Grevelingen Tidal Project

Market consultation about a flood barrier variant with tidal power plant

2018 market consultation final report

Date
30 March 2019

Status
Definitive final report

project
GetijGrevelingen

Foreword

In 2014, the Cabinet selected the improvement of water quality in Lake Grevelingen as a development perspective in the Government Development Plan design for Lake Grevelingen and Volkerak-Zoommeer. For this purpose, tides will be reintroduced on the lake to a limited extent through a flood barrier in the Brouwersdam that connects Lake Grevelingen to the North Sea.

The basic principle is a tidal range of no more than 50 cm for an average median level of 0.20 m below sea level (NAP), the current middle water level. The partnership aims to find out whether the function of the flood barrier can be combined with a Tidal Power Plant. The state's prerequisite is that the project itself must be self-sustaining as public funds are intended for water quality or fall under regular subsidy programmes.

On 7 March 2018, the Ministers of Infrastructure and Water Management and the Ministry of Agriculture, Nature and Food Quality announced their intention to make an additional €75 million available for the construction of a flood barrier (letter TK IenM/BSK-2018/41968). This meant the funding was in place, and the Grevelingen Tidal Project has been given the go-ahead. Preparations are being made to take an MIRT 2-decision in 2018 (Dutch Multi-Year Programme for Infrastructure, Spatial Planning and Transport). A choice will be made as to which variant(s) within the scope of the project are to be included in the plan development phase (MIRT 3).

Whether the Tidal Power Plant variant is included in the plan development phase depends in part on market interest. The Tidal Power Plant Steering Group has commissioned a study to assess market interest and to make all public information regarding this variant available to the market.

Turnout during the market consultation was high; questionnaires were answered in detail and orally clarified, and clear guidelines were established. I would therefore like to thank those market parties for their participation. Their involvement has provided a clearer picture of the boundary conditions that would need to be in place to facilitate a tidal power plant. The document is the final report of the 2018 market consultation.

The market consultation and complementary investigations have demonstrated that a flood barrier with a tidal power plant can contribute to public water-quality objectives. On this basis, it is advised that the tidal power plant should undergo further investigation in the plan development phase.

Han Weber

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Chairman Steering Group Tidal Power Plant Province South Holland

Summary

Background

This final report of the market consultation has been compiled by the Grevelingen Tidal Project by order of the Steering Group Tidal Power Plant. It outlines the results and all relevant information from the 2018 market consultation.

The Grevelingen Tidal Project is investigating the feasibility and affordability of the reintroduction of tides to Grevelingen, possibly in combination with a tidal power plant. As part of an MIRT 2 decision, likely in 2019, recommendations will be issued to public partners in the partnership regarding which variant(s) in the project scope will be incorporated into the plan development phase. Market interest in a tidal power plant variant will be taken into consideration.

The market consultation involved contributions from contractors, turbine constructors, engineers, and consultancy firms. 24 companies registered for the market consultation day on 8 November 2018, with an attendance of 57 people.

Approach

The market consultation comprised comprehensive documentation of all publicly available information relating to the flood barrier variant with a tidal power plant. The plenary meeting and detailed sessions on the market consultation day offered the opportunity to ask questions, a report of which was compiled. The questions were then answered in writing on a topic-by-topic basis and summarized by the project organization. Individual discussions then followed with those who responded to the questionnaires in writing. These discussions went into further detail about the risks and opportunities specified by the market parties. Concise reports were compiled of these discussions and submitted for comment. The Grevelingen Tidal Project team compiled a draft final report, which was submitted to an internal review team. The recommendations are included in the final report. The reference list contains all relevant underlying information and reports from the market consultation.

Conclusions

Please see Section 5 for a complete overview of the conclusions. The following is a broad outline of the conclusion.

The key question in this market consultation is if and to what extent the market is interested in risk-bearing participation in a tidal power plant. The conclusion is that the majority of participants have, from different perspectives, indicated that there is a high degree of interest in risk-bearing participation.
Based on the information provided during this market consultation, this interest cannot yet be pledged with absolute certainty. Further insight is, therefore, required. This insight must be accrued during the plan development phase in consultation between public and private parties. This phase must be concluded with a go/no-go moment, at which point a definitive decision can be taken.
Market parties have indicated that their commitment to the plan development phase must be fully reimbursed, should the government arrive at a no-go decision. This relates to all decisions taken or that can be taken by the government alone, including the SDE+ subsidy. Proper distribution of risk, opportunities, and conditions precedent for a no-go are essential in this regard.

Energy yields are, to a significant extent, dependent on water-level management and sea-level rise and whether or not an SDE+ subsidy is granted. Consideration should be given to whether or not to pay on the basis of the availability of the tidal power plant for energy generation, as is typical in a DBFM situation, whether or not in combination with an SDE+ subsidy for energy production.

On the basis of the risks in Table 3 (paragraph 5.2), it can be concluded that the market is unable to bear all of the risk, as a number of the risks rest with the government. Yields cannot be determined themselves in view of the fact that the basic principles, such as water-level management and storm closure, have not yet been established. The capacity to operate is broadly recognized but cannot be determined in detail. Market parties recognize a number of opportunities that may be capitalized on as part of joint elaboration during the plan development phase. A key success factor is, therefore, an open and transparent partnership.

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1 Reason and objective

1.1 Introduction

This final report of the market consultation has been compiled by the Grevelingen Tidal Project by order of the Steering Group Tidal Power Plant. It outlines the results and all relevant information from the 2018 market consultation.

All relevant information can be found

- on TenderNed
- at www.gcbd.nl and

The Grevelingen Tidal Project is investigating the feasibility and affordability of the reintroduction of tides to Grevelingen, possibly in combination with a tidal power plant. As part of an MIRT 2 decision at the end of 2019, advice will be issued to public partners in the partnership regarding which variant(s) in the project scope will be incorporated into the plan development phase. Market interest in a tidal power plant variant will be taken into consideration.

Grevelingen Tidal Project programme

Brief outline of the project

We would like to improve the quality of the water in Lake Grevelingen through the limited reintroduction of tides. This is good news for underwater wildlife and offers opportunities for more integrated environmental improvement in the long term. It provides a robust basis for sustainable development of the area as a whole, with social, economic, and environmental development in full equilibrium. A flood barrier would need to be provided to facilitate the reintroduction of tides. This would offer the opportunity for sustainable energy generation by means of a tidal power plant.

Background

In 1971, Lake Grevelingen was closed off by the Brouwersdam as part of the Delta Works, ensuring safety in and accessibility to the area. Lake Grevelingen has since developed to become a nature area of international importance, attractive to visitors for its recreational opportunities and diving and vital to shellfish fishing.

The quality of the water in the area has, however, deteriorated over the years, with the disappearance of ebb and flow contributing to a lack of oxygen in certain areas. This has led to ‘dead soil’, in which only bacteria are able to thrive. The lack of soil life means that an important link in the food chain is missing, increasing the vulnerability of the overall ecosystem.

Action needs to be taken to improve the situation, which will benefit not only the environment but also the continued sustainable development of water-based and land-based recreation, tourism, fishing, and the regional economy.

Safety and innovation

A closable flood barrier in the Brouwersdam will mean the reintroduction of tides to Lake Grevelingen. To ensure manageability, the reintroduction of times would be limited, helping to ensure safety. In this regard, we take into account sea-level rises as the result of climate change.

The flood barrier in the dam would also offer opportunities for combination with a tidal power plant for the generation of sustainability energy, harnessing the natural ebb and flow of the water. The expertise acquired in this innovation is an interesting export product to river deltas elsewhere in the world where sea-level rise is also an issue.

