FREED

Funding Resources for Innovation in Energy Enterprise Development

Energy Innovation Needs Report

WP 3: D3.3.1

November 2016

Western Development Commission

Northern Periphery and Arctic Programme 2014–2020

EUROPEAN UNION

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About FREED

FREED (Funding Resources for Innovation in Energy Enterprise Development) is a three year project funded under Interreg's Northern Periphery and Arctic Programme.

The Project will provide SME's in the programme area with the support network required to introduce and develop energy innovations which would otherwise be unavailable to them.

FREED's five step process will:

- Carry out a needs analysis of the types of energy innovations required in the partner region
- Initiate a tender process to generate the necessary technology innovations
- Partner R&D institutions with SME's from the region
- Develop business plans to assist the SME's in delivering the innovation in the region
- Provide a financing service that utilises private investment funds to aid the development of the innovations

The project, which is led by the University of Oulu in Finland, is a collaborative partnership involving private investment firms, R&D institutions, colleges of education and public bodies from Scotland, Northern Ireland, Norway, The United Kingdom, Germany and Ireland.

1 Introduction

Overview

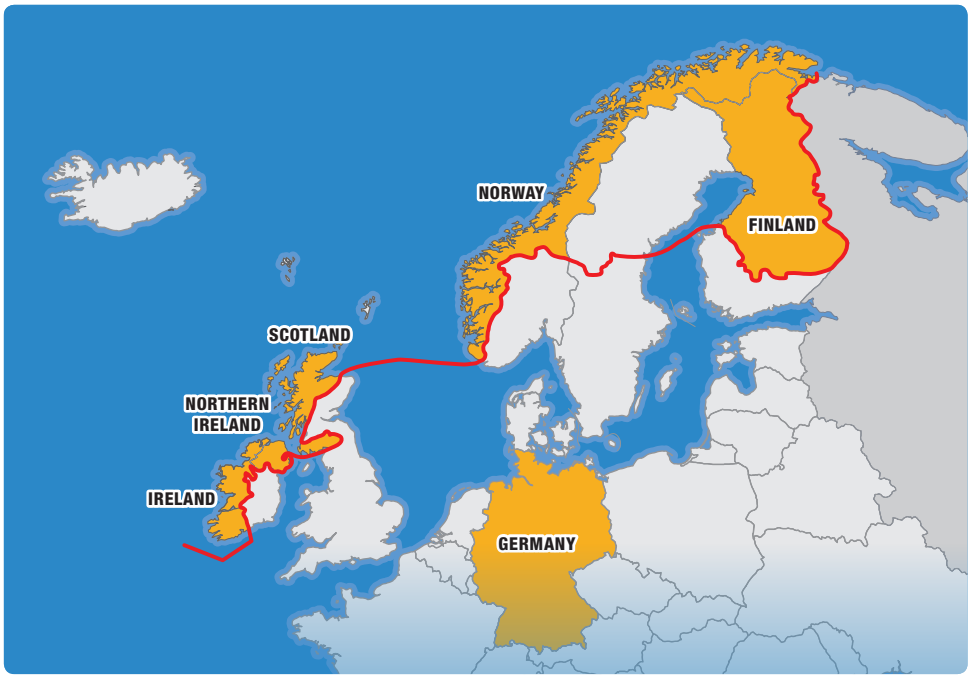
Work Package 3: This work package aims to uncover the energy innovation needs of the specific NPA areas ie: Finland, Norway, Ireland, Northern Ireland and Scotland. In consultation with existing innovation agencies and programmes, as well as regional or local development agencies, FREED will identify what needs exist for innovation in energy, and how these are prioritised. The public sector will be interviewed regarding needs in energy improvement in educational institutes, health care and environmental services, administrative buildings, etc. The retail and commercial sectors will also be consulted to establish what requirements are not currently met for the pursuit of their trade. The analysis will include a hierarchy of need for innovations in energy that provides priorities by market sector, as well as a definition of the scale of need.

Purpose of report

This summary report presents the key findings of research conducted by the FREED partners to assess the energy innovation needs of their regions. The results are then utilised to identify the shared energy innovation needs in the project area.

Specifically the regions examined are:

- Ireland
- Finland
- Northern Ireland
- The Highland and Islands of Scotland
- Norway



NPA programme area and participating countries in the FREED project.

2 Energy Innovation Needs by Market Sector (WDC & LIT) Ireland

The Western Development Commission (WDC) and Limerick Institute of Technology (LIT) consulted with a wide range of organisations and stakeholders in both the public and private sector to determine the innovation needs of the region.

