



Getijdencentrale
Brouwersdam

Tidal Power Plant Brouwersdam Project Bureau
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ZUID



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Introduction

A tidal power plant, if chosen, will be the visible result of an intensive process of modelling, interaction and dialogue with the market and with stakeholders in the area. The lessons that were learned and the approaches and instruments that were developed are much less visible to the outside world. That is why the Project Bureau is making those lessons explicit in this report, so that future projects can be developed and marketed quickly, effectively and jointly.

You can read the results of the precompetitive phase and make your own calculations using the extensive documentation about the precompetitive dialogue. All results and insights, all information supplied by the Project Bureau and all studies are combined in this documentation. Only the confidential, competition-sensitive information contributed by market parties is excluded.

With this extensive documentation, the Project Bureau has provided a substantive basis for the follow-up and has also guaranteed a level playing field for the future market approach. This document is an English translation of the summary of the Dutch-language report on the precompetitive phase. This summary is more comprehensive than usual, so that it can be read as a standalone document. For more background information, please refer to the Dutch-language report.

All relevant documents from the precompetitive phase have been made available to the market parties and can be accessed using a special download page on the website of the Tidal Power Plant Brouwersdam Project Bureau: www.gcbd.nl/PF. The majority of this documentation is in Dutch. If you would like more information, please contact the Tidal Power Plant Brouwersdam Project Bureau. The relevant contact data is displayed on the back cover of this document.

Summary

Background

In the Southwestern Delta Steering Committee (ZWD), the State and the region are working to create an economically vital, ecologically resilient and water-safe delta. The focus is on the Grevelingen and Volkerak-Zoommeer basins. In the State development strategy by the same name, the preferred alternatives have been worked out for both basins.

For the Grevelingen basin, the focus is on improving the water quality in accordance with the European Water Framework Directive. It is important to improve the availability of oxygen in the deeper layers of the basin and to halt the deterioration of the soil organisms. This will stimulate fishing, recreation and tourism in and around the Grevelingenmeer basin.

After the construction of the Brouwersdam in 1971, the tide disappeared, resulting in unfavourable conditions for the water quality and the soil organisms. To allow for sustainable improvement of the situation, it is necessary to restore a limited tidal range. To do this, an adjustable water passage in the Brouwersdam is necessary between the Grevelingenmeer and the North Sea. And to permanently guarantee the safety of the area, it must be possible to close this water passage.

The water passage through the Brouwersdam can be upgraded to a tidal power plant. This would increase the social value of the restoration of the tide because it would create an innovative demonstration project that not only has export potential but also contributes to the sustainable energy objectives.

On 5 June 2013, a Steering Committee and the Tidal Power Plant Brouwersdam Project Bureau (GCBD) were formed to explore the feasibility of a tidal power plant. As part of that exploration, the GCBD Project Bureau organised an extensive precompetitive dialogue with market parties in the hydraulic engineering and energy sectors. The Project Bureau also held dialogues with local stakeholders and social organisations.

Approach

What makes a tidal power plant in the Brouwersdam special is the relatively limited tidal ranges on both sides of the dam. The extraction of 'tidal energy' in a cost-effective and fish-friendly way from such a small drop has never been done before. This is an excellent chance to introduce new and innovative delta technology. In a precompetitive dialogue, Rijkswaterstaat, the Provincial Governments of Zuid-Holland and Zeeland and the Municipalities of Goeree-Overflakkee and Schouwen-Duiveland challenged market

parties to come up with an innovative proposal for a feasible business case.

This dialogue began in November 2013 and continued up to December 2014. It examined how the financial gap of the power plant can be reduced and which solutions are required to do this. In the precompetitive dialogue, after an initial session with market parties (market consultation), a process of Joint Fact Finding (JFF) was initiated, followed by a Red Flag Analysis (RFA). Furthermore, talks were held with the Ministry of Economic Affairs and a number of banks. These processes and talks are outlined below.