Legal framework and environment
The flood barrier would satisfy the water-quality requirements as stipulated by the Water Act. Realization of the project must also satisfy the Natura2000 legislation. The interests of all people and organizations in and around Lake Grevelingen will form a part of the development of the plan – investigations are being carried out into the effects on both sides of the dam.

Variants
A number of flood barrier variants are possible, both with and without a tidal power plant. These variants will undergo further elaboration in the plan development phase.

Timescale
The comprehensive plan for the floor barrier, with associated tidal power plant where appropriate, will be compiled shortly. The intention is for development of the plan to be completed in 2020/2021. If a tender process is to be embarked upon for construction of the flood barrier, it can commence in 2022/2023, with operational readiness between 2024 and 2026. If a decision is taken to include a tidal power plant in the flood barrier, preparation is likely to be extended by around one year.

1.2 Background

In 2014, the Cabinet selected the improvement of water quality in Lake Grevelingen as a development perspective in the Government Development Plan design for Lake Grevelingen and Volkerak-Zoommeer.'. The Ministers of Infrastructure and Water Management and of Agriculture, Nature and Food announced on 7 March 2018 that they would make €75 million available – in addition to the previously promised funds – for the construction of a flood barrier. This meant the funding was in place, and the Grevelingen Tidal Project has been given the go-ahead. The goal is to achieve a resilient and robust ecosystem by reintroducing the tide.

To reintroduce limited tides, a flood barrier in the Brouwersdam must connect Grevelingen with the North Sea again. The basic principle is a tidal range of no more than 50 cm for an average median level of 0.20 m below sea level (NAP), the current middle water level. With the ministers' decision, the funding of the public goals, as formulated in the concept Government Development Plan, has been secured.

The pledge by the region is to combine the flood barrier with a tidal power plant. In addition to generating sustainable energy, this offers opportunities for innovation and export. The state's prerequisite is that the project itself must be self-sustaining, as public funds are intended for water quality or fall under regular subsidy programmes.

The Brouwersdam Tidal Power Plant Project Agency organized an initial market consultation in 2013 as part of an early-stage dialogue with the market. Market

parties have, at various points, been able to offer advice on technology and design, risks and opportunities, financing, and market strategy. An overview of the steps followed is provided in Table 1.

Table 1: Involvement of the market in the market consultation process

Step in market consultation	Period
2013 market consultation	September 2013 - January 2014
2014 market consultation	
– Joint Fact Finding	January 2014 - January 2015
– Red Flag Analysis	June 2014 - January 2015
2018 market consultation	July 2018 - February 2019

The information from this dialogue with the market has been used to compile a business case, establish the scope of the Grevelingen Tidal Project, and formulate the question that formed the basis for the 2018 market consultation.

Preparations for taking an MIRT 2 decision were initiated in 2018. The parties are currently working on a Management Agreement to formally securely these aspects. There are two basic principles in this regard:

- In the plan development phase, the primary aim is an optimal balance between underwater and overwater nature. Secondarily, the chance of combining sustainable energy production with fish-friendly turbines in a catching opportunity.
- A decision needs to be made regarding which variant(s) in the scope will be included in the plan development. Whether the tidal power plant variant of the flood barrier is included in the project scope depends partly on market interest.

Figure 1: Location of the flood barrier in the northern section of the Brouwersdam

The Tidal Power Plant Steering Group has commissioned a study to assess market interest and to make all public information regarding this variant available to the market. This was conducted in the second half of 2018 and completed in February 2019 with publication of this final report.

1.3 Market consultation objective

The market consultation organized by the Grevelingen Tidal Project in 2018 has the following objective:

The project organization is using the market consultation to investigate market interest in risk-bearing participation in the energy component of the project in a potential win-win situation.

This is paired with the following operational objectives:

- To share the results of the 2013 market consultation widely with the market, in order to ensure a level playing field.
- To reflect on the chosen main direction of the market approach and to examine this in more depth with the market.
- Testing market interest for a tidal power plant includes the following topics:
  - General
  - Finance: feasibility of the business case.
  - Market approach: method of involving the market in the plan development phase and any possible follow-up.
  - Technology and design: an achievable design that contributes to the objectives of the Government Development Plan design.

Three variants will be considered in this assessment:

1. A floor barrier with no tidal power plant
2. A flood barrier in which a tidal power plant is installed
3. A flood barrier in which a tidal power plant can be installed at a later date

1.4 Market consultation target group

The target group of the 2018 market consultation is all private parties, individually or in a consortium, who have a serious interest in developing and realizing a flood barrier in the Brouwersdam, including a tidal power plant, and to operate the tidal power plant in a risk-bearing capacity. The target group includes contractors, turbine constructors, engineers, and consultancy firms.

2 Grevelingen Tidal Project

This chapter describes the steps that have been taken so far, the anticipated market involvement, and the anticipated timeline.

2.1 Preparations and decision on the scope of the Grevelingen Tidal Project

Layers of water that are low in oxygen continue to spread throughout Lake Grevelingen. In the Lake Grevelingen and Volkerak-Zoommeer Government Development Plan design, the government has indicated that there is no likelihood of an autonomous improvement in water quality in Lake Grevelingen. The reintroduction of tides through a flood barrier in the Brouwersdam offers the most sustainable solution for this issue.

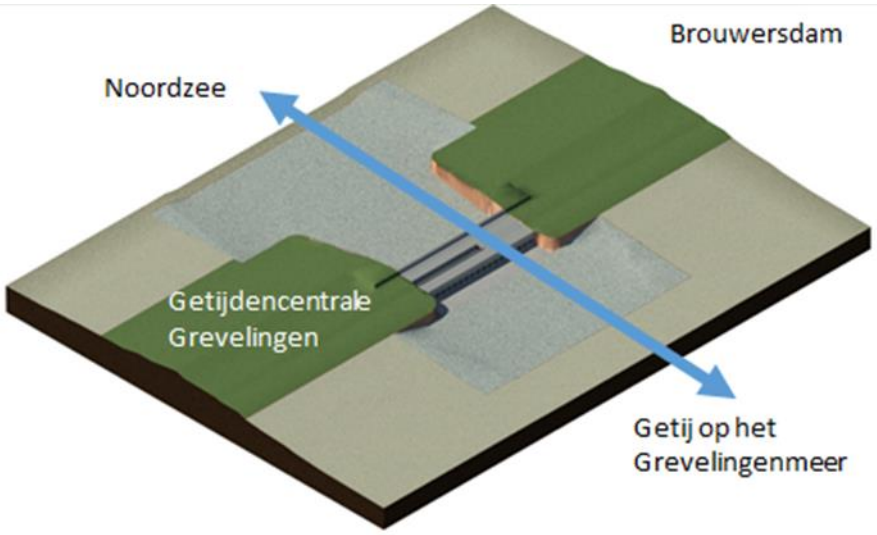

Figure 2: Position of the flood barrier in the Brouwersdam

Realizing a flood barrier in the Brouwersdam offers opportunities for generating tidal energy, namely by constructing a tidal power plant in the barrier.

The Tidal Power Plant Project Agency began investigating the feasibility of a tidal power plant in combination with a flood barrier with various market parties in 2013 in earlier stages of the market consultation (see Table 1). The results were recorded in the report of the 2015 pre-competitive phase (see www.gcbd.nl).

A reference variant and business case were developed in 2015 in cooperation with the European Interreg NWE project 'Pro-Tide'. This business case is publicly available. The business case offers market parties and investors/financiers an idea of feasibility and forms a reference on which to base their tenders.

The market had already indicated its interest in the 2015 market consultation. See the report on the pre-competitive phase (see Appendix 1 References).

2.2 Market approach during the plan development

The '2018 market consultation procedure' document (see Appendix 1 References) outlines the provisional market approach. This approach may still be amended.

