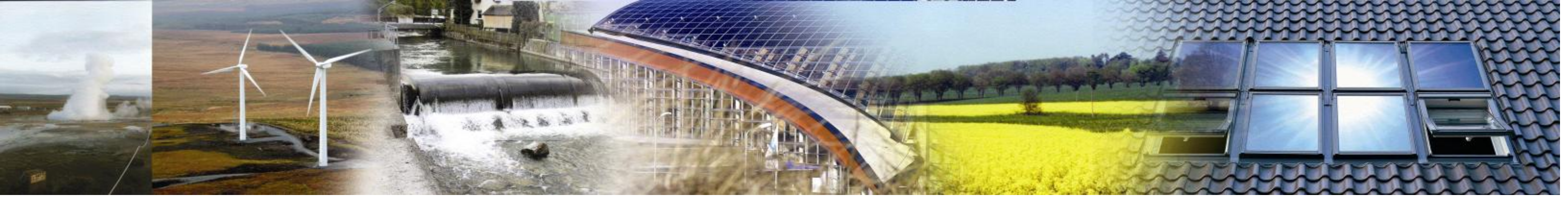
Scale of projects should stay indicative

- Demonstration has 2 objectives:
  - Proving a technology works reliably at large scale
  - Help bring that technology to market prices
- Inherent difference between CCS and REs:
  - For CCS, the first point might be more relevant
  - For innovative Renewables the second is
- Size of projects as indicated in Annex IAII should be
  - An indicative threshold, but
  - not a target to be reached by project developers and
  - not a criteria for value for money



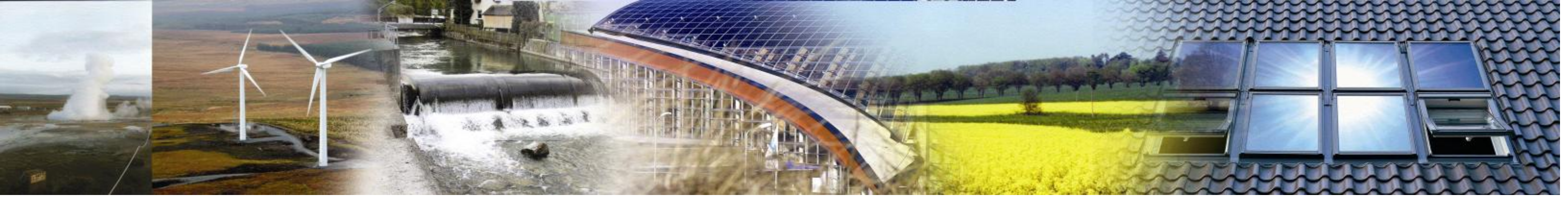
(un)balance of funding allocation

- REs should get more than 50% of the funding
  - REs are not one sector, but 8 sectors with each a number of innovative technologies
  - REs have a proven track record of avoiding emissions
  - NER-funds will help achieve 2020 RES targets
- In its current state, Annex IAII could mean a 20%-80% “ex-post” split in favour of CCS, mainly because of
  - Project categories
  - MW/Size of RE projects listed
- EREC still considers that an ex-ante split is the best way to ensure that each technology gets reasonable funding



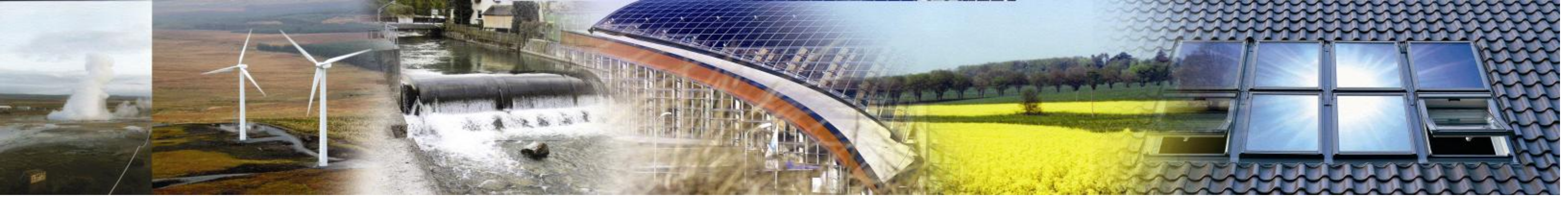
Going for upfront financing

- 3 main reasons:
  - REs are generally capital intensive
  - Funding is needed during construction phase, not during operation
  - Upfront financing helps bring onboard additional private investments (esp. in current financial crisis)



No “claw-back” clause needed

- Financing innovation presents inherent risks
  - The investor is supporting 50% of the risk
  - The EU should be willing to do the same
  - The selection process (the call) will ensure that too hasardous projects are discarded
- Claw-back clauses jeopardise the whole company
  - NER-money will be spend during construction phase
  - Reclaiming money already spent will jeopardise the company (not only the project)
- « The EU-way of financing Innovation » (FP6-7)
  - 50% of investment, no claw-back
  - Grants made available as money is being spent



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Milestones as potential solution

