Greening Energy
Market and Finance

Innovations in Renewable Energy Sources (RES): Adaptation to the climate change

dr Adam Adamek

Project website: http://grenfin.eu

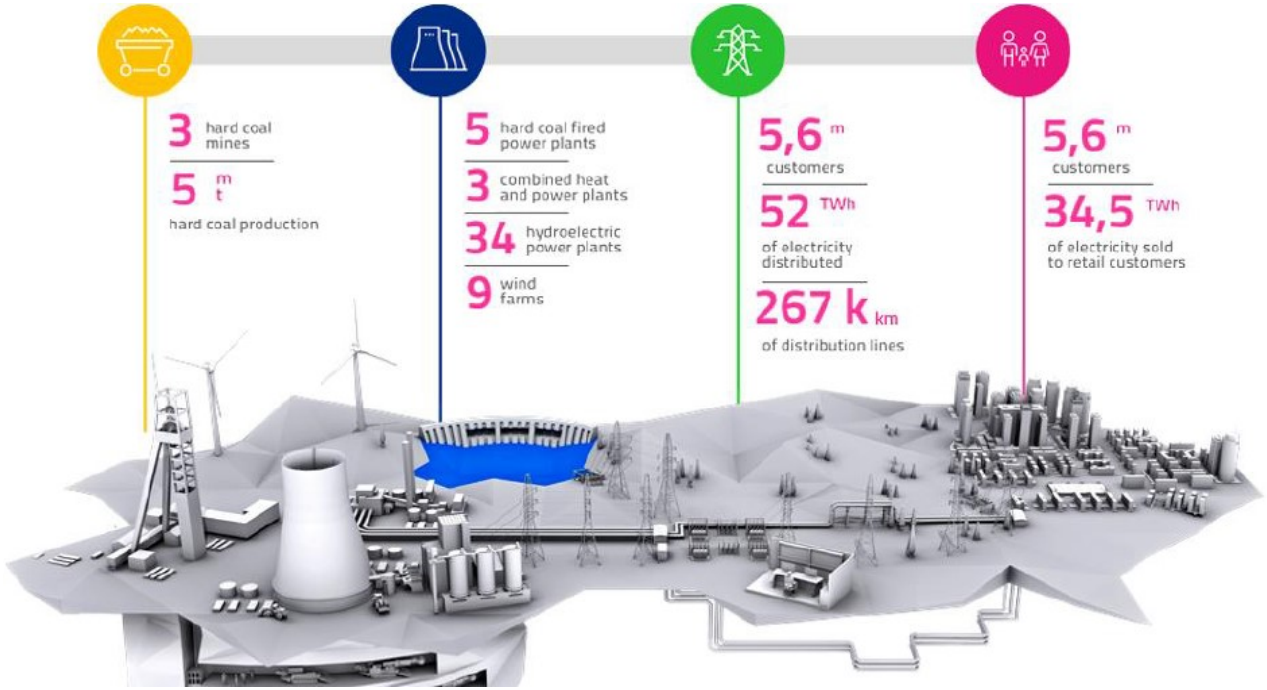
With the support of the
Erasmus+ Programme
of the European Union

About me

Adam Adamek, Ph.D. graduated from the Faculty of Energy and Environmental Engineering at the Silesian University of Technology. He obtained Ph.D. degree in Environmental Engineering, Energy and Mining in 2019 at the Agriculture University in Cracow, degree from postgraduates studies at the AGH University of Science and Technology in specialization of Renewable sources of Energy and postgraduates studies at the SGH Warsaw School of Economics in specialization Effective IT management. He took part in the design of the largest modern power units in Poland Currently, manager of the research and development project "Model of 2.0 distributed Energy generation – self-balancing network areas" at TAURON Polska Energia.

With the support of the Erasmus+ Programme of the European Union

TAURON GROUP



One of the largest business entities in Poland, with over 18 bilion equity and approximately 25 thousand employees.

Core business includes coal mining, generation, distribution and supply of electricity and heat.

TAURON supplies 50 TWH of electricity to over 5,5 milion customers per year, which makes it the largest distributor of electricity in Poland.

The holding controls approximately 30% of Polish hard coal resources.

With the support of the Erasmus+ Programme of the European Union

Agenda

- Why is adaptation an important issue?
- What is an adaptation to climate change?
- Theoretical issues
- Effects of climate change
- Practical examples of adaptation and mitigation
  - ➢ Urban Space
  - ➢Transport
  - ➢Energy sector
- Case study

With the support of the Erasmus+ Programme of the European Union

THEORETICAL ISSUES

With the support of the
Erasmus+ Programme
of the European Union

Why this is an important topic?