In the market approach for the Grevelingen Tidal Project, the public organizations consider the following to be important:

- Early use of private company expertise. In this way, optimal use can be made of their knowledge, creativity, and innovative capacity for smart and innovative solutions.
- Interweaving of private expertise and public procedures. The spatial procedures and the design process are interwoven in an integrated design that is both financially and technically feasible.
- Rapid certainty with regard to costs so that a positive business case can be developed for the tidal energy component as early as possible.
- Designing an efficient and effective process, resulting in a shorter lead time for the entire project and limited transaction costs.
- A phased approach to achieve a manageable ambition, scope, and an indication of the financial feasibility of the overall project scope (flood barrier with integrated tidal power plant).

If the aforementioned results in this integrated variant being selected, the public organizations aim to design the market approach as follows:

- The tender phase will commence with a competition-oriented dialogue. As is typical, three parties will take part, but prompt shortlisting to decide on a single private contracting partner will remain the objective. This does justice to the complexity of the project and the requisite integrity (technical and financial) of the solution.
- An integrated contract will be concluded with the selected party for, in principle, plan development up to and including realization and operation of the integrated project. The contract will therefore be divided into two phases separated by a go/no-go decision:
  - The first phase concerns the plan development and preparations for realization with the selected partner.
  - The second phase concerns realization and operation following the plan development phase.

In the first phase, the selected partner will work with a mandated contractor on behalf of the public partners, in a form of partnership that is suitable for the project. A reason to choose a public-private form of cooperation is that government agencies would like to see generation of sustainable energy as well as the introduction of water-quality measures. The innovative character of this combination of functions requires early market involvement in order to achieve an integrated and financially feasible design.

For the second phase – realization of the integrated project, – a contract type will be selected at a later stage according to which variant is finally chosen. For a variant comprising only a flood barrier, a different type of contract would be needed than for the integrated variant.

3 The market consultation

3.1 Approach

The 2018 market consultation comprised the following components:

1. A joint meeting (market consultation day) with:
   a. A plenary session involving feedback from the previous market consultation (2013 – 2015) and the project, and during which clarification was provided on currently known issues.
   b. An interactive section, in which a discussion was held on the questions incorporated into Section 4 of the document entitled 'Procedure marktconsultatie 2018'('2018 market consultation procedure').
2. A written round, in which participants were asked to provide written responses to the questions that had previously been clarified.
3. Individual discussions, where needed, for which market parties were approached to provide further clarification on their responses.
4. A final report of the market consultation that will be published on TenderNed.

The project organization emphasizes here that this market consultation document does not form part of any future tender and that no rights may be derived from this. Suggestions and insights obtained during the market consultation will be used (where relevant) to prepare the tender procedure and the tender documents. The project organization reserves the right not to use these suggestions and insights, or not to use them in their entirety.

Planning

The market consultation forms part of the preparations for a choice of project scope within the context of an MIRT 2 decision that is expected to be made in 2019. The market orientation adheres to the timeline provided below.

2018 market consultation advance notice

An 'Advance notice of works' was issued on 12 July 2018. The invitation was sent to companies and combinations of companies that are interested in realizing the project and thus in taking part in the market consultation.

Market consultation day

The project organization held a market consultation day on 8 November 2018. The goal of the meeting was to provide participants with insight into the issues surrounding the Grevelingen Tidal Project. Participants registered via TenderNed. To enable discussion with the widest audience possible, participation was limited to two participants per organization.

Plenary discussion and sub-sessions

The project organization delivered a presentation in the morning. The sheets for this presentation are available via TenderNed (see Appendix 1: References). In the afternoon, participants were able to attend interactive sub-sessions that clarified the various topics, giving participants as much information as possible to answer the questionnaires.

Written consultation based on a questionnaire

Following the joint meeting, all participating parties had the opportunity to express their opinion by completing a questionnaire. This list is included in Section 4 of the document entitled 'Procedure marktconsultatie 2018'('2018 market consultation procedure'). The questionnaires were submitted via TenderNed.

Oral clarification of the written responses

After receiving the questionnaires, the project organization needed to look in-depth at the responses provided. All parties that had submitted a questionnaire were therefore invited to attend a discussion. The objective of these discussions was to obtain greater insight into the risks and opportunities as seen by the market.

No new information was provided to those parties invited to take part in the oral clarification. As a result, all potential interested parties were in possession of the same information, so as to ensure a level playing field.

Completion of the market consultation and feedback on the results

The project organization completed the market consultation with the publication of the underlying final report, which will be made available via TenderNed. The market consultation's most important conclusions are incorporated into the report.

In connection with this report, the project organization would like to emphasize the following:

1. The final report will be made publicly available. By participating in the market consultation, market parties have given permission to the project organization to use their responses and other information and/or data provided by them in this report.
2. The responses and other information and data provided will be anonymized for inclusion in the report. The report will contain an appendix indicating the participating market parties.

3.2 Other stipulations relating to the market consultation

To ensure that participants in the market consultation are not in a favourable position, the project organization will ensure that information shared at the market consultation is made available to all parties during the future tender procedure(s) based on the report of the market consultation.

In a future tender, no distinction will be made between private parties who have or have not participated in the market consultation.

Advancing insights or changing circumstances may result in information from this market consultation deviating from information provided at a later stage (in the context of a tender procedure or another recruitment process). As such, no rights may be derived from the information provided within the context of this market consultation.

3.3 General Data Protection Regulation (GDPR)

The GDPR details the legal handling of personal data. Data relating to participating parties were registered as part of the market consultation process (market consultation procedure document, 1 October 2018). The following outlines how these data have been processed. The data controller is the Ministry of Infrastructure and Water Management. All registered data are archived in accordance with the legal stipulations for project archiving.

To register for the market consultation, participants' names, roles, and organizations were registered via TenderNed. The data have been used solely for the purpose of the Grevelingen Tidal Project market consultation. These data were used to create the badges worn by participants during the market consultation day on 8 November 2018. The data have been saved in a file[1] that is now stored in the Grevelingen Tidal Project archive.

Written responses to the questionnaires were registered via TenderNed, with both the organization and name of the contact person also registered. Written responses have been archived in the Grevelingen Tidal Project archive.

Parties who responded to questions in writing were invited to attend a discussion that involved registering the name and organization in the Ministry of Infrastructure and Water Management Facilitor (Rijkswaterstaat Facilitor) as to facilitate building access and ensure security. To compile summaries of the individual discussions, the contact person, e-mail, and organization were registered and have been archived in the Grevelingen Tidal Project archive.

This final report on the market consultation includes the names of organizations that registered for the market consultation day. The final report will be published via TenderNed and on the website www.getijgrevelingen.nl.

A separate list includes the name and organization of participants in the market consultation and the individual discussions, provided that their consent has been granted. The list will be published via TenderNed. The Ministry of Infrastructure and Water Management intends to act with transparency in this regard and to preserve a level playing field. This also provides the market with insight into who is involved and the knowledge network around the tidal power plant.

The data files on TenderNed are secured by the Ministry of Economic Affairs and Climate Policy. The Grevelingen Tidal Project archive is secured by the Ministry of Infrastructure and Water Management.

[1] 181108 Grevelingen Tidal Project, Ministry of Infrastructure and Water Management guest list FINAL

4 Results of the market consultation

4.1 Introduction

A total of 24 companies registered for the market consultation day, with an attendance of 57 people. Of those companies, fifteen subsequently submitted a questionnaire. All of those fifteen companies then received an invitation to an individual discussion, thirteen of which accepted.

