



# Oceanography and Climate Change

Business Game Offshore Wind Energy



## Teacher's guideline

Responsible Research and Innovation [www.irresistible-project.eu](http://www.irresistible-project.eu)





Colophon



IRRESISTIBLE is a project on teacher training, combining formal and informal learning focused on Responsible Research and Innovation. It is a coordination and support action under FP7-SCIENCE-IN-SOCIETY-2013-1, ACTOVITY 5.2.2. Young people and science: Topic SiS.2013.2.2.1-1 Raising youth awareness to Responsible Research and Innovation through Inquiry Based Science Education. The project IRRESISTIBLE is funded by the EU as FP-7 project number 612367

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Deutsches Museum



Technische Universität München



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

# General information

If you already have experiences with pupil-activating and problem-orientated learning environments in your teaching job and maybe have already taken part in a business game like the business game “Energetingen” about the energy revolution in Germany, it will surely be easy for you to use this module. If you have a very little experience with business games so far, this module is a good start for this teaching method.

The business game Offshore is a so-called frame game. It is planned, that you fit the business game to your own needs and country-specific conditions. That way the city and the real project will naturally come from your own country and country-specific conditions can lead to changes on the part of the actors. But it is important that the game can also simply be played in its basic form at any time.

The business game “Offshore wind energy” can be played alone as well as it can be linked to the business game “Energetingen” (community level).

If there are any questions or suggestions, especially if there are any progress reports and requests for further offers about business games and problem-orientated learning environments, the developer of the module senior teacher Klaus Masch from the TUM School of Education, Munich, will gladly be there for you.

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# Overview on the module



## Overview on the module

### Short description

The module “Oceanography and Climate Change” highlights the influence of mankind on the oceans. Covering more than 70% of the globe, oceans have a significant impact on the climate on earth. Due to their immense size, oceans are relatively inert systems, but being confronted with immense intakes from various domains (CO<sub>2</sub>, plastics, pollutants, ...), we have come to a level where conditions change. Illustrating some of these domains and their influence is the core idea of this module.

The submodule “Business Game Offshore” is a simulation game in which students discuss the possible investment of a municipality into an Offshore wind farm. They research and adopt the roles of different stakeholders (e.g. the local mayor, a representative of the company operating the wind farm, an ocean research scientist, an environmentalist) and debate the risks and benefits of the investment in the light of local (municipal) and global (ocean) aspects.

### Framework

**CoL members:** Paul Hix, Klaus Masch, Michael Röhricht, Christian Sicka, Thomas Weingand, Sabine Wirth

**Module focused on:** grade natural sciences / physics course (15+ years)

**Number of participants:** 6 – 36 pupils



**Duration of the module:** 5 hours (á 45 min) + individual research (homework)

**Starting level:** The students need to know how to conduct basic background research on a topic in order to prepare for their roles.

### Learning goals and learning outcomes of the module

**Main goal:** Students gain basic knowledge on this complex problem and understand that many stakeholders with different viewpoints are involved in solving this problem. They learn how to channel information and knowledge from research and innovation into a social and political debate and receive insights into how responsible decisions are made on such issues. The students should then be able to transfer this process to other topics concerning research and innovation.

### Learning outcomes (content)

At the end of the module, students will be able to:

- Present and debate the risks and benefits of Offshore wind farm from the viewpoint of their individual roles, based on their own research.
- Understand and accept that various stakeholders have different viewpoints in regard to a complex problem.
- Understand how political processes can lead towards responsible decisions in complex problems.
- Comprehend that complex problems do not have clear-cut 'right' and 'wrong' solutions, but require a process of compromise and responsible decision making.



### Learning outcomes (RRI)

At the end of the module, students will be able to:

- Independently research and adopt roles of different stakeholders who discuss the risk and opportunities of building an Offshore wind farm. This includes condensing a wide range of information into concise facts and the presentation of these. They will also be able to reacting to counter-arguments based on their acquired knowledge. ("Science Education")
- Adopt and present different roles and opinions in regard to a subject which do not necessarily conform to their personal views. ("Engagement")
- Understand that political decisions can be greatly influenced by insufficient preparation of individual stakeholders. Thus, in order to enable a fair debate, all parties must have access to all necessary information. ("Open Access")
- Identify and present social and ethical aspects within their own role and understand and accept that other stakeholders might have other social and ethical aspects. ("Ethics")
- Recognize that there can be significant differences in what and how men and women contribute to a debate, both in regard to the content as well as in how it is presented. In a responsible decision making process the arguments of both genders need to be considered. ("Gender Equality")
- Comprehend the processes involved in decision-making processes in politics and regulation. In a complex problem scientific facts are only one of the factors which contribute to the final decision. ("Governance")

### Learning activities

#### The use of the 6E model to structure the module:

Engage: The module starts with a description of the scenario: in order to secure the future energy supply, the local community (adapted to local town name and situation) would like to invest in an Offshore wind farm and invites a number of stakeholders to a council meeting to discuss the proposition.