Joint Fact Finding

The Joint Fact Finding (JFF) is a process in which the Government and market parties together want to gain an understanding of alternative solutions to a social challenge put forward by the Government. The market parties contribute knowledge and help to map out uncertainties, risks and opportunities. As part of this, expert knowledge and various models are used in conjunction with each other to test the knowledge that has been brought to the table. This provides a reliable picture of the suitable variants. Specific knowledge contributed by the market parties about variants they have proposed is not made public to ensure that balanced market relationships can be maintained. This was agreed in a non-disclosure agreement with the participants during the JFF process.

The aim of the JFF process is to determine the scope for solutions in order to arrive at an optimal proposal at a later stage. To reduce the financial gap, the costs of the proposed variants were calculated on the basis of several business cases. At the same time, this insight helps to reduce uncertainties in the project and to gain an understanding of the costs so that the parties can see the risks and opportunities more clearly and make better choices during any follow-up procedures.

Using this method, the function and intended and unintended effects of a planned engineering structure in its surroundings can be modelled with the relevant stakeholders at an early stage in a project. This is how the Project Bureau realised the need for co-creation. The intended result was a more comprehensive picture of the future costs, benefits and social effects, including any bandwidths. In this way, factors that have a major influence on the results are made visible so that they can be utilised more effectively in the follow-up approach. The results of the JFF were used to draw up the design for the State development strategy for the Grevelingen and Volkerak-Zoommeer basins (RSV).

Red Flag Analysis

The Red Flag Analysis (RFA) is a process during which the Government and the market identified optimisation opportunities and cost savings in the measures needed to reduce tidal effects in both the Grevelingenmeer and the Volkerak-Zoommeer basins. The Volkerak-Zoommeer basin will become salty as a result. Four consortiums took part in this process in May and June 2014. The participating market parties ascertained that a total saving potential of 20% is possible for this package of measures if the implementation of the package is put out to tender early and in an integrated approach. The results of the RFA were used in the consultations between the Minister and the Southwestern Delta Steering Committee, which were held on 2 July 2014.

Energy

Talks were held with potential energy purchasers, energy experts, banks and the Ministry of Economic Affairs to gain an insight into the way the tidal power plant can best be positioned in the electricity market. Tidal energy emerged as a valuable addition to other types of sustainable energy, but it is not (yet) possible without energy subsidies (e.g. DEI and SDE+). The Ministry of Economic Affairs recently commissioned a study entitled 'Market Opportunities for Energy & Water'. In the study, diverse types of energy from water are classified according to their importance for sustainable energy in the Netherlands and their export potential. Tidal energy scores high on both scales.

Models

For the JFF process, a modelling team with guaranteed expertise was formed. All of the models and the basic principles were validated. The result is a business case for each variant. The basic principles were recorded in a list of generic parameters, based on requirements from the competent authority (Top Requirements) and supplemented with other generic basic principles. In addition, a list of specific parameters was drawn up that are specific to the consortium; these parameters are confidential. Based on the results, a risk analysis and a sensitivity analysis were conducted to test the robustness of the variants. All the results were discussed with the relevant market parties, leading to this report, which is aimed at making all the public information available to the market. All the underlying public reports and records were published on the website of the Tidal Power Plant Brouwersdam.

On the basis of the end result, consultations were held with the Ministry of Economic Affairs and a number of leading banks to determine whether financing and subsidies are realistic and feasible. The Ministry of Economic Affairs and the banks evaluated the assumptions and basic principles and pronounced them to be 'healthily conservative'. The banks would like to be involved in the follow-up. The Ministry of Economic Affairs is also exploring possibilities to take part in the follow-up.

Results of the precompetitive dialogue

The results of the market consultation and specifically the JFF process are recorded in confidential reports. A summary of the public data in the JFF is displayed in Table 1.

A number of different variants were studied on the basis of free-flow turbine technology. At this stage, the best variant has a negative project result of € -40 million and supplies around 16 GWh/y of energy to five thousand households. However, this variant has no positive internal rate of return (IRR). This variant requires additional public funding. With this project result, a variant with free-flow turbines is comparable to a water passage without a tidal power plant.

The (near) full scale variants have a negative project result of € -30 to € -63 million and supply between 85 and 116 GWh/y of energy to 25 to 35 thousand households with a positive internal rate of return (IRR). A (near) full scale variant therefore scores equally as a water passage without a tidal power plant, but with a positive IRR.