The '2018 market consultation' section of the document entitled 'Marktconsultatie over variant doorlaatmiddel met getijdencentrale' ('Market consultation about a flood barrier variant with tidal power plant') was published via TenderNed on 28 September 2018, with reference TN189894. The other section was also published, entitled 'Beschrijving variant getijdencentrale marktconsultatie 2018' ('Description of tidal power plant variant, 2018 market consultation'), including appendices with references, basic principles and considerations, and the tidal power plant factsheet.

The market consultation involved contributions from contractors, turbine constructors, engineers, and consultancy firms.

4.2 Structure of the market consultation day

The market consultation day took place in Utrecht on Thursday 8 November 2018. The event commenced with a plenary session in which the following presentations were delivered:

- Presentation by Hans Kleij (Province of South Holland)
  (for a link to the video shown, please see: Appendix 1 References)
- Presentation by Han Vrijling (Horvat & Partners)
- Presentation by Matthijs Mahler (Province of South Holland)
- Presentation by Sander Terlouw (Staatsbosbeheer)
- Presentation by Jessie van de Linden (Ministry of Infrastructure and Water Management)

The presentations are included in the reference list of Appendix 1 and are available via TenderNed and the website www.gcbd.nl.

Following the plenary session, participants took part in three sub-sessions looking at the following topics:

- Topic 1: Financial
- Topic 2: Market approach
- Topic 3: Technology and design

Two sub-sessions were held for each theme. The following paragraphs outline what the market provided in terms of relevant comments and suggestions.

The reports of the working session attempt to name the ideas and suggestions as fully as possible, without providing a verdict or opinion from the public client. Participants provided comparable suggestions during separate sub-sessions. To aid the legibility of this report, suggestions are not repeated.

4.3 Results of the sub-sessions

4.3.1 Financial sub-session

Discussion leader: Rianne Post

The session involved an open dialogue with the following questions as a guide:

- Do you endorse the basic principles employed in the market consultation and the methodology of the business case?
- What other or additional basic principles do you see?
- What risks do you think should be borne by the client for a feasible business case?
- What is your opinion on the scope of the investment – approximately €60 million – in relation to the annual energy production of approximately 60 GWh? How do you view this in relation to investments in alternative sustainable energy sources?

The market's impression was that the financing paragraph of the business case was rather too positive. A number of participants suggested that the total investment amount would be amortized over 30 years, which would be a no-go. Banks will demand an amortization period of fifteen years. In addition, financing also now presumes a 70% bank, 30% own-capital split, which would appear to be infeasible. A 50/50 split would, however, be more acceptable. There is a difference in insight here, and some banks will permit a longer amortization period for sustainability.

The market indicated that when it comes to obtaining finance, the distribution of risk in the contract must also be examined closely. Participants gave the impression that the documents compiled suggest that all risks rest with market parties. It was recommended that clarification be provided as to where the different risks should rest. Participants differed in their opinions on where the risk of not realizing energy production should rest, i.e. with the contractor or with the client. A turbine manufacturer said that energy production could only be guaranteed if all boundary conditions, i.e. tidal range and sea-level rise, are met.

A number of participants considered the estimate of 60 GWh power realistic, while others thought that it seemed optimistic. As soon as the boundary conditions are uncertain, a business case can offer nothing concrete about a profitable outcome. The Netherlands has little practical experience with tidal energy (with such a low water drop) when compared with offshore wind farms, for example. Even here, there are no turbine suppliers with fully certified turbine types. Such suppliers do exist abroad, but none were present at the market consultation. One participating party did express willingness to issue guarantees at its own risk, under penalty clause.

The manner in which the energy yield has been calculated was explained on behalf of the project organization. The year 2009 was used as a basis. According to the data available, 60 GWh is achievable, and this takes into account the rise in sea level. The discussion leader indicated that the estimate was more conservative than optimistic. The rise in sea level is, after all, not likely to be an immediate 30 cm, although this has been taken into account. With the sea level as it is today, yields would be between 59 and 62 GWh. The yield is primarily

determined by the tidal range. An Excel file is available on TenderNed showing the calculations. Participants can use the figures available to perform their own calculations.

Participants indicated that support from the government would be key to attracting financing. In particular, they indicated that making a prototype model available would help in obtaining financing. They also indicated that the government could play a role in organizing permits and connections. A separate SDE+ category for tidal energy for the next fifteen to 30 years would likewise be a useful contribution.

As far as investment costs are concerned, the market also indicated that the government could do more. This project could act as showcase, and if the government sees the benefit, they could invest more.

Participants suggested that the government could act as a guarantor in the event that the tidal power plant were not profitable, such as due to a rise in sea level. If the contractor needs to take responsibility for this, the risk involved in undertaking the project would be too great.

The same also applies to the risks relating to permits, changes in legislation, and changes to management of the ecology. All of these risks must rest with the government, as the market is unable to manage them.

The technology that would be used for the project is new technology and would involve a learning curve for the market. The government cannot expect the market to bear all of the risks of a new form of energy generation such as the one proposed from the very outset.

There were a number or participants who, by contrast, did not consider it necessary to place the risk of tidal energy with the government. It is also important to understand that the primary objective of the Ministry of Infrastructure and Water Management is to create a water management instrument. The power plant is a secondary objective.

The results of the market consultation were used to draw up the calculations. Price levels have, however, increased since then. The market advised the project organization to incorporate this into the available budget.

It was also pointed out that the combination of water management and electricity involved a risk in its integrated development, owing to the fact that the two disciplines are entirely separate.

The assessment of the relationship between investment and yield is dependent on the way in which it is viewed. The tidal power plant can also serve as an export product, thereby becoming a showcase for tidal energy. The advice was to act quickly, as there is a niche market for tidal energy. If the Netherlands does not act promptly to realize this project, there is a risk of France gaining an advantage. The Netherlands is still in a position to take a leading role.

The market also pointed out that the benefit of tidal energy over wind energy is that energy yields are more predictable. Wind energy is highly unpredictable. As such, tidal energy delivers a higher price per MWh.

In terms of the tender process, participants suggested that three parties is too many to enter into a dialogue phase and advised that it should be completed with two parties.

In conclusion, the participants were generally positive about the plan. Proper thought needs to go into the distribution of risk, and a suitable type of contract needs to be identified.

4.3.2 Market approach sub-session

Discussion leader: Ben Spiering

The session involved an open dialogue with the following questions as a guide:

- Are you prepared to commit to a task-setting budget (as yet to be determined) for the realization of the public objectives of the Grevelingen Tidal Project?
- Are you prepared to develop, realize, and exploit tidal energy, bearing the risk that this brings?
- Are you prepared to develop the bid (public objectives) and business case (energy exploitation) with the government as an alliance partner in the development of the plan?
- Are you prepared to work fully transparently?

The sub-sessions on this topic indicated that the market is certainly interested in the project. A number of participants suggested that the project is primarily of interest on account of its innovative character and the important investment opportunity that it presents. It was also pointed out that the project involves export potential and that, as a result, there are opportunities for Dutch energy developers to establish themselves on the European energy market.

In terms of the risks and distribution of risk between the client and contractor, the market indicated that the distribution needs to be more balanced and that transparency is essential in this regard. More in-depth consideration would need to be given to arrive at a proper balance.

The overwhelming majority of participants indicated that the risk profile of the project is too high or remains too high, which means that there is little willingness on the part of the market for full or partial risk-bearing participation. They suggested that the public client should lower the risk profile of the project. The general impression was that all participants are willing to bear a limited amount of risk certainly suppliers in the turbine sector – with emphasis on the fact that the project involves an innovation and that the market is not yet sufficiently mature.

The majority of participants were able to see the added value of an alliance model and remain open to entering into a partnership. A number of participants indicated that a project of this nature would not be feasible if a different type of contract were chosen.

