



Oceanography and Climate Change

Business Game Offshore Wind Energy



Student material

Responsible Research and Innovation www.irresistible-project.eu



Colophon



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Deutsches Museum



Technische Universität München

1. **Role Descriptions** 6
2. **General information about the topic Offshore wind farm** 13
3. **Research phase: Letter of the Mayor** 17
4. **Information and Planning Meeting** 19

1

Role Descriptions

Role Descriptions

Project:

Participation of the city of Miesbach in the wind farm project OMEGA VENTURI in the North Sea

Actors: Mayor, opposition leader

Starting position

The situation is very clear to the mayor and the opposition leader of the city Miesbach: If the power supply shall stay safe and payable for the citizens over the next years, then the city must take action. The secured energy supply by building of new high voltage/direct current transmissions (HVDC) for Bavaria guarantees that Offshore wind farms can renewably produce electricity environmentally friendly and that the current dependency on fossil fuels and nuclear power will soon be history. The mayor is convinced that he exactly senses the mood of the population: Offshore wind farms are the most efficient, cheapest and the most accepted energy source by the population. And the town's treasurer has already pointed out: High subventions and a good return on the investments are in store in case of taking part in the operating company for the wind farm "OMEGA VENTURI". The head office of the international active financial capital company "SHARK INVEST LTD" is in Miesbach. Their support and expertise will surely make the planned investment become a successful project for the city (and also for the mayor). All important actors and stakeholders should come together in an information and planning meeting and have discussions.

Role description and target

As the mayor you moderate the information and planning meeting. Make sure that a decision about the project is made by voting at the end.

As the opposition leader you take over the co-moderation.

Project:

Participation of the city of Miesbach in the wind farm project OMEGA VENTURI in the North Sea

Actors: City council with treasurer

Starting position

The situation is very clear to the mayor of the city Miesbach: If the power supply shall stay safe and payable for the citizens over the next years, then the city must take action. The secured energy supply by building of new high voltage/direct current transmissions (HVDC) for Bavaria guarantees that Offshore wind farms can renewably produce electricity environmentally friendly and that the current dependency on fossil fuels and nuclear power will soon be history. The mayor is convinced that he exactly senses the mood of the population: Offshore wind farms are the most efficient, cheapest and the most accepted energy source by the population. And the town's treasurer has already pointed out: High subventions and a good return on the investments are in store in case of taking part in the operating company for the wind farm "OMEGA VENTURI". The head office of the international active financial capital company "SHARK INVEST LTD" is in Miesbach. Their support and expertise will surely make the planned investment become a successful project for the city (and also for the mayor). All important actors and stakeholders should come together in an information and planning meeting and have discussions.

Role description and target

As a member of the city council you support the mayor in preparing and performing the information and planning meeting. The city's treasurer is in the city council team, who knows about the financial situation of the town, and the director of the public utilities.

Project:

Participation of the city of Miesbach in the wind farm project OMEGA VENTURI in the North Sea

Actors: Representatives of the financial capital company “SHARK INVEST LTD”

Starting position

The situation is very clear to the mayor of the city Miesbach: If the power supply shall stay safe and payable for the citizens over the next years, then the city must take action. The secured energy supply by building of new high voltage/direct current transmissions (HVDC) for Bavaria guarantees that Offshore wind farms can renewably produce electricity environmentally friendly and that the current dependency on fossil fuels and nuclear power will soon be history. The mayor is convinced that he exactly senses the mood of the population: Offshore wind farms are the most efficient, cheapest and the most accepted energy source by the population. And the town's treasurer has already pointed out: High subventions and a good return on the investments are in store in case of taking part in the operating company for the wind farm “OMEGA VENTURI”. The head office of the international active financial capital company “SHARK INVEST LTD” is in Miesbach. Their support and expertise will surely make the planned investment become a successful project for the city (and also for the mayor). All important actors and stakeholders should come together in an information and planning meeting and have discussions.

Role description and target

As a representative of the financial capital company “SHARK INVEST LTD” you support the mayor in realizing the project. There are experts in the financial capital company's team, who know about the financial conditions, and experts for subventions and state subventions for the project.