To calculate the water passage according to the ECKB¹ method, an optimisation was implemented on the basis of an expert meeting, and the project result for the water passage variant without tidal power plant was set to 'zero'. The other variants were optimised during the JFF process and during an additional study. The scale advantages of 20% in the RFA have not been applied to the water passage variants with a tidal power plant. For these variants, a number of opportunities for optimisation have been identified.

Here, the project result of the variants with a tidal power plant are estimated in the following way:

- For the near full scale variant, the project result is defined as positive;
- For the variants with a bulb turbine, a positive internal rate of return was already calculated without optimisation. This means that the bulb variants can be potentially financed on the basis of Government funding of € 100 million for the measures in the Grevelingen basin.

Level playing field

In this precompetitive dialogue, the market and the Government have studied whether a Tidal Power Plant Brouwersdam is feasible and have also examined the scope for solutions that is necessary to achieve that. During this process, market parties have contributed their confidential knowledge, the global end results were made public and confidential information was protected. To guarantee a level playing field in the competition phase, all the public information has been made available in this report.

¹ Costs and Benefits Expertise Centre (ECKB), Rijkswaterstaat

Table 1: Variants of business cases for a Tidal Power Plant Brouwersdam

	water passage	Seasonal power plant	Free flow small	Free flow large	Near Full Scale	Full Scale
Installed capacity (MW)	not applicable	4-5	4-5	14	25	41
Turbine type	not applicable	Free flow	Free flow	Free flow	Bulb	Bulb
Energy production per year (GWh/y)	not applicable	11	16	28	85	116
Number of households	not applicable	3,200	4,800	9,000	25,500	34,900
Investment nominal (mln€)	100*	161**	161**	185**	250**	353**
Project result NCW (mln€)	-27	-43**	-40**	-41**	-30**	-63**
Project result after optimisation* NCW (mln€)	0	+/-	+/-	+/-	+	+/-
Internal Rate of Return	not applicable	0%	0%	0%	+	+

* After optimisation estimate for water passage.

** Without optimisation estimate for tidal power plant.

Parties that showed an interest in the market consultation are invited to take part in the JFF. In a session held on 9 January 2014, all the parties were notified about the structure of the JFF. A selection process was then held in which three of the five interested parties were selected on the basis of their competency and the quality of the process. These parties were granted a predefined amount as a fee for engineering costs.

All parties that took part in the JFF process signed a non-disclosure agreement. This agreement safeguards the confidential part of the knowledge and it has also given the Government and market parties an insight into the feasibility and requisite scope for solutions.

In a plenary session held on 20 May 2014, the results of the JFF were presented to all stakeholders in the market consultation. A report was drawn up of this session.

The stakeholders for the JFF were invited to take part in the RFA. In the RFA, one of the parties submitted an Unsolicited Proposal for a possibly feasible variant. After a Quick scan, it was decided to study this variant in a similar way as was done in the JFF. The results are made available in a report.

In the impending call for tenders, the process described in the market approach will be followed.

For all participants in the call for tenders, a level playing field will be guaranteed because:

- All public information in the precompetitive dialogue has been made transparent and accessible in a report;
- No information whatsoever has been shared with participants in the JFF and RFA that they could use to obtain an unbridgeable knowledge advantage;
- Selection in the tender procedure is based on competencies, quality of processes and the ability to work together; all this based on a functional programme of requirements.

Social embedding

From the very start, the Tidal Power Plant Brouwersdam Project Bureau has focused on a good social embedding. Social embedding is aimed at connecting government organisations, businesses, residents and market parties with each other so that they can take advantage of the opportunities a water passage – where relevant, upgraded to a power plant – has to offer. In this interaction, there is also space for sharing questions and concerns with each other. A number of social needs will be included in the tender procedure as a special requirement and will therefore play a role in the evaluation of the proposals in the tender offers the market parties will make. Other social requirements can be included, for example, with the mitigating measures.

Conclusion

Based on the results presented in this report and the insights gained from the precompetitive dialogue described in the underlying appendices, the Tidal Power Plant Brouwersdam Project Bureau has come to the following conclusions:

- 1 It is feasible to upgrade a lockable water passage in the Brouwersdam to a tidal power plant. Here, the following basic principles apply:
 - The Government will contribute € 100 million to the total costs of the measures in the Grevelingen basin;
 - If the project is realised, the market party or parties can realise a cost reduction of 20% by jointly including the tidal power plant - provided they do this punctually and completely - in an integrated tender procedure with other measures in the region.
- 2 After taking the known optimisation possibilities into account, the project result of the variants with a tidal power plant will be determined in the following way:
 - For the near full scale variant, the project result is estimated to be positive;
 - For the variants with a bulb turbine, a positive internal rate of return (IRR) has already been calculated without optimisation. This means that the bulb variants can be potentially financed on the basis of Government funding of € 100 million for the measures in the Grevelingen basin.

For the free-flow variants, the investment costs for an exploitable tidal power plant in the Brouwersdam are between € 163 and € 185 million and for the bulb variants between € 250 and € 350 million.

- 3 An exploitable tidal power plant is possible within a search area of between 5 and 45 megawatts of installed capacity. Annual production is between 11 and 116 GWh/year. Different turbines are possible within this area:
 - The variants with free flow turbines are at the bottom of this bandwidth; These variants are cheaper, have a lower energy yield and on balance have a neutral project result compared to the variant with just a water passage;
 - The variants with modified bulb turbines are at the top of this bandwidth. These variants are more expensive, have a higher energy yield and on balance are indicative of a positive project result compared to the variant with just a water passage.

The Ministry of Economic Affairs and a number of leading banks have stated that the business cases for a number of the variants are realistic. The market parties in question and the Tidal Power Plant Brouwersdam

Project Bureau see good opportunities for further optimisation of the business cases that were presented.

- 4 As a result of the precompetitive dialogue a cost reduction of 20% is possible if the measures for the Grevelingen and Volkerak-Zoommeer basins are put out to tender at an early stage and in an integrated approach. The challenge, which is to fulfil the objectives for the water quality in both basins and for energy-from-water in conjunction with each other, can best be tackled in a market approach with two lots:
 - 1 Restoration of tidal forces on the Grevelingenmeer basin and the Volkerak-Zoommeer basin (making this basin salty); and
 - 2 Energy-from-water in the Brouwersdam.

By choosing this approach, it is possible to arrive at a design with a public-private alliance in an optimisation process in which a tidal energy power plant is integrated with the lockable water passage in the Brouwersdam necessary to improve the water quality in the Grevelingenmeer basin.

- 5 There is broad support among local stakeholders for upgrading the water passage to a tidal power plant, provided that this also allows for the sustainable preservation of the Noorderzeestrand, that it is realised in a fish-friendly manner, and that the use of space on the dam and in the recreational areas in the immediate surroundings is limited. Private citizens and businesses are willing to take responsibility for improvement of the quality of their living environment and to invest time and money in it.
- 6 For a successful tender procedure the following conditions must be met:
 - On behalf of all public parties, a single client will be mandated that will manage the tender and the subsequent phases (plan development, preparation, realisation and – after the decision-making process – actual realisation), preferably Rijkswaterstaat;
 - The procedure will have a go/no-go moment in 2018. In the case of a no-go decision, the public parties will remunerate the planning costs for water quality measures incurred by the market parties;
 - More certainty will be provided in advance about the public conditions for the energy component of the tender.

The Tidal Power Plant Brouwersdam Project Bureau is a joint venture between:



provincie **HOLLAND**
ZUID



Provincie **Zeeland**



Rijkswaterstaat
Ministerie van Infrastructuur en Milieu



gemeente
Goeree-Overflakkee



Gemeente
Schouwen-Duiveland

Planning

2013-2014

Programme Area development Grevelingen and Volkerak-Zoommeer and a study into the (financial) feasibility of the tidal power plant

2013-2014

Consultation with market parties and other stakeholders

eind 2014

Design-State development strategy Grevelingen and Volkerak-Zoommeer, including decision on restoring the tides in the Grevelingen basin

2015-2017

Selection and optimisation of turbine technology in the Grevelingendam test centre

2015-2016

Permits, financing, and investment decisions

2016-2017

Awarding of the contract to a single consortium

2018

Start of work on the tidal power plant

2020

Commissioning of the tidal power plant

More information

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