One important request from the market was for the contract and procedure to be flexible, with a number of participants indicating that the exit strategy requires further elaboration. More clarity on the level of the tender reimbursement would be required beforehand.

In addition, turbine developers in particular were very concerned about their part in the reimbursement in the event that the tidal power plant were dropped in the

go/no-go decision after the plan development phase. This would affect them specifically; the civil engineer would still, however, be able to deliver the flood barrier. It was noted that the current procedure has the potential to provoke 'opportunistic behaviour'.

The majority of participants requested rapid consensus on the further details of the project and on transparent procedures for collaboration amongst parties. One suggestion was to look at the two-stage tender procedure as used in the United Kingdom.

4.3.3 Technology and design sub-session

Discussion leader: Matthijs Mahler

The session involved an open dialogue with the following questions as a guide:

- Is the development of the reference variant thorough and realistic?
- Do you consider the tidal power plant's 60 GWh electrical energy yield to be realistic, taking into account the requirements regarding water-level management? On what basis do you think the yield will be higher or lower?
- Are you of the opinion that turbines can be used effectively to 'fine-tune' the water level in Lake Grevelingen?
- How do you think you will be able work with the client to minimize the risk and maximize the opportunities?

The recurring points in these sessions appeared to be:

- The basic principles used
- The freedoms in the construction

Participants indicated that they had the impression that a number of basic principles had already been chosen at a technical level, based on, for example, water level and regulation. This had led to a number of technologies being excluded in advance. A number of participants indicated that the example design made available by the authorities supported their assumptions. The design included a turbine capable of generating energy that would also be capable of functioning as a pump. If additional water-level management were to be imposed as a requirement in the tender, approximately 80% of the potential turbines would be excluded. Further discussion then look place on the extent to which the function of the pump is crucial and a condition, including for the flood barrier alone. The discussion also examined the relationship between sea-level rise and the pump functions of the turbines.

Participants questioned the desired tidal range and the regulation thereof (e.g. with sluices). The market indicated that the restriction imposed on the bandwidth would have consequences for the maximum use of the turbines, leading to lower returns from the tidal power plant. Since water-level management has not yet been established, any determination of the return at this stage remains uncertain.

One participant questioned the river continuity of the tidal power plant for fish and biomass. Which standards apply? How will the number of fish be determined and to which fish does this apply? The public authorities refer to the general policy on fish-friendly activity, which is currently the basic principle.

When asked about the 60 GWh yield from tidal energy, participants indicated that it is too early to be able to provide a definitive answer. They suggested that the

figure seemed high, especially when the restrictions on water-level management are taken into consideration. By contrast, they suggested that the freedom provided for in the design of the civil construction offered scope for optimization.

Participants were curious about the option in the model of only including yields from energy generation during the flow phase. The project organization explained that, at the end of the 30-year period (with a 30-cm sea-level rise), it would be difficult to get the water out of Lake Grevelingen. If the resistance of the turbines were also to play a role in this situation, the challenge would become greater still. In addition, there is also the possibility of the tide cycle over the whole period being such that water enters the lake more easily during the flow phase than leaves the lake during the ebb phase.

Participants questioned the extent to which there is flexibility for market parties to propose modifications to dimensions such as length and depth. The project organization indicated that there is still flexibility in this regard as the example design involves assumptions. The freedoms would be limited by what is actually and legally possible at the location and with the task-setting budget.

Participants questioned the extent to which a large number of the topics that have already been fleshed out by the project are firm requirements. These included the oxygen demand, position and use of sluices, desired tidal range, and the number of shafts. The project organization explained that these were assumptions at this point in time, and that the plan development phase would involve seeking the most optimal variant in collaboration with the private consortium.

A number of participants concluded by suggesting there may be value in looking at the experiences of the Oosterschelde and the Afsluitdijk, where considerable data and experience have been amassed. It was also suggested that the current momentum be capitalized on and that decisions be taken as quickly as possible.

4.4 Results of the written questionnaires

This paragraph provides an overview of the responses to the questionnaire attached to the market consultation, ranked by the central topics:

1. General
2. Financial
3. Market approach
4. Technology and design

The following are the results and the key findings, structured by question as set out in the document entitled ‘Procedure marktconsultatie 2018’(‘2018 market consultation procedure’). The background and foundation for these topics are detailed in the document entitled ‘Beschrijving variant getijdencentrale marktconsultatie 2018’ (‘Description of tidal power plant variant, 2018 market consultation’) (see Appendix 1 References).

4.4.1 General information

The general questions relate to the market’s vision concerning the duration and opportunities for the process to be accelerated, the involvement of the government and the risk-bearing participation of the market, and the scope of the project.

A1. How can an open and interactive plan development resulting in long lead times be prevented? This project forms part of the 'impulse programme' in which lead time is a critical aspect.

The market indicated that clear, open, and transparent communication and different project management methods could help to minimize the lead time.

To ensure a firm grip on the lead time, the market expressed a preference for an integrated design for the flood barrier including tidal power plant. A clear decision for a flood barrier with tidal power plant and corresponding policy and administrative commitment would be helpful in this regard. The market indicated that prompt shortlisting in the tender process with a decision for a single alliance party/combination for development of the plan would help to minimize the lead time.

The market also suggested that clarity with regard to the boundary conditions and basic principles, a realistic plan for milestones/deadlines, and a go/no-go moment would also have a positive impact on the lead time.

The same would also be true of clear distribution of risk and responsibilities based on impact, such as environmental management (permits and support amongst stakeholders).

A2. Regarding the outlined timeframe, do you see any possibilities for acceleration?

The market indicated that the opportunities for acceleration were limited. One participant suggested that there is a possibility of shaving six to twelve months off the timeframe. Suggested possibilities for acceleration were:

- Earlier tendering with more prompt shortlisting with a decision for a single party/combination, including by shortening competition-oriented dialogue
- Reliable and clear boundary conditions
- Prompt organization of public conditions (permits, mitigating measures, support amongst stakeholders)
- More certainty in the business case through:
  - A revenue model based on the availability of the turbines
  - Integration into the grid arranged in advance by the government
  - SDE+ subsidy arranged in advance by the government

A3. Which approach and input of the involved public organizations do you consider necessary in order develop a feasible plan and clear lead times?

The market was unanimous in its indication that major involvement and commitment on the part of public organizations would be necessary to arrive at a feasible plan with realistic scheduling. Collaboration and transparency in communication and actions were highlighted as important.

The following were cited as involvement from public organizations:

- Environmental management (arranging permits and support amongst stakeholders)
- Costs for mitigating measures borne by the government

- Permits arranged by the government or the support of the government throughout the permit procedure, or a simplification thereof on the part of the government
- Distribution of risk (public/private) according to influence and capacity
- The government as a launching customer (buyer of energy at a guaranteed energy price/availability reimbursement)
- The government safeguarding the SDE+ subsidy
- An integrated budget to arrive at the best flood barrier (most economically beneficial) and tidal power plant (feasible business case)
- Clarity with regard to the interests of public partners with respect to a flood barrier with/without tidal power plant
- A government that, together with the market, has faith in tidal energy

A4. Are you prepared or do you see opportunities for operating the tidal power plant in a risk-bearing capacity?

The market signalled its interest in risk-bearing operation of the tidal power plant. The majority responded to this question with: 'Yes, provided that...'. What follows the 'provided that' differed from party to party and was partly dependent on their background/business sector and business strategy with respect to sustainable energy and the export potential of innovative delta technology. For example, parties indicated that a prestigious project would be of considerable importance to the domestic market.