The organisations consulted in the FREED programme for WP3, Activity 3.3 are as follows:

National and Local Government: Local Authorities in Mayo, Sligo, Leitrim, Donegal, Clare and Galway and Tipperary.

Energy Agencies: Galway Energy Agency, Mayo Energy Agency, The Sustainable Energy Authority of Ireland (SEAI), Tipperary Energy Agency, Kerry Energy Agency, Energy Cork and Aramark.

Economic Development Agencies: Enterprise Ireland, Local Enterprise Offices, WDC Investment Fund, and Udaras na Gaeltachta.

Educational Institutes: Sligo Institute of Technology (IT Sligo), Galway Mayo Institute of Technology (GMIT), The National University of Ireland Galway (NUIG), Letterkenny Institute of Technology (LYIT), Cork Institute of Technology (CIT), Limerick Institute of Technology (LIT), Tralee Institute of Technology, Mary Immaculate College Limerick and additional second level colleges in the region.

Community Energy Groups: Claremorris & Western District Energy Co-Op, Aran Islands Energy Co-Op.

Chambers of Commerce: representing the retail and business community, Questum Acceleration Centre Clonmel, LIDL, Dunnes Stores and IDA Property.

Health & Leisure: Facilities managers in hospitals (including South Tipperary General Hospital, Nenagh General Hospital) & leisure centres (Active Ennis Leisure Complex).

Environmental: Clonmel Wastewater Treatment Plant.

Public Buildings: Clare County Council Offices Ennis and Ennis Museum.

Residential: Energy Agencies.

Other Organisations and NPA Projects involved in energy innovation: The Marine Institute, The Office of Public Works, Environmental Protection Agency, GREBE Project, SECURE Project.

In the private sector, the Western Development Commission (WDC) and Limerick Institute of Technology (LIT) consulted with a number of SME's involved in technology development across the region as well as economic development agencies assisting start up's and SME's in the energy innovation space.

In terms of innovation needs – a common problem experienced is a lack of understanding of actual energy used on-site, very few sites have a real time monitoring and recording system in place. There appears to be a low level of awareness of the different energy technologies and also a low level of awareness of financial and other impacts of energy solutions generally. Technical issues regarding integration with the grid need to be solved and the relatively high cost of some technologies is impacting on largescale roll out and is not helped by a scarcity of energy storage options (on macro and micro levels). The lack of feed-in-tariffs also impacts on the development of the sector.

Although not directly related to innovation, increased energy efficiency and decarbonisation of remaining energy usage is a notable priority highlighted by all of those interviewed. Development of supports for start-ups and SME'S involved in energy innovation including networking opportunities and clusters of expertise is also seen as a priority. On a positive note, there is significant ongoing interaction between indigenous research institutes and both large companies and SMEs which will lead to the continued development and commercialization of new energy solutions.

Arising from the interviews the most notable Energy Innovation Needs are:

Energy Distribution

- Smart mart meters/ smart distribution/ ICT solutions to encourage monitoring and recording of energy use linked to behaviour and environmental conditions for individuals and communities
- Affordable (BMS) building management systems with more controls
- Real time data measurement and controls/ strategic metering, sub metering and data analysis
- Integrated Computerised Maintenance Management Systems (CMMS)

Energy Storage

- Local off grid power storage
- Solar PV with Battery Storage for small dwellings and apartments
- Low maintenance Solar PV for existing buildings – Freed-in Tariff required for grid connection.

Heating and Cooling

- Advanced heat pumps/Solar Thermal
- Heat Recovery for domestic & commercial

Biomass

- Biomass Heating Solutions/initiatives to replace oil with local wood fuels
- Support policies and mechanisms for Biomass supply chain development and biomass boiler development plan
- Reliable and cost effective boiler maintenance contracts

Transport

- ICT Innovations in transport
- Biogas for Fuel solutions
- Alternative Low Energy fleet vehicles

Building and Renovation

- Smart Buildings/Demand side management
- Smart HVAC system to heat and ventilate our Built Heritage - Convection Heaters powered by Solar, individual kits for individual properties solar air heating with convection ventilation to keep empty houses warmer and drier
- Warning systems in temperature and humidity controls in museums

Public Street Lighting

- Individually controlled public smart lighting

Water and Waste Water Treatment Solutions

- Energy efficient water treatment

Innovation Support

- Finance options for capital investment and increased access to ESCO options
- Initiatives to use on-site renewables, similar to above in relation to finance and ESCO options
- Greater promotion of real success stories
- Networking opportunities for SME's involved in energy innovation
- Economic research for establishing sustainable communities to investigate and support AD, CHP and community energy projects

Partner Proposal

What actions the partners propose to take for FREED i.e what innovations they regard as important and would like to support/develop as part of the FREED project.