The topic is increasingly appearing in strategic documents and in EU law.

Mandatory element of environmental impact assessment.

Knowledge of adaptation to climate change is needed in the work of a designer or government official

With the support of the Erasmus+ Programme of the European Union

Climate change

The Intergovernmental Panel on Climate Change (IPPC) defines climate change as "Climate change referring to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use”

With the support of the Erasmus+ Programme of the European Union

Adaptation to climate change

The Intergovernmental Panel on Climate Change (IPPC) defines adaptation as "any adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects which moderates harm or exploits beneficial opportunities".

Adaptation - adapting human systems to the effects of climate change

With the support of the Erasmus+ Programme of the European Union

EFFECTS OF CLIMATE CHANGE

With the support of the
Erasmus+ Programme
of the European Union

Some of the effects of climate change

Temperature changes

- Heatwaves
- Froswtaves

Changes in rainfall intensity and wind speed

- Floods
- Droughts
- Windstorms

With the support of the Erasmus+ Programme of the European Union

Climate change and urban area

water retention problems

bad air quality (e.g. smog)

health problems of residents

damage of city infrastructure

With the support of the Erasmus+ Programme of the European Union

Climate change and transport

- icing of roads
- Blocked roads
- melting and cracking of road surfaces

With the support of the Erasmus+ Programme of the European Union

Climate change and energy

heating of water used for cooling power units

broken power lines

destruction of biomass crops

problems with the delivery of fuels and raw materials to the production site

device demage and decrease in productivity

With the support of the Erasmus+ Programme of the European Union

EXAMPLES OF ADAPTATION AND MITIGATION ACTIVITIES IN URBAN AREA

With the support of the Erasmus+ Programme of the European Union

Green roofs and green walls

Internacional Congress Centre in Katowice
Source: http://www.portalsamorzadowy.pl;

Roof of the University of Warsaw Library
Source: http://www.panoramio.com

Green walls in the city centre in Katowice
Source: Wojciech Wardecki

Green roofs and walls

roofing or wall covering consisting of many layers of structure with a layer of soil on which planting is allowed.

With the support of the Erasmus+ Programme of the European Union

Green roofs and green walls

Some EU countries have enacted laws requiring new commercial buildings to have roofs at least partially covered with vegetation or solar panels.

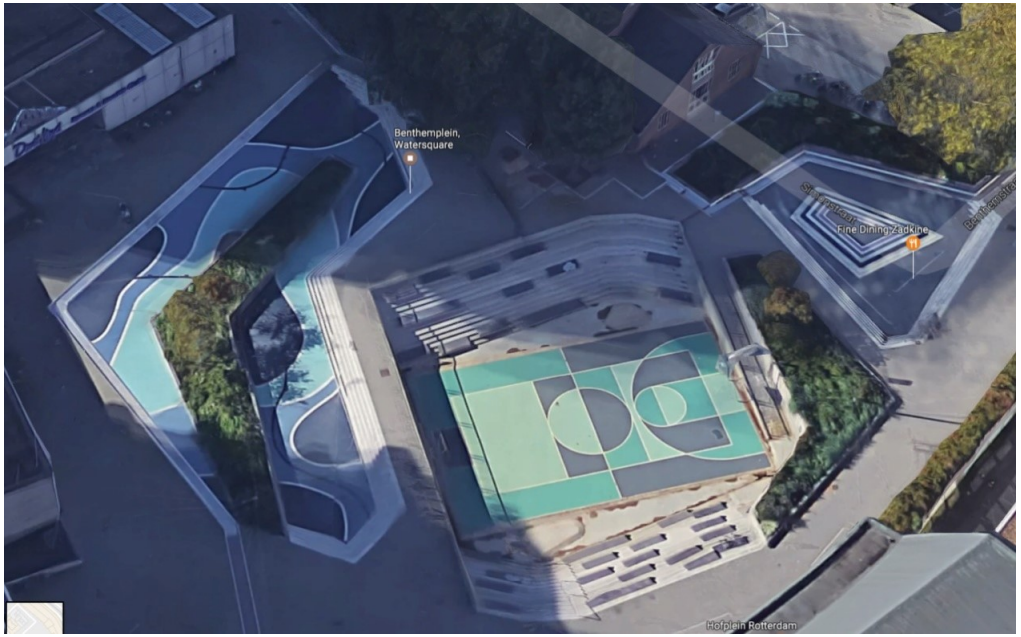
- Basel in Switzerland has the largest green roof area in the world in relation to the number of inhabitants. By updating the construction law, it was decided that all new and renovated roofs should be green
- In Copenhagen it was decided that since 2010 all newly built and modernized buildings with a flat roof should be planted