In summary, the 'provided thats' can be broken down as follows:

- The feasibility of the business case would be ensured in the plan development with:
  - Sufficient public commitment
  - Design development principles and corresponding design
  - Further elaboration of the technical design and financial model
  - A safeguarded SDE+ subsidy
  - Distribution of risk (public/private) according to influence and capacity
  - A firm and fixed energy price or reimbursement based on availability
  - Clarity with regard to boundary conditions such as water-level management, closure regime, and sea-level rise
  - Public parties taking care of permits

A5. Does the formulated project scope together with the task-setting budget form a sound basis for you to tender?

In general, the market indicated that it expected the scope to be feasible for the task-setting budget. The same would also apply to the civil work on the flood barrier. For the flood barrier variant with tidal power plant, market parties indicated points for attention that are partly dependent on their background/business sector:

- This is dependent on further elaboration of the technical and financial/business case in the plan development phase.
- The bandwidth of 23% SSK estimate is still on the high side, but typical for this phase of the project.

- A preference for an integrated budget for the flood barrier with tidal power plant.
- Reimbursement to cover costs incurred should the tidal power plant not go ahead, where not attributable to the market party.
- Distribution of risk (public/private) would be dependent on influence and capacity.

General summary

Risk-bearing participation and operation

A majority of market parties indicated their willingness to participate in the tidal power plant on a risk-bearing basis. They named a number of risks for which more clarity would need to be provided beforehand. In particular, this included distribution of risk according to influence and capacity. The specified risks are:

- Obtaining an SDE+ subsidy and the timeframe of max. fifteen years
- Development of electricity prices after fifteen years (expiry of SDE+)
- Risks to return, such as water safety, water quality, sea-level rise, and water-level management (incl. in relation to Natura2000 types)

Planning and lead times

Market parties indicated that the scheduling of the plan development phase and realization phase appeared challenging, but that they saw opportunities for acceleration depending on, in particular, the distribution of risk between public and private parties. Prompt shortlisting with a decision for a single party/consortium and integrated project involving a flood barrier with tidal power plant project are examples of this.

Scope and task-setting budget

Based on the market consultation documents, most market parties indicated that the task-setting budget for the flood barrier appeared realistic given the information available at the time. They indicated that there are questions about the basic principles chosen and the estimate of costs, and that there are ideas about possible optimizations. Overall, the market indicated that it would be able to manage with the task-setting budget.

Partnership

The market valued the market consultation and would be pleased to be involved at an early stage. The market highlighted the importance of an open and transparent partnership. It emphasized the need to learn from the experiences of other public/private partnerships, the integrity of the project (also in terms of budget), and transparency in communication and action.

4.4.2 Financial

The financial basis for the project is formed by an energy business case and an estimate for the flood barrier and mitigating measures, based on the task-setting budget. The task-setting budget is €139.5 million; the investment costs for the tidal power plant would be €60 million.

B1. Do you consider this to be a realistic basis?

There were two different signals from the market on this question.

The market indicated primarily that it would be sufficient to elaborate the basis further in continued substantive dialogue. Market parties suggested that the following points for attention were important:

- A healthy return must be realized over the long term.
- A healthy return over 30 years is uncertain, as the duration of the SDE+ subsidy is only fifteen years. In this respect, the estimated basic amount of €130 per MWh is high. The number of full-load hours and corresponding energy production also appear to be high and require further elaboration.
- The risk profile needs more detailed elaboration.
- The level of the investment costs for the turbines is considered realistic, with potential for further optimization. Cost indexation must be considered in a subsequent phase.

B2. Can you use this to produce a financial model that will form an important part of the proposed tender?

The market answered with 'Yes', albeit a number of respondents expected that this would not provide a positive business case. At present, the reasoning for this has not yet been provided and is a combination of aspects that require further elaboration in the plan development phase. The financial model certainly requires further optimization.

B3. Are you prepared to finance or partly finance your participation in the plan development phase?

Virtually all parties indicated that, in the event of a no-go decision at the end of the plan development phase, full reimbursement to cover costs incurred would be reasonable. If the no-go were attributable to the parties themselves, partial reimbursement may be possible.

B4. Are you prepared to commit in advance to the project scope (flood barrier and tidal power plant) and the associated task-setting budget?
If not, what is needed for you to be able to do this?

A small number of market parties indicated their preparedness to make a commitment now, albeit with similar concerns/questions to parties who would not be able to commit in advance.

The majority of market parties indicated that no commitment could be given for the scope and task-setting budget for a flood barrier variant with tidal power plant. Further coordination is required on areas including a healthy return, reasonable distribution of risk, and clear delineation of the scope. This applies in particular if the project is carried out as an integrated project.

B5. Are you prepared to commit to operating the tidal power plant in a risk-bearing capacity in advance, if a feasible business case can be developed in the planning phase?

The majority of parties signalled their preparedness to commit to risk-bearing operation if the following conditions are met:

- The plan development phase gives a 'go' to both the public and private components of the project.

- The distribution of risk must be reasonable, with the market only assuming risks within its control.
- The business case must be formulated jointly to ensure that financiers are prepared to take part.

B6. What is your opinion of the influence of recent price increases in construction?

Market parties across the board said that the influence of price increases would be limited, provided that robust agreements are made concerning indexation. This would make it a manageable risk.

B7. What financial incentives do you think are needed to enable the market approach to succeed?

To allow a range of parties to take part in the tender phase, reasonable reimbursement for unsuccessful participants was considered reasonable. Reimbursement in the event of a no-go in the plan development phase was also mentioned again. Full reimbursement was requested.

The market indicated that it would expect there to be a predictable source of income in the operational phase. This could be achieved through the granting of concrete guarantees with regard to subsidies and electricity price. The inclusion of an incentive based on the availability of the tidal power plant, instead of being dependent on yields from the energy supplied, would also be a possibility – partly on account of the fact that energy yields can be influenced by government intervention (owing to aspects of water safety).

Finally, parties proposed that the requisite technological developments relating to the turbines be supported by a government programme or fund for the promotion of tidal energy.

B8. What is your opinion of the private party's responsibility for formulating the energy business case, the request for subsidies, and everything that is needed to achieve private operation of the tidal power plant?

The overwhelming majority of market parties indicated that this responsibility ought to be borne by the market. It was also suggested that the client could make the difference for market parties in terms of subsidies. Certainty over obtaining the SDE+ subsidy in particular was considered important to obtaining a conclusive business case.

Financial summary

The market went into detail on the basic principles as the basis for the financial model, return, and corresponding risk profile and what conditions would need to be satisfied before market parties would be able to participate in a tidal power plant in a risk-bearing capacity.

Financial model assumptions

Although the model provides sufficient basis to enter into dialogue in this phase, the market took a critical view of the following assumptions currently in the model:

- Level and duration of the SDE+ subsidy
- Energy production
- Turbine investment costs

The SDE+ subsidy was considered crucial to the realization of a feasible business case. Before risk-bearing participation in a tidal power plant, there must be certainty over obtaining the SDE+ subsidy.

Market parties estimated that the level of the potential energy production would be variable, while a large proportion of the market considered current assumptions about energy production to be overly positive.

The investment costs for turbines were considered realistic, with potential for further optimization and a request from the market for flexibility in this regard.

Risk-bearing participation

For risk-bearing participation, further clarity is required on the risk profile. According to the market, the most important risks in addition to obtaining the SDE+ subsidy are:

- The influence of water-level management on energy production
- The influence of sea-level rise on energy production
- Development of the electricity price following the expiry of SDE+
- Obtaining permits

According to the parties, a potential solution for the long operational period would be to measure not energy production but the availability of the tidal power plant. This would help to ensure a reliable source of income in the long term.

Distribution of risk

Market parties indicated that risk-bearing participation would depend on a robust distribution of risk. The basic principle must be that risks are borne by those that are best able to manage them. The market can only assume the risks that it is able to manage, which would not include water-level management, sea-level rise, and SDE+ and other subsidies. These were considered major risks that can only be assumed by the client.