- **Intelligent Energy Systems (IOT's)**
- **Energy Management Systems**
- **Demand Side Management**
- **Business & Finance Models on Energy Innovation**

3 Energy Innovation Needs by Market Sector
Norway

In Norway, the national strategy for research, development, demonstration and commercialisation of new energy technology, the highest priority is given to research on renewable energy and flexible energy systems.

In 2016, it was decided to focus on eight priority areas based on the innovation needs of:

- Long-term perspective
- Stable financial framework
- Outstanding research environment
- Cooperation between research, industry and public administration

The funding of the centres is a long-term initiative from the Research Council to generate solutions to climate and energy rela ted challenges and promote industrial development. The centres comprise dynamic research groups and a large number of user partners from trade and industry and the public sector. The user partners will take active part in the centres management, financing and research activities. The long-term perspective for each centre provides greater opportunity to achieve valuable results in the field of energy and climate research, results that can also be applied in trade and industry for added value.

The centres were selected on the basis of scientific merit, potential for innovation and value creation, and the extent to which they fulfil government targets relating to energy and greenhouse gas emission. The eight new centres will start up in 2017 and be fully operating from 2018.

The centres will work to reduce greenhouse gas emission in Norway and internationally, utilise energy more efficiently and increase the production of renewable energy. The centres will also disseminate the results of their research and contribute to a knowledge based debate on environment friendly energy.

Energy Innovation priority by market sector:

- CCS research – CO_2 capture, transport, storage
- Hydropower Technology
- Bio Energy – Fuel/Reduction cost
- Intelligent electricity distribution – Modernisation of the electricity grid
- Energy efficiency – Raising Energy efficiency in Norwegian industry
- Solar cell technology – Environmental Production process/silicon based solar cells
- Zero emission energy systems – Hydrogen + batteries
- Smart cities – RE benefit for local environment

The energy businesses in Northern Norway (NPA-Area) gives priority to three market sectors:

- Solar Technology
- Hydrogen Technology
- Small Hydro Power Plants

Innovation support – capital investment in the early stage of energy innovation is especially needed in the solar cell technology development.

Partner Proposal

What actions the partners propose to take for FREED i.e what innovations they regard as important and would like to support/develop as part of the FREED project.

- **Solar Technology**
- **Hydrogen**
- **Small Hydro Power Plants**
- **Early stage funding/Business Angel Network**

4 Energy Innovation Needs by Market Sector (University of Oulu) Finland

The discussions with the local stakeholders revealed a wide range of activities and needs in different sectors regarding energy innovations

The organisations consulted in the FREED programme for WP3, Activity 3.3 are as follows:

- The Council of Oulu Region
- Tekes – The Finnish Funding Agency for Innovation
- Business Oulu
- Oulu Innovation Alliance/ Centre for Energy and Environment (OIA/CEE)
- Ii Municipality, Micropolis Ltd. (Or Greenpolis)
- City of Oulu, Oulu Facilities Centre. (Oulun Tilakeskus)
- Ii Micropolis Ltd., Vähähiku project
- The Northern Ostrobothnia Hospital District. (PPSHP)
- University Properties of Finland Ltd. (SYK)

University of Oulu has reviewed at least 20 energy innovations in Northern Finland during the opening phase of the project. The topics can be divided roughly into eight specific issues, but many of these are directly connected to renovation of public buildings and the various ways to meet their energy needs and manage their energy usage.

Some of the needs are more universal of nature, such as smart illumination and HVAC systems in buildings, use of renewables as traffic fuels and smart distribution and measurement of energy. Some of these specific needs have their roots in our own region and its characteristics here in Northern Finland, which might differ greatly from those that you can encounter in the European heartlands. These include the next level of the well-established district heating system of our urban areas, how to use it as a centralised heat storage, and on the other hand there are the decentralised solutions for production and storage of electricity and heating in the more sparsely populated areas. Replacing of oil heating by increased usage of local biomasses, which should not be a problem in the well forested Northern Finland, is another topic originating firmly from our "terroir".