Basel
Source: https://www.google.pl/

With the support of the Erasmus+ Programme of the European Union

Water retention

Rotterdam has become famous as a city managing waters. The city is highly resistant to natural disasters and unforeseen water shortages. A special officer for city adaptation is employed in Rotterdam.



Water Square - Rotterdam
Source: https://www.google.pl/

With the support of the Erasmus+ Programme of the European Union

Others

Rasing streets in Miami (USA)
Source: http://www.miamiherald.com

Drifting cafe (Netherlands)
Source: own date bank

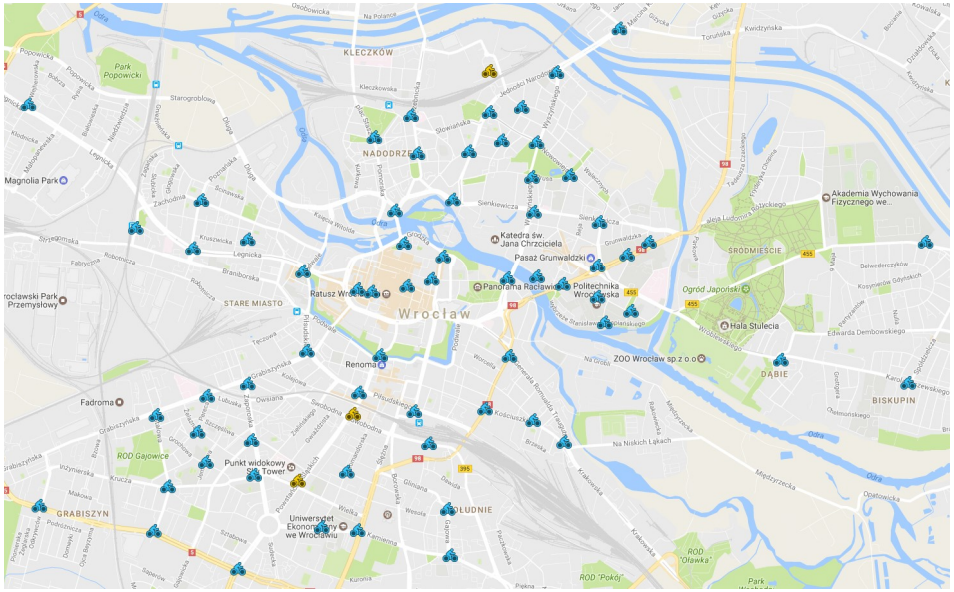
With the support of the Erasmus+ Programme of the European Union