Task-setting budget and opportunities for savings

Market parties indicated that there is potential for savings, provided that different projects are bundled together (see also 2015 market consultation). Other projects and area developments, combined into a single project, may allow profit and loss to be balanced out. This would allow risks to be better managed.

The market indicated that the business case cannot be realized without the usual subsidies, such as those that exist for wind energy.

4.4.3 Market approach

The proposed market approach (see the document entitled 'Beschrijving variant getijdencentrale' ('Description of tidal power plant variant') assumes early market participation in the plan development (design and Project EIA) and realization and operation after a 'go decision' at the end of the plan development phase.

C1. Does the proposed market approach appeal to you? Which suggestions or additions do you have?

The majority of market parties were positive about the proposed market approach (see Section 2.2 Market approach). Suggestions included:

- Prompt shortlisting in the tender
- Alliance in the plan development phase
- It was stated multiple times that a DBFMO model would be preferable, where payment would be made based on the availability of the flood barrier and the tidal power plant. The yields from operation could be deducted from the reimbursement for availability. The addition of alliance elements to this model for certain risks could also be considered.
- The market expressed a preference for a concession for operation of the tidal power plant, should this not be integrated into a single contract with a single contractor.

C2. What is your opinion of the outlined timeframe?

The timeframe is challenging but appears feasible – in the plan development phase at least. Threats are the risks associated with aspects including permits and technological developments, as these could have a negative impact on the timeframe. A number of interested parts indicated that the lead time for the tender process could be shortened. The realization time for the technology in particular was considered somewhat short, given that the technology itself is still in its infancy.

C3. What are your findings and/or advice regarding the design of the process? What risks and/or opportunities do you see in this?

The market was positive about early market participation but warned that involving multiple market parties or consortia of market parties in the long term would have a cost-increasing effect on tender processes. It was indicated that, for the plan development phase, there was a lack of clarity as to whether the client wished to do this with multiple consortia or a single party. The market expressed a preference for a single consortium with the suggestion not to develop multiple variants concurrently on account of the cost-increasing effect, diminished focus, and potential for 'opportunistic behaviour'.

Moreover, a joint preparation phase can have the advantage of there being only a limited number of changes.

In addition, the market asked how incurred costs would be handled in the event of a no-go decision on the part of the client. The market suggested that, in the event that the no-go decision cannot be attributed to the private consortium, all costs should be reimbursed and not only partially.

C4. What do you consider to be the most important issues for the plan development?

The various market parties signalled a number of issues:

- Feasibility of the business case.
- Optimization of integrated design (in relation to technology, surroundings, environment, and LCC).
- Administrative support.
- Permits and Natura2000.

C5. How do you view the use of substantial capacity in the plan development phase, in which realization/operation is not yet certain?

Market parties considered use possible in many cases; however, the majority also indicated that in the event of a no-go on the part of the client, the costs incurred would need to be reimbursed in full.

The proposed reimbursement was considered low.

C6. What is your opinion of partial or full pre-financing of the plan development?

Some were of the opinion that, following the costs incurred in the tender phase, the costs of the plan development should be considered as part of the order. These should appear in the order total, with payment on good performance.

Market parties who suggested that this might be possible in part indicated that (as for question C5) robust agreements would need to be made about costs incurred in the event of a no-go on the part of the client.

C7. How do you view the deployment of public organizations in an alliance in the plan development phase? Which responsibilities are appropriate in this?

The proposed alliance model was well supported by the market. The majority signalled their openness to a partnership/alliance and collaboration.

Certain tasks within the alliance should remain with the client on the basis of risk management (administrative support, exogenous risks). A private party would have no influence over the management of such risks.

In addition, it was also indicated that the client would be expected to play a central role in coordinating and streamlining the various public organizations and their interests. A single point of contact for all government bodies would be an essential condition.

C8. Which governance structure is a good match for this?

The majority of market parties indicated that a structure with a management team would be preferable. The management team would need to include both the client and contractor (equally distributed) and supervise the management team of the executive alliance (in which both the client and contractor would be represented).

C9. What risks do you envisage regarding an alliance-type partnership in an alliance form during the plan development phase?

Market parties highlighted a number of risks:

- Monitoring of an open and transparent culture of collaboration is a precondition for a successful alliance. In a team composed of public and private interests, this would be considered a risk.

- The substantive complexity and continuous need for consensus may negatively influence the decisiveness that is needed.
- The process of coordinating and aligning with the parent organizations of the alliance partners and insufficient knowledge of an alliance on the public side were seen as a risk.
- Some participants indicated that the distribution of risk needs further improvement, as it remains insufficiently transparent, or not transparent at all. In addition, many market parties suggested that the project has a high risk profile and that not everyone is ready to bear that risk or ready to be able to bear it.

C10. Which project scope and market organization form do you envisage for the phase after the plan development, i.e. for realizing a flood barrier that incorporates a tidal power plant, and the operation of this?
What is your motivation for this?

Respondents' thinking was broadly in two directions:

- On the one hand, the formation of an integrated combination with SPC[2], EPC[3], and M-company[4] was proposed, as is typical for DBFMO[5] projects.
- On the other hand, separate realization of the flood barrier and tidal power plant (sequential) was proposed.

C11. Which market organization form do you prefer for this?

Parties expressed two preferences:

- The first was for an alliance as the organizational form, which was preferred for the plan development phase in particular. See also the responses to question C7.
- The second was for a DBFMO type of contract. An integrated approach to the flood barrier and tidal power plant was preferred, with a DBFMO being the most appropriate form for this.
- In addition, several market parties indicated their preference for this to be realized in a consortium with different market parties such as a civil engineer, a technological engineer, and an investor.

C12. Which conditions are needed for this and who should be responsible for this?

In terms of attitude and conduct, parties emphasized the need for partnership and long-term thinking. This should see not only financial incentives provided, but also a focus on quality – certainly in the tender phase. More specifically, this should include the functional development of the requirements so that there remains flexibility for creativity and innovation.

In addition, it was indicated that the option of interaction between the flood barrier budget and tidal power plant budget would offer scope to strengthen the business case.

[2] Special Purpose Company
[3] Engineering Procurement and Construction
[4] Maintenance Company
[5] Design Build Finance Maintain Operate

Market approach summary

Tender phase
The market was of the opinion that prompt shortlisting in the tender procedure would be effective. This would help market parties to keep transaction costs to a minimum.

Plan development phase
There is sufficient time in the plan development phase to arrive at a go/no-go moment. As a condition, full financial reimbursement must be provided for incurred costs.

The market parties were of the opinion that the realization time would be too short to arrive at a sound design and execution.

The market would prefer an integrated approach to a flood barrier and tidal power plant. This would yield the most efficient result in terms of realization and operation.

Open and transparent partnership is a key priority to ensuring success during the plan development phase. The market was very clear on this area.

In addition, concerns were expressed about the potential for opportunistic behaviour during the plan development phase. The market is eager to prevent a party, selected for a flood barrier with tidal power plant, being capable of only developing a flood barrier without tidal power plant.

4.4.4 Technology and design

The project has a number of uncertainties, which must be addressed by the government and market in the joint plan development. These are uncertainties regarding:

- Feasible energy exploitation and the conditions for this
- The level of tide that is required/sufficient to ensure that Lake Grevelingen remains sustainable in the long term
- The arrangement of stakeholders and environment, for example regarding Natura2000 values or the migration of fish and marine animals
- The level and pace of sea-level rise, with a considerable influence on the functional service life of the flood barrier/tidal power plant.

In the joint plan development, a 'design freeze' will be implemented until a plan has been developed that is financially, legally, and socially feasible. A realistic basis and sufficient options for optimization will then be required.