#### 1-Overview on the module

**Explore:** After the initial presentation the students choose a stakeholder role. They then have to explore relevant facts and arguments in order to present and defend their position on the issue. This also includes considering the arguments of other stakeholders and preparing appropriate responses. This can be done in numerous ways: internet research, literature review (e.g. in a library), visit to a science center or museum, dialogue with relevant scientists and experts.

**Explain:** In the municipal debate pupils have to present and explain their viewpoints and arguments as a specific stakeholder within their role. This can range from technical and scientific information to social, ethical and personal points.

**Elaborate:** After the initial viewpoints have been given in the municipal debate, the pupils have to react to the statements of the other stakeholders and elaborate on their previous presentations. The pupils will be required to develop and refine their standpoints based on both their initial research as well as on the new information of the other pupils. This phase also requires pupils to reflect on their initial views in light of the emerging complex problem, thus challenging them to develop and propose a responsible decision.

**Exchange:** An exchange takes place at different levels throughout the simulation game: usually an identical stakeholder role is assigned to two or three pupils. In the research phase these have to work together, exchanging findings on facts and arguments.

Also various different stakeholder groups with similar goals can be encouraged to meet prior to the ‘municipal conference’ and exchange ideas. The main exchange then occurs in the ‘municipal conference’, where the various stakeholders debate the issue of whether the municipality should invest in Offshore wind energy.

Individual actors can also create a 5-minute-video about the topic of Offshore wind power which can then be submitted to a video competition (e.g. “Jugend präsentiert” – youth presents)

Finally, it is also possible to exchange the findings of the conference with other pupils, teachers and/or parents, e.g. by presenting the various viewpoints in an exhibition or publishing an article on the proceedings and outcome of the conference in the school newspaper.

**Evaluate:** The simulation game always ends with a communal debriefing session, in which the pupils reflect on the simulation game. First, they focus on their emotions within their roles, then they ‘discard’ their roles and discuss the content, process and result of the conferences, as well as any impact they might see on their everyday life.



#### Addressing RRI:

When performing the module, different RRI aspects show up, but are not highlighted as such. In the debriefing session a reflecting unit is embedded, looking back and collecting all those pieces of RRI:

**Engagement:** In the roles of various stakeholders the students actively participate in a debate on a current and important topic with local and global aspects.

**Gender Equality:** The pupils prepare and ‘play’ their roles according to their own gender.

**Science Education:** In their preparation the pupils need to research a wide variety of facts and arguments from different fields (basic knowledge, current research, society, ethics ...), thus linking science education with other fields and encouraging interdisciplinary work and thinking.

**Ethics:** In the debate the different stakeholders present numerous, often conflicting ethical concerns in regard to the scenario. This gives the pupils an insight into the nature of complex problems which often do not have clear-cut 'right' and 'wrong' solutions, but require compromise and responsible decision making.

**Open Access:** The role of openly available information is touched at several points. During the reflecting unit it is discussed in the framework of media literacy.

**Governance:** During their research phase several groups are confronted with regulations concerning the 'use' of maritime environment, e.g. how far off the coastline or natural habitats a wind farm may be placed.

## Assessment

The achievement of the learning goals is assessed at the end of the module

- Reflection on RRI in the debriefing session
- Outcome of municipal debate
- RRI questionnaire

## Planning the course



Phase	lesson (45 min)	Comment
Engage phase	1-2	Resources: starting position, role profiles  RRI criteria: All RRI criteria are addressed in this phase.
Explore and Explain phase	(homework)	Resources: internet, books, films  RRI criteria: Science Education, Open Access, Ethics, Gender Equality
Elaborate and Exchange phase	3-4	Resources: materials for municipal conference (name tags, computers with internet access, overhead projector and transparencies)  RRI criteria: All RRI criteria are addressed in this phase.
Evaluate phase	5	Debrief session

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# Procedure of the Business Game

## Procedure of the Business Game

### 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.

### Actors

1. Mayor, opposition leader in the city council (teachers)
2. City administration with the treasurer
3. Representatives of the financial capital company "SHARK INVEST LTD"
4. Experts of the operating company from the wind farm „OMEGA VENTURI"
5. Scientists from the institute for applied marine research Kiel
6. Representatives of the environment activist group "Save the Ocean"

### Performance of the business game "Offshore"

1. Introduction to the business game: Current press report about the building of electricity routes to Bavaria and a short commercial clip about Offshore wind farms (YouTube); PPP for introduction with outline data, for example energy/electricity need for Bavaria 2013
2. Naming of the actors and stakeholders (design according to PBL), arrangement of the starting position for the groups; the pupils give themselves role names and arrange, extend and find the most important tasks within the group.
3. Research phase
4. Preparation of the information and planning meeting
5. Performance of the information and planning meeting
6. Debrief

### Material for the business game "Offshore"

1. Current press report about the topic HVDC
2. Commercial clip Offshore (YouTube)
3. Project outline data about the wind farm „OMEGA VENTURI“
4. Starting position for the actors
5. Time table / time schedule with all milestones in the business game
6. Literature and information material analog/digital

### Activities in the business game "Offshore"

Individual actors create a 5-minute-video about the topic Offshore wind power, in which the basic principles of the generation and / or impacts on flora and fauna are dealt with. With this video clip you can take part in the competition "Jugend präsentiert". (Youth presents)