Some of the needs are purely specific for Northern Finland, others are present also in other corners of the NPA programme area and some are – as mentioned – more global in their nature:

Decentralised electricity generation and storage

- Solar and wind energy production
- Local storage of the produced energy
- Leading towards energy independent villages and other off-grid solutions

Decentralised heating, heat storage and emission control

- Decentralised heat energy production needs cost effective bioenergy solutions
- Decentralised heat storage in the consumer side
- Emission measurements and control of decentralised heating
- Renewable / decentralised energy specialist training.

District heating, centralised heat storage and emission control

- Utilising industrial overflow of energy and materials (waste) in the nearby municipality. Industrial-municipal circular economy concepts. Example: Kokkola Industrial park and its synergy with Kokkola municipality: e.g. produced heat and water treatment to the municipality
- Flexibility of the demand, municipal solution: energy efficiency with synergy of real estates; overproduction is utilised in other buildings. This requires smart distribution and optimising with change of the people's behaviour and habits

Large-scale biomass sources

- The emission targets, replace oil heating with renewable ones
- Cost-effective solutions for bioenergy use
- Availability of energy wood
- Carbon capture and storage (CCS)
- An import product when the e.g. wood chips can be very local
- Alternative use of the waste and side products fractions, which are now burned for energy

Traffic

- The traffic the biggest emission sources
- Biogas as traffic fuel

Building and renovations

- Smart illumination
- Smart HVAC

Smart distribution and measurement of energy

- Energy efficiency with synergy of real estates: overproduction is utilised in other buildings
- The novel service procedures and change of behaviour
- The communities could have common projects concerning the energy
- Electricity consumption spikes and their smoothening
- The smart electricity consumption measuring with separation of the real estate costs from the functions/actions costs
- Flexibility of the demand, communal solution: energy efficiency with synergy of real estates; the overproduction is utilised in other buildings. This requires smart distribution and optimising with change of the people's behaviour and habits

Partner Proposal

What actions the partners propose to take for FREED i.e what innovations they regard as important and would like to support/develop as part of the FREED project.

- **The role of SME's in the Energy Sector - how small innovative start-ups in the energy sector can have visibility.**
- **Raising the awareness of SMEs of the variety of possibilities in the energy sector.**
- **Smart Illumination.**

5 Energy Innovation Needs by Market Sector (Green Angel Syndicate) Scotland

Scotland, Green Angel Syndicate concentrated on the energy innovation programmes already established and in progress in order to ensure FREED is of maximum benefit to their work, and that it does not duplicate or complicate existing initiatives. Green Angel Syndicate itself is investing in energy innovation, but not within the NPA region.

The organisations consulted in the FREED programme for WP3, Activity 3.3 are as follows:

- Highlands and Islands Enterprise (Stuart Ship)
- Wave Energy Scotland (Tim Hurst)
- National Health Service Highland (Alan Whiteside)
- Scottish Enterprise (Dumfries & Galloway) (Colin Bell)
- Scottish Enterprise (Veronica Noone)
- Scottish Government (Innovation) (Simon Coote)
- Scottish Government (Local Energy) (Sue Kearns)
- Scottish Government (Water) (Barry Greig)
- Local Energy Scotland (Chris Morris)
- Scottish Water (Allan Mason)
- Hydro Nation Water Innovation Service (Peter Murphy).

In the private sector, Green Angel Syndicate also consulted with companies based in Scotland working on energy innovations, including:- *Sunamp (Andrew Bissell) / Synaptec (Philip Orr) / ACT Blade (Sabrine Malpede) / CDC (Ian Stephen).*

In addition, during the period of the project, Green Angel Syndicate has reviewed at least 20 energy innovations outside the NPA region, aiming to introduce technology to the sector, as well as talking to the innovation fund managers in energy companies such as Statkraft, National Grid and Dong. This revealed a range of activity in energy innovation in the different sectors, in particular within the innovation programmes run by Wave Energy Scotland and by Local Energy Scotland. But these are limited to wave energy technologies, and community energy respectively. Although there is a very evident need for energy innovation generally, and energy innovation specifically for Scottish needs, the innovation programmes are quite unimaginative in their engagement with the market potential represented in Scotland.

In terms of the needs this reveals, the most notable are:

- Local Energy distribution technologies to reduce the cost of energy in remote regions
- Energy storage technologies for remote regions
- Energy cost reduction technologies for water treatment in remote regions

- Wave and tidal technologies to reduce the LCOE (levelised cost of energy) for both technologies to become competitive with other methodologies.