D1. Do you think that the basic principles are formulated in a sufficiently functional way and offer sufficient space for optimization?

The various parties had varying opinions, but the point was made that there is sufficient space for optimization. Questions were raised about water-level management and other details in the documentation provided. It was stated that the objective would be a tide that is as natural as possible. Parties indicated that there was a lack of clarity over the extent to which the pump function is crucial and a condition for operation of the flood barrier during the ebb phase following a rise in sea level. For water-level management, half a metre should be strictly applied every day.

Explanatory note: as it was not considered feasible, in practice, to strictly apply this on a daily basis, this basic principle has been formulated with slightly more flexibility on the basis of a monthly average, including a small permissible deviation.

D2. Is the tension between project scope/basic principles and a task-setting budget healthy and realistic? From a technical perspective, are there opportunities for optimization?

Not all interested parties saw the option to carry out detailed investigations. Parties who did respond gave a varying picture:

- Concerns were raised about feasibility within the budget.
- In addition, reference was also made to opportunities to further optimize the reference topic.
- During the market consultation, a difference was noted between the financial model and the technical model. The financial model is based on 18.5 turbines, resulting in 50 GWh instead of 60 GWh.
- It was remarked that the model was too 'rosy', based on figures from 2009, and would not paint a realistic picture.

D3. Is the development of the reference variant thorough and realistic?

The majority of market parties indicated that this had not been assessed in detail and that there were too many questions concerning the figures chosen and the feasibility of the yields.

It was remarked that the form of the example design was not yet fixed and that this would be selected as part of the partnership.

D4. Do you have confidence in the underlying models and methodologies?

It was indicated that there are still many questions concerning the models used, particularly with regard to tidal range, the number of turbines, the reference year used (2009), sea-level rise, and the specified return.

D5. How should the knowledge and interests of the environment and of other stakeholders be rendered as a plan development and ultimately into an achievable integrated plan?
Do you consider the proposed approach for this to be a sound basis?

Environmental management with a robust stakeholder analysis as its basis was seen as extremely important. A number of respondents considered that the primary task for this should rest with the client. The remainder foresaw joint responsibility between the client and the contractor.

Optional questions on technology and design

A number of interested parties indicated that they had not been able to study the details within the time available. The summary of responses from these optional questions is therefore based on a limited group of market parties.

D6. Do you consider the 60 GWh electrical energy yield from the tidal power plant to be realistic, taking into account the requirements regarding water-level management?
On what basis do you think the yield will be higher or lower?

Market parties indicated that 60 GWh was an optimistic estimate, with 40 - 50 GWh seen as more realistic. This was based partly on the number of turbines installed (11 instead of 18.5), a 50-cm tidal range as a maximum,

with 40 cm as the average, and the fact that there is only limited knowledge and experience with turbines of this scope.

D7. *Are you of the opinion that turbines can be used effectively for fine-tuning of the water level in Lake Grevelingen?*
The majority indicated that this would be an effective means, but likely with a negative impact on the return from the tidal power plant.

Some market parties remarked that fine-tuning would be better left as a responsibility of the public parties.

D8. *Can water safety be ensured with single sluices combined with turbines?*
The majority indicated that this could be an option but would be dependent on the design.

The market indicated that this would be an additional risk if the responsibility were to rest with a private party for operation of the tidal power plant.

D9. *How do you think this project can proceed cost-efficiently together with the client?*
The majority of market parties said that the chosen form of partnership was extremely important, with an alliance most often presumed. In addition, it was also suggested that freedom of design in the plan development phase would have a positive contribution.

D10. *How do you think you will be able work with the client to minimize the risk and maximize the opportunities?*
Here, the market gave a similar response as to question D9: that the quality of the partnership between the client and the contractor is of crucial importance. In terms of the risks and opportunities, many market parties view a shared risk file with clear distribution of risk as an important instrument. One option of reducing the risks is to start with a single turbine and subject it to thorough testing. Permits and financial support measures must be requested and established as quickly as possible.

The market indicated that this tidal energy project would be a showcase for the Dutch export market and must be a visible project.

A number of market parties made specific remarks regarding the technology in the descriptive document. Remarks will be processed into an amended version of the document that will be made available together with the final report.

Technology and design summary

Feasibility

Market parties see a number of opportunities in terms of the feasibility of the design presented but made a number of remarks. These came about, in part, because parties felt that there had been insufficient time for a thorough examination of the details. They also thought the basic principles chosen by the project organization were not concrete enough. There are, however, necessary preconditions for market parties to be willing to participate. Important aspects in this regard are collaboration in the plan development phase and sufficient flexibility for technical innovations to be realized if desired by the market. Integrated development is of key importance in this respect.

Water-level management

Installing pumps in the flood barrier would allow the desired water-level variations to be maintained for longer. Depending on the capacity of the pumps, which would pump water away from Lake Grevelingen in response to the increased sea level, this could take more than 40 years.

The same pumps could be used to produce electricity in the event of flow currents into Lake Grevelingen, enough for 20,000 homes and for a saving of 30 kilotonnes of CO_2. This would create a combined tidal power plant and pumping station. This would be an innovative route, as this has never been carried out on this scale in the Netherlands before.

A pump/turbines offer(s) better control. The flow can be slowed at any point in time, or accelerated. This has the following benefits:

1. Increased water safety (redundancy)
2. More accurate water-level management
3. Energy production

Alternatives

The in-depth discussions again emphasized that free flow technology is also available, in addition to the pressure turbines chosen in the example design. The drawback of this technology is its lower energy production, but it does have the advantage of lower costs and could lead to a better business case. Another advantage is that this technology has already been used in Antwerp and the Oosterscheldekering storm surge barrier.

5 Conclusion

The main question for this market consultation is: 'Are market parties interested in risk-bearing participation in a flood barrier including a tidal power plant?' The main question was approached from three different angles: financial, technology and design, and market approach. This section summarizes the key findings and answers the main question.

A total of 24 companies participated in the market consultation. All companies registered for the market consultation day and participated with 57 people. Of those 24 companies, fifteen subsequently submitted a questionnaire. All of those fifteen companies then received an invitation to an individual discussion, thirteen of which accepted. The market consultation involved contributions from contractors, turbine constructors, engineers, and consultancy firms.

5.1 Summary of key findings

The following is a summary of the results from paragraphs 4.3 and 4.4, summarized by topic.

Table 2: Summary by topic

Topic	***Finding***
Financial	▪ Positive business case with realistic boundary preconditions/basic principles. ▪ The SDE+ subsidy is vital to the integrated variant (flood barrier with tidal power plant). ▪ This subsidy is an unmanageable risk for the market. The period must be fixed at 30 years, not fifteen, or must be converted to an availability reimbursement after fifteen years, as with DBFM. ▪ Reimbursement based on energy price is less attractive than reimbursement based on availability. ▪ Full reimbursement after the plan development phase if the tidal power plant does not ultimately go ahead.
Technology and design	▪ Integrated development of a flood barrier and tidal power plant is important. ▪ The option for various technological solutions, such as free flow turbines and pressure turbines, should be kept open. ▪ Not all technical requirements for the product are defined, impeding potential innovative solutions on the part of the contractor.
Market approach	▪ Prompt shortlisting with a decision for a single party for the plan development phase ▪ Shorten the tender lead time ▪ Minimize transaction costs

The key question in this market consultation is if and to what extent the market is interested in risk-bearing participation in a tidal power plant. It can be concluded that the majority of participants have indicated, from different perspectives, that there is a high degree of interest. Based on the information provided, this interest cannot yet be pledged with absolute certainty. This would require collaboration in the plan development phase, concluded with a go/