EXAMPLES OF ADAPTATION AND MITIGATION ACTIVITIES IN TRANSPORT

With the support of the Erasmus+ Programme of the European Union

Bicycle sharing system

Bike rental
Źródło: https://nextbike.pl



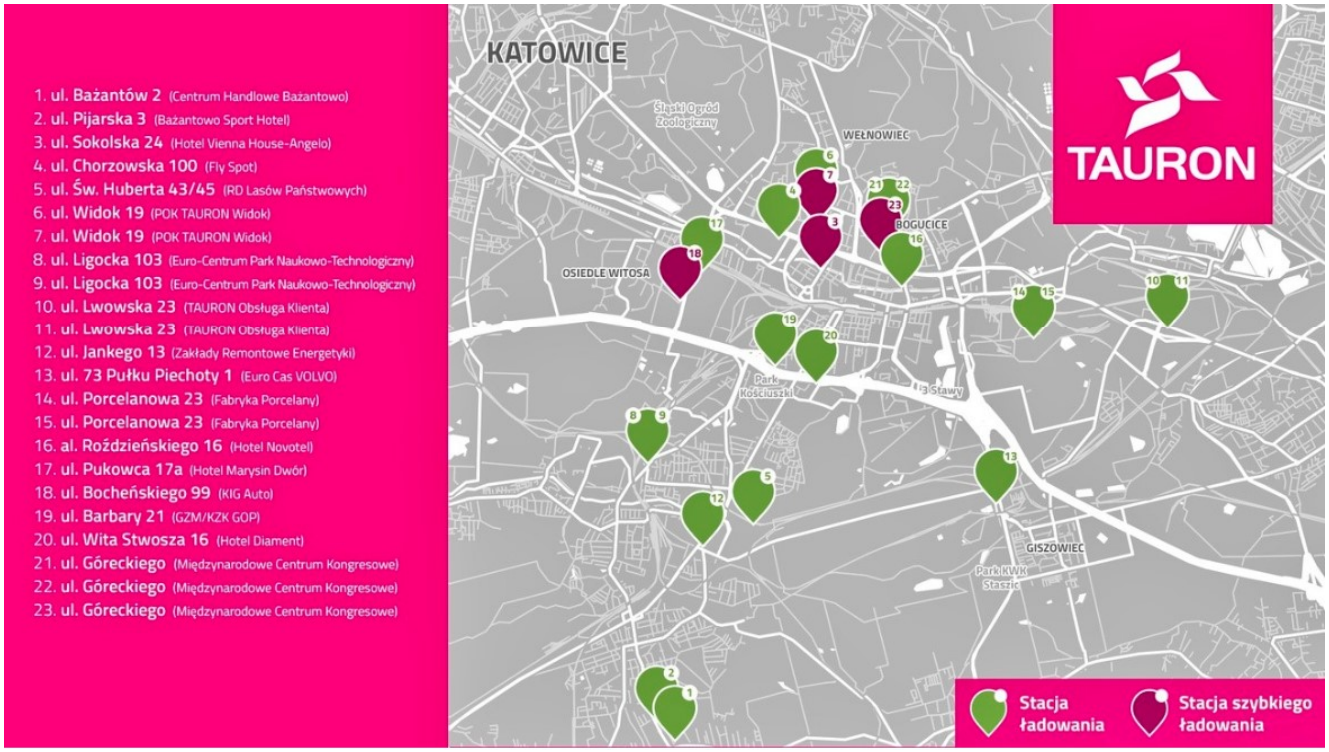
Bike sharing system in Wrocław in 2017
Source: http://www.wroclaw.pl

With the support of the Erasmus+ Programme of the European Union

E-mobility and car sharing

The car sharing system is an increasingly common solution in cities.

Typically, electric vehicles are used in this system.



With the support of the Erasmus+ Programme of the European Union

EXAMPLES OF ADAPTATION AND MITIGATION ACTIVITIES IN ENERGY SECTOR

With the support of the Erasmus+ Programme of the European Union

Megatrends in energy sector

Reducing emissions and reducing the environmental impact of investments

Development of Renewable Energy Sources

Growing social awareness

Improving energy efficiency

Development of energy storage technology

With the support of the Erasmus+ Programme of the European Union

Development of RES sources

The development of renewable energy has been implemented for years using wind and photovoltaic technologies. Renewable energy sources work depending on weather conditions, therefore it is important to combine them into systems ensuring greater work efficiency.

Source: https://grybow.pl/wp-content/uploads/2018/03/farma_fotowoltaika.jpg

With the support of the Erasmus+ Programme of the European Union

Development of offshore wind farms

In recent years there has been a dynamic development of offshore technology (farms installed on the water). Like onshore farms, these are high power sources.

Installations of this type implement the assumptions of the megatrend of RES development and emission reduction.

Source:
https://pbs.twimg.com/media/ECEtGvfUYAEvgso.png

With the support of the Erasmus+ Programme of the European Union

Distributed energy – the effect of increasing public awareness

In addition to the development of large RES, the number of domestic RES installations is growing dynamically.

This trend creates new challenges and at the same time creates new opportunities - attempts to connect these installations into larger systems.

Source: https://www.apricum-group.com/residential-energy-storage-business-models-growth-germany/

Source: http://polish.windturbinegeneratorsystem.com/sale-10086686-3kw-wind-solar-hybrid -off-grid-system-1500w-eolic-wind-generator-for-home.html

With the support of the Erasmus+ Programme of the European Union

Innovation in RES

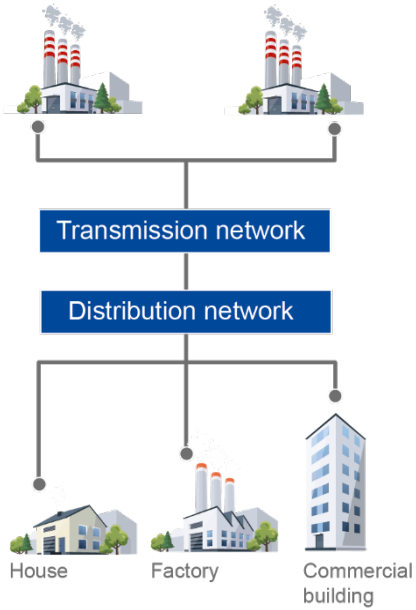
Innovation is a sequence of activities leading to the creation of new or improved products, technological processes or organizational systems.