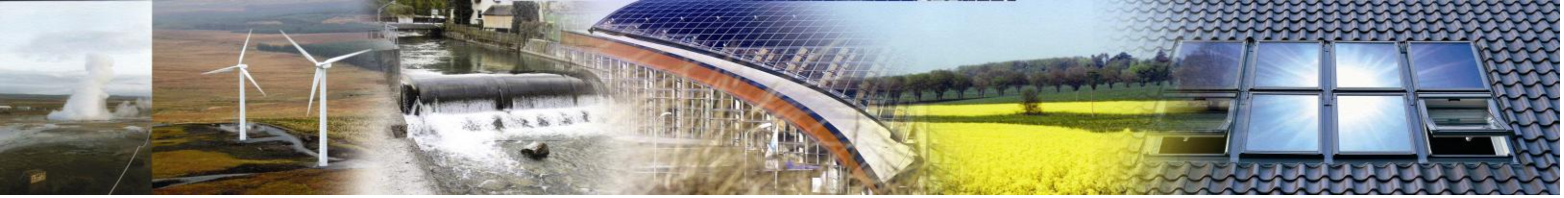
Milestones, can ensure proper disbursement of public money, but only if set during construction phase for RE

Fundamental difference between CCS and REs regarding emissions:

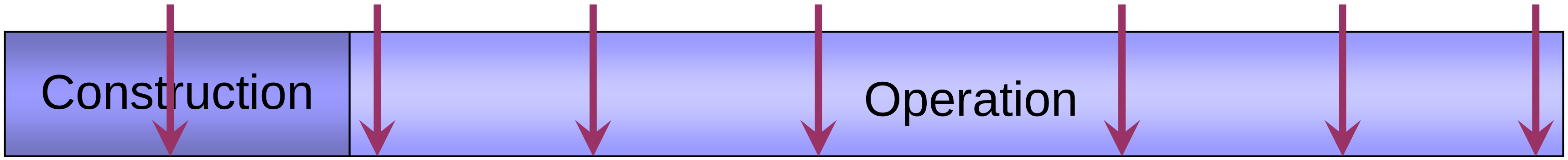
- Coal *can* store emissions with CCS
- CCS can be « turned off »
- An incentive must be provided for CCS to stay on during operation
- Revenue for CCS is linked to electricity production, not to CO2-avoidance

- REs *always avoid* emissions
- REs developper always aim at generating as much electricity as possible, hence avoid as many emissions as possible
- Revenue for REs is directly linked to electricity production ***and*** CO2-avoidance

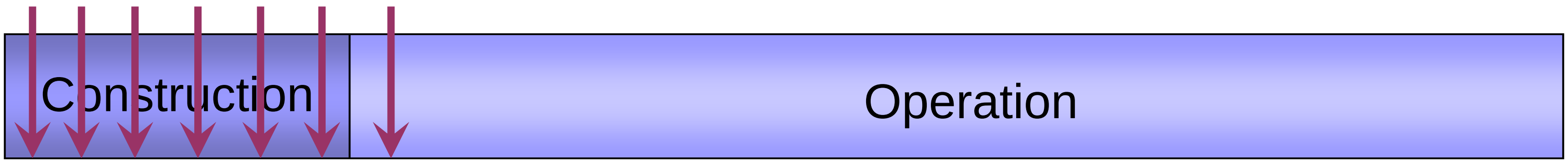
Setting milestones during project operation for REs is not useful
A last milestone after start of operation can validate the CO2-avoidance



Setting Milestones for REs

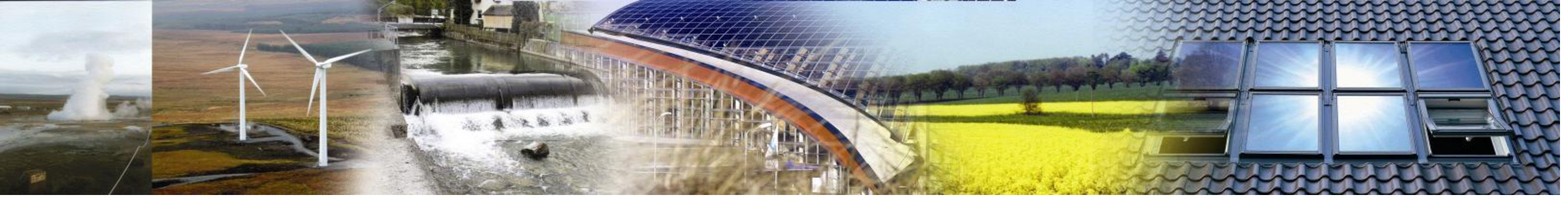


Process for CCS



Process for Renewables

- Milestones are set during
  - Both Construction and Operation phase for CCS
  - Construction phase for RES
  - Final milestone for RES after start of operation
- Milestones
  - Validate construction spending *and*
  - Avoid the need for a claw-back clause



Conclusion

- Annex I A II needs revision along the lines described earlier
- Above 50% of the funding should go to RES
- NER funding should be provided through upfront finance, possibly with the help of milestones

Thank you for your time!