Project:

Participation of the city of Miesbach in the wind farm project OMEGA VENTURI in the North Sea

Actors: Experts of the operating company from the wind farm “OMEGA VENTURI”

Starting position

The situation is very clear to the mayor of the city Miesbach: If the power supply shall stay safe and payable for the citizens over the next years, then the city must take action. The secured energy supply by building of new high voltage/direct current transmissions (HVDC) for Bavaria guarantees that Offshore wind farms can renewably produce electricity environmentally friendly and that the current dependency on fossil fuels and nuclear power will soon be history. The mayor is convinced that he exactly senses the mood of the population: Offshore wind farms are the most efficient, cheapest and the most accepted energy source by the population. And the town's treasurer has already pointed out: High subventions and a good return on the investments are in store in case of taking part in the operating company for the wind farm “OMEGA VENTURI”. The head office of the international active financial capital company “SHARK INVEST LTD” is in Miesbach. Their support and expertise will surely make the planned investment become a successful project for the city (and also for the mayor). All important actors and stakeholders should come together in an information and planning meeting and have discussions.

Role description and target

As an expert of the operating company from the wind farm „OMEGA VENTURI” you support the mayor in realizing the project. Among the experts of the operating company from the wind farm „OMEGA VENTURI” there are engineers and technicians, who know about the technical conditions and challenges of the project.

Project:

Participation of the city of Miesbach in the wind farm project OMEGA VENTURI in the North Sea

Actors: Scientists from the institute for applied marine research Kiel

Starting position

The situation is very clear to the mayor of the city Miesbach: If the power supply shall stay safe and payable for the citizens over the next years, then the city must take action. The secured energy supply by building of new high voltage/direct current transmissions (HVDC) for Bavaria guarantees that Offshore wind farms can renewably produce electricity environmentally friendly and that the current dependency on fossil fuels and nuclear power will soon be history. The mayor is convinced that he exactly senses the mood of the population: Offshore wind farms are the most efficient, cheapest and the most accepted energy source by the population. And the town's treasurer has already pointed out: High subventions and a good return on the investments are in store in case of taking part in the operating company for the wind farm "OMEGA VENTURI". The head office of the international active financial capital company "SHARK INVEST LTD" is in Miesbach. Their support and expertise will surely make the planned investment become a successful project for the city (and also for the mayor). All important actors and stakeholders should come together in an information and planning meeting and have discussions.

Role description and target

As a scientist from the institute for applied marine research Kiel you have your eye on the impacts of the project on flora and fauna in the ocean. Among the scientists from the institute for applied marine research Kiel there are biologists and marine explorers as well as physicists and chemists, who know about the impacts of the project on the maritime environment.

Project:

Participation of the city of Miesbach in the wind farm project OMEGA VENTURI in the North Sea

Actors: Representatives of the environment activist group “Save the Ocean”

Starting position

The situation is very clear to the mayor of the city Miesbach: If the power supply shall stay safe and payable for the citizens over the next years, then the city must take action. The secured energy supply by building of new high voltage/direct current transmissions (HVDC) for Bavaria guarantees that Offshore wind farms can renewably produce electricity environmentally friendly and that the current dependency on fossil fuels and nuclear power will soon be history. The mayor is convinced that he exactly senses the mood of the population: Offshore wind farms are the most efficient, cheapest and the most accepted energy source by the population. And the town’s treasurer has already pointed out: High subventions and a good return on the investments are in store in case of taking part in the operating company for the wind farm “OMEGA VENTURI”. The head office of the international active financial capital company “SHARK INVEST LTD” is in Miesbach. Their support and expertise will surely make the planned investment become a successful project for the city (and also for the mayor). All important actors and stakeholders should come together in an information and planning meeting and have discussions.

Role description and target

As a member of the environment activist group “Save the Ocean” you are strictly against the project. You do not only have your eye on the negative impacts of the project on flora and fauna in the ocean, but also on the destruction of the environment during the building of transport routes for the HVDC lines to Bavaria. Among the members of the activist group “Save the Ocean” there are biologists and marine explorers as well as physicists and chemists, who warn about the impacts of the project on the maritime environment.

2

General
informa-
tion
about the
topic
Offshore
wind farm

General information about the topic Offshore wind farm

Extracts from the World Ocean Review 1, Chapter 7, p.156 f., renewable energies
http://worldoceanreview.com/wp-content/downloads/wor1/WOR1_gesamt.zip

"Until now, the expansion of renewable energies, such as wind and solar power, has mainly taken place onshore. The energy in the oceans has remained largely untapped. But things are changing. The production of environmentally friendly energy from the oceans is now being promoted worldwide. Expectations are high. It is hoped that wind, waves and ocean currents will meet a substantial share of the world's electricity needs.