In other sectors, the sector needs did not relate to innovation, but to the use of established means for cheaper or de-carboned energy production. For example, NHS Highland needs considerable help with its energy usage, but it does not necessarily need innovation.

A simple hierarchy of need for the Scottish region can be presented following this review:

- Community energy management innovations
- Community energy storage
- Community energy distribution and grids
- Wave energy innovation technologies
- Tidal energy innovation technologies
- Water treatment energy reduction innovation
- Heat storage innovation
- Energy innovations in transport
- Local grid storage innovation
- Domestic energy storage innovation

Partner Proposal

What actions the partners propose to take for FREED i.e what innovations they regard as important and would like to support/develop as part of the FREED project.

- **The role of GAS is to help innovations generated through the FREED project to develop Business Plans and raise the investment funds required to commercialise their technologies.**
- **In terms of innovations in other regions, GAS is keen to examine wave and tidal opportunities and is also very interested in energy storage. GAS is also in a position to draw in the opportunities represented in the Associated Partner, Sustainable Ventures, based in London, which has three different companies with relvant technology innovations available for development in the NPA region.**

6 Energy Innovation Needs by Market Sector (South West College) Northern Ireland

The eligible regions for Northern Periphery and Arctic Region (NPA) projects in Northern Ireland are: the East, North, West and South of Northern Ireland.

As the only partner located within N.Ireland South West College set to review the energy innovation needs of the whole region with specific focus on existing work programmes within the region for the purpose of exploring potential synergies and to avoid duplication of effort. The organisations consulted for WP3, 3.3 activity include:

- Fermanagh & Omagh District Council
- Invest NI – Northern Irish Regional Business Development Agency
- Centre for Renewable Energy and Sustainable Technology (CREST)
- Centre for Advanced Sustainable Energy (CASE)
- Lisburn Enterprise Organisation (LEO)
- Omagh Enterprise Centre
- Action Renewables
- Ulster Farmers Union
- CEMES (Community Energy Group)

In the private sector, South West College also consulted with companies based in Northern Ireland working on energy innovations, including:-

- B9 Energy
- Arbarr
- Salii

Arising from the discussions and interviews the most notable Energy Innovation needs are:

Smart Grid/ Intelligent Energy Management Solutions

- Distributed electricity generation and storage e.g. solar PV/battery hybrid
- Asset monitoring solutions to enable flexible real time control
- Microgrid solutions to include load control/ demand side management
- ICT solutions to encourage monitoring and recording of energy use linked to behaviour and environmental conditions
- Real time energy usage monitoring and reporting for an entire community utilising IoT technology e.g. LoRa.

Decentralised heating and thermal energy storage solutions

- Decentralised heat energy production needs cost effective bioenergy solutions
- Decentralised thermal energy storage on the consumer side e.g. phase change materials, hot water
- Utilising industrial overflow of energy and materials (waste) from local council facilities. Industrial-circular economy concepts. e.g. Anaerobic Digestion of Council Waste Streams to provide local souce of electricity and district heating

Building and renovations

- Use of ICT software to create BIM/Digital Twin
- Smart illumination e.g individually controlled street lights
- Smart HVAC systems

Transport

- ICT Innovations in Transport
- Biogas for Fuel solutions
- Alternative Low Energy fleet vehicles

Partner Proposal

What actions the partners propose to take for FREED i.e what innovations they regard as important and would like to support/develop as part of the FREED project.