Innvoations in RES:

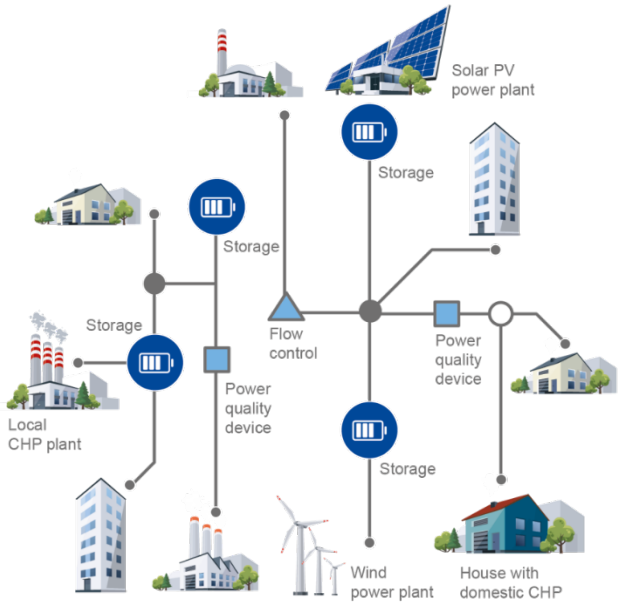
- the use of new materials, e.g. graphene photovoltaics
- new types of generation sources, e.g. hydrogen energy
- new locations of generation sources, e.g. photovoltaics floating on water
- new methods of managing production sources, e.g. virtual power plants, microgrids

With the support of the Erasmus+ Programme of the European Union

Microgrids – combining small RES into larger systems



Megatrends



MICROGRIDS TODAY

Individually managed distributed energy sources

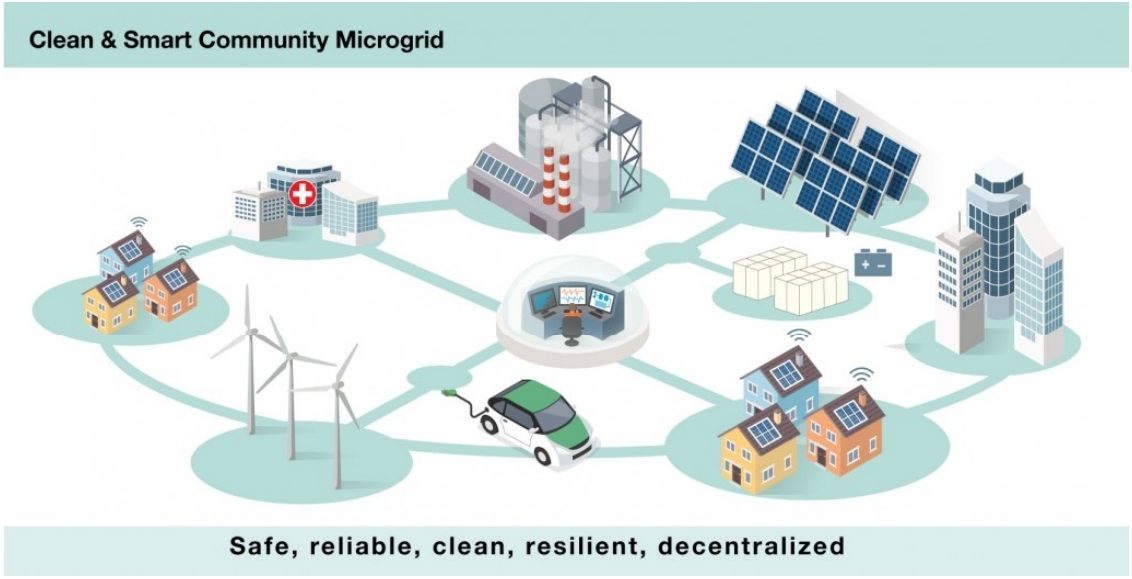
MICROGRIDS 2.0

Professional cooperation between distributed energy sources/energy islands and distribution grid

Project website: http://grenfin.eu

With the support of the Erasmus+ Programme of the European Union

Microgrids – combining small RES into larger systems



Microgrid
Source: https://theclimatecenter.org/wp-content/uploads/2019/11/microgrid-1030x525.jpg

An microgrid is a physically separated area covering local energy sources (mainly RES) and consumers of energy produced from these sources. Energy storage and gas or oil generators are also built into the microgrids, which provide energy in situations of insufficient production of energy from renewable energy sources. All elements of the microgrid are connected by a power network, and the work of the installation is controlled by an IT system.

With the support of the Erasmus+ Programme of the European Union

Microgrid in TAURON

analytical tools
for determination of profitability of the microgrids for different locations

operating pilot plant
combining elements of energy generation, transmission & storage

know-how and proven experience
in the field of construction and operation of microgrids

PILOT PLANT

Energy consumers

Active players
(prosumers, local entities)

Local energy sources
(PV ,wind turbine, gas engine)

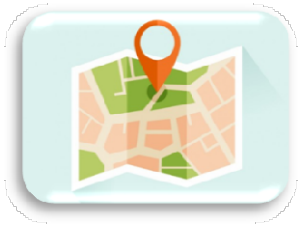
Energy storage

Internal results:

Representative pilot plant together with a detailed documentation of operational and technical issues, ready to implement in other locations.

With the support of the Erasmus+ Programme of the European Union

Microgrid in TAURON



separation of a certain area of the energy network together with connected consumers, in order to make them independent of energy supplies from the external network

generation of electricity through locally available sources of electricity:

- Photovoltaic panels: 100 kW
- Wind turbines: 60 kW
- Gas engine: 40 kW
- Accumulation unit capacity: 250-300 kWh

application of advanced automation and control systems as well as an IT system managing plant operation

With the support of the Erasmus+ Programme of the European Union

CASE STUDY:

Innovations in Renewable Energy Sources (RES): Adaptation to the climate change

With the support of the Erasmus+ Programme of the European Union

Case study – description

As part of a research and development project, the energy company wants to build the first microgrid in Poland. The microgrid is to be composed of photovoltaics, wind turbines, an energy storage, a gas engine and an installation management system. The microgrid can operate in the following operating modes:

- classic method (generation sources generate energy to the grid, consumers get energy from the grid)
- island mode (the microgrid operates independently of the grid. The generation sources of the microgrid generate energy consumed by the microgrid consumers or accumulated in the microgrid energy storage).

The project has an innovative aspect, which is to test the island operation in real conditions. The production sources are devices available on the market. Their cooperation within the microgrid is an innovation - the production sources operate together as one installation thanks to the IT management system.

With the support of the Erasmus+ Programme of the European Union

Task 1 - Identify possible climate and financial risks. Propose forms of mitigation

It is enough to indicate one form of mitigation for each risk. Descriptions of mitigation forms do not have to be detailed.

Hints:

- how could the effects of climate change affect the microgrid and individual production sources?
- whether the company has relevant experience in the field of RES?
- What are the consequences of not receiving a project funding?
- What if the effects of climate change lead to damage to the microgrid?

With the support of the Erasmus+ Programme of the European Union

Task 2- Propose sources of co-financing for the project

There is no need to check the exact criteria for the selection of projects. It is enough to indicate the co-financing program in a general way and describe how the project fits into its assumptions. Try to identify at least two different funding programs.

Hints:

- keep in mind the aspect of innovation that appears in the project
- remember that the project is part of the development of renewable energy and adaptation to climate change

With the support of the Erasmus+ Programme of the European Union

Task 3- Develop a schedule for the described project

The schedule should include the main design tasks. The schedule must cover tasks from the preparation of the tender to the completion of microgrid construction and commissioning of the microgrid.

Hints:

- Think about what is necessary to conduct the tender. What do you need to be able to talk about the project with a potential contractor?
- Remember that the Contractor does not have all the elements necessary for the construction in stock. Some elements must be produced by the manufacturer and then delivered to the Contractor.
- Remember that before commissioning, it is necessary to carry out tests to verify the correct operation of the microgrid.

With the support of the Erasmus+ Programme of the European Union

Greening Energy Market and Finance

Project website: http://grenfin.eu

With the support of the Erasmus+ Programme of the European Union