An unretrieved treasure trove

The oceans are teeming with energy. Tidal forces move immense masses of water. Strong winds build up mighty waves. Almost 90 per cent of global wind energy is contained in the turbulence above the world's oceans. Wind, waves and currents together contain 300 times more energy than humans are currently consuming. For a long time, this abundance went untapped. In recent years, however, we have begun to harness this energy. The first offshore wind farms were built. Hundreds of power plants have been and are being built to convert ocean current and wave energy to electricity. The key renewable marine energies are:

- Wind energy;
 - Wave energy;
 - Tidal energy;
 - Ocean current energy;
 - Energy derived from temperature differences at various ocean depths
- [...]

Offshore wind energy

Wind energy is currently at the most advanced stage of development, and the signs are extremely promising. Experts estimate that offshore wind power alone could in future supply about 5000 terawatt-hours (TWh) of electricity a year worldwide – approximately a third of the world's current annual electricity consumption of about 15,500 terawatt-hours (1 terawatt-hour = 1 trillion watts). It is anticipated that offshore wind energy plants (WEPs) alone in Europe will supply about 340 terawatt-hours a year by 2015.

About 40 offshore wind energy projects have so far been implemented worldwide, most of them in the United Kingdom, Denmark, the Netherlands and Sweden. Two trends are clear. One, that the facilities are getting bigger all the time, and two, that we are constantly venturing into deeper waters, which will allow the construction of wind farms over far greater areas. Whereas at the beginning of this century we were building in coastal areas at depths of 2 to 6 meters, wind turbine towers are now anchored to the ocean floor at depths of more than 40 meters.

Floating offshore concepts are also being developed for even deeper waters. The world's first floating wind energy plant was recently constructed off the coast of Norway by a Norwegian-German consortium. Backed by the experience of hundreds of thousands of onshore WEPs, wind energy has become a mature technology. The high wind speeds and harsh environmental conditions at sea, however, mean that some technological improvements are required, a fact borne out by the problems encountered by the first large-scale wind farm in Denmark. For this reason only twelve wind turbines from different manufacturers were initially built and tested at Germany's first offshore wind farm "Alpha Ventus". Located in the North Sea about 40 kilome-

ters off the island of Borkum, the farm was sponsored by the German Federal Ministry of Economics.

Offshore plant is still considerably more expensive to construct than onshore due to the challenging foundation work and complicated connection to the power grid. Nonetheless, according to experts, offshore wind energy, supported by feed-in payments and support measures, will continue to grow substantially in the coming years.

The right location for green power

In future, before energy systems can be built in the sea, environment impact assessments must be made to determine how the technology will affect the marine environment. Many suitable locations are likely to be ruled out on environmental grounds. Experts therefore differentiate between the technical potential of an energy technology and its sustainable potential. The technical potential includes all the plant locations which are theoretically feasible. The sustainable potential looks at environmental factors, such as the damage a tidal power plant may cause to stretches of river, thus eliminating some locations. The sustainable potential is accordingly lower than the technical potential. Experts are calling for marine spatial planning for ocean-based renewable technologies to be simplified. Until now, separate approval processes have applied to wind energy and wave energy facilities respectively. To shorten decision-making processes, it would make sense to incorporate several energy production technologies in spatial planning at the same time, rather than individual wind farms, thereby designating areas for renewable marine power generation as a whole. This would make it much easier to combine different technologies in a single marine area – for instance, wind turbine towers which also incorporate ocean current plants.

There are already windmills in the ocean in many places. One of the largest offshore wind farms with 48 rotors is in the Baltic Sea between Denmark and Sweden. A transformer station has been constructed here to feed power into the Swedish grid. Nowadays windmills are mostly constructed at a water depth of maximum 45 meters, because otherwise the building of the masts is too expensive. Floating windmills, which are anchored in the ocean bed with holding ropes, are an alternative.

The first prototypes are already being tested. The development of technologies for renewable energy production in the ocean has made a large step forward. But even though many seem promising commercially, nearly all technologies are still dependent on support, because they are forwarded by young and small companies in many cases. Apart from the technical and economic risks one problem is to reach project sizes with the farms, which make the productivity of such investments possible. Therefore, supporting the technologies is necessary. Several nations offer such programs. The US ministry for energy (Department of Energy) and the European Union already support the development with several hundred million Euros. The complex approval procedures for farms or grid connections must also be made easier. While the approval of offshore wind farms in Germany is completely in the hands of the Federal Maritime and Hydrographic Agency, farm operators in the USA have to fight their way through various offices and approval procedures. Making this easier would be helpful."