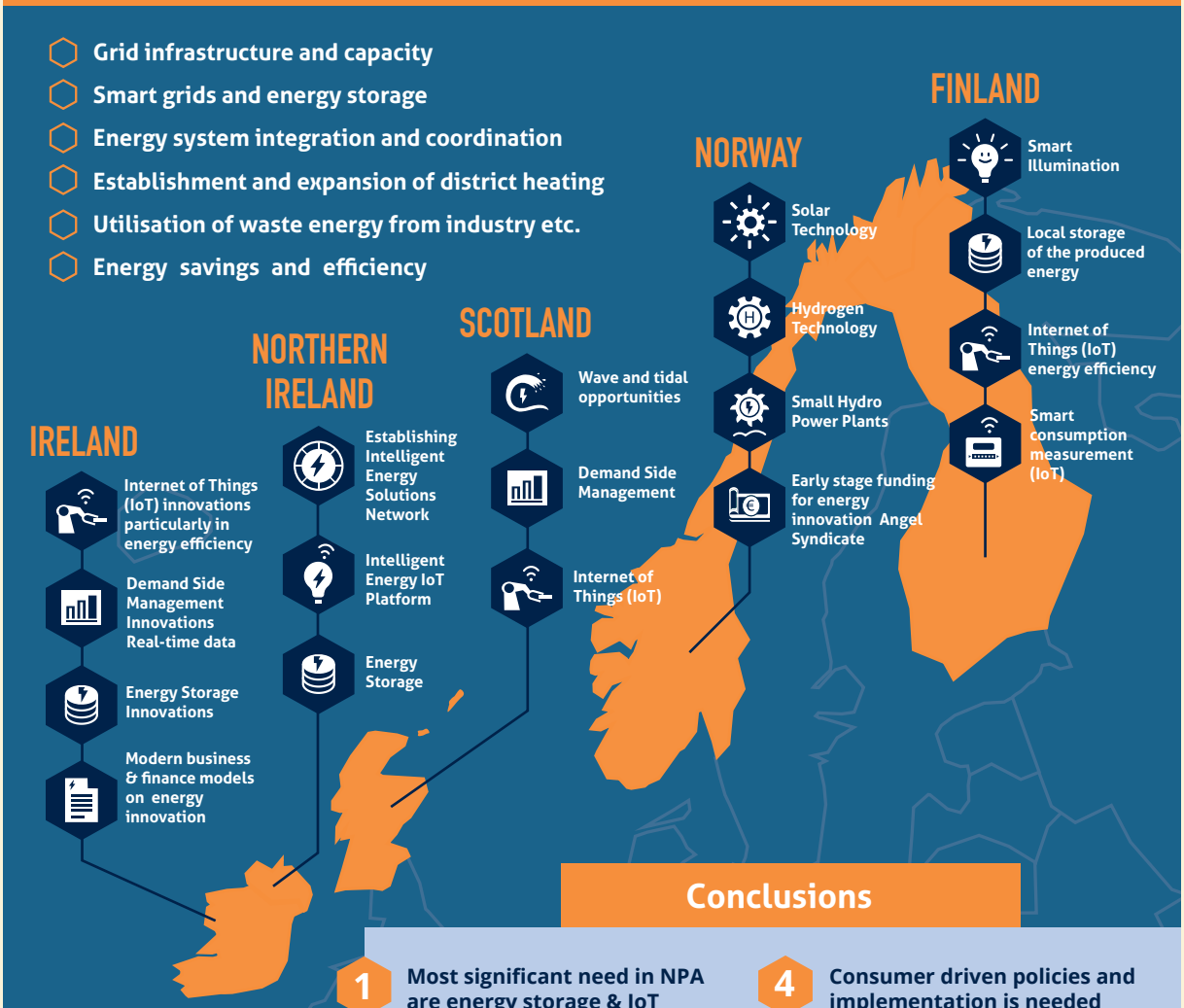
- **Establish Intelligent Energy Solutions Network to develop a collaborative approach for developing innovative market solutions.**
- **Intelligent Energy IoT Platform focusing on energy monitoring, communications, data analysis and real time control of renewable energy assets, energy storage (electrical and thermal) and controllable loads (industrial, commercial, residential).**

The Northern Periphery and Arctic (NPA) energy system has to change in two ways: by cutting down the primary energy demand, so the question of consumers requires to be at the very centre and by large scale deployment of renewable energy.

The energy transition process is simply a no-brainer to the NPA regions. Energy transition will create and retain welfare by much needed innovation, investments, job creation, opposition to energy poverty and lowering future energy costs that will lead to sustainable development across the NPA regions.

Main areas for innovation & development in the NPA:

- Grid infrastructure and capacity
- Smart grids and energy storage
- Energy system integration and coordination
- Establishment and expansion of district heating
- Utilisation of waste energy from industry etc.
- Energy savings and efficiency



Conclusions

1. Most significant need in NPA are energy storage & IoT solutions
2. Need for new technology deployment that are "smarter" such as energy storage, demand-side management, energy efficiency solutions
3. Energy storage and smarter systems key step in integrating larger amounts of renewable generated energy
4. Consumer driven policies and implementation is needed
5. The problem the NPA faces is not a lack of technical solutions but a lack of time in the implementation and finance to make policies and target happen
6. Greater innovation in energy was one of the strongest points of agreement at the recent Paris talks

Notes:




FREED

Funding Resources for Innovation in Energy Enterprise Development

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