*Extracts from the World Ocean Review 1, Chapter 7, p.161, pressure grows
(http://worldoceanreview.com/wp-content/downloads/wor1/WOR1_gesamt.zip)*

Pressure on the ocean floor is growing

For centuries the oceans provided a single resource – food. Only during the past few decades have technologies been developed which can extract more from them – for instance drilling

technology to extract oil and gas. Until now drilling has been in relatively shallow waters, but companies are now penetrating greater depths. It is a complex and expensive process, but is becoming more feasible as land-based reserves become scarce and prices rise. The same applies to the metal reserves which are embedded in manganese nodules, cobalt deposits, massive sulphides and ore slurry in the sea. As metal prices rise, mining from the depths will become more attractive – although this will only apply to valuable metals such as copper, nickel and gold. As yet, however, no mining technology is gentle on the environment. With respect to methane hydrate, it is unclear to what extent it is possible to mine the ocean floor without harming people or the environment. Also, virtually no technology exists for the purpose. Many basic principles must first be clarified, such as whether laboratory results can be applied to mining practice. If it were possible to extract methane and at the same time safely store carbon dioxide from the burning of oil and gas, harnessing methane from the ocean bed might even prove to be a climate protection option.

The most sustainable system of marine energy production in terms of climate protection is probably from the ocean currents, waves and wind. In most cases there is considerable need for research into the impact of energy systems on the marine environment. Some technologies are ready for operation, while others are still in the pilot phase. Some nations have reduced the bureaucratic hurdles that planners and developers face. Before facilities can be utilized on a large scale, however, countries must decide whether and how they wish to promote ocean energy, because without initial governmental support none of the current technologies can be established in the medium term."

3

Research
phase:
Letter of
the Mayor

Research phase: Letter of the Mayor

Ladies and Gentlemen,

as a participant of the information and planning meeting for the planned project about the energy revolution “Miesbach taking part in the Offshore wind farm project OMEGA VENTURI”, which will take place next Thursday, 19.03.2015 in the physics rooms of our high school, sure you will want to specifically prepare yourself today for our meeting. Following issues are of vital importance to me, as the mayor and meeting leader, to ensure a successful and profitable process of the meeting for our town:

1. Name the areas of tasks and responsibility in your interest groups and the names of the actual contact person. Use the handed out name tags and write down the names and task areas by hand today. Please print a respective name tag in color with the template on the high school’s server for the meeting.
2. Structure your data, facts and arguments in detail in a mind map.
3. Prepare a 5-minute-statement for the information and planning meeting, which will be held by the speaker of the group.
4. Use the relevant sources on the internet today, and the information posters of the touring exhibition “Fascination Offshore”, which are presented in the physics room P1.

As the mayor I thank you for your special engagement and look forward with pleasure and confidence to the information and planning meeting as a pioneering element in the plans for a better future for our town.

Kind regards,

Dr. Franke
Mayor of Miesbach / Upper Bavaria

4

Information and Planning Meeting

Information and Planning Meeting

Schedule

Time: 01:00 to 02:20 pm, max. 1.5 h

Room: Physics (class) room with variable seating plan

6 group tables as a rectangle

2 group members sit at a table and max. 4 behind as participants at the information and planning meeting for the planned project about the energy revolution "Miesbach taking part in the Offshore wind farm project OMEGA VENTURI"

Timetable

1. Welcoming by the mayor

2. Opening statement of the groups, max. 5 min., PPP possible

01:00 – 01:30 pm Order:

1. Experts of the operating company from the wind farm „OMEGA VENTURI“
2. Representatives of the financial capital company "SHARK INVEST LTD"
3. City council with treasurer
4. Scientists from the institute for applied marine research Kiel
5. Representatives of the environment activist group "Save the Ocean"

3. Discussion about the project

01:30 – 01:50 pm moderation: mayor

4. Closing statement about the project and naming of open questions about the project

01:50 – 02:00 pm

5. Debrief of the business game

02:00 – 02:20 pm

(Method: 4 E)

Emotions: chair circle

Events: chair circle, roles „taking“

Explore: chair circle, outside the roles

Everyday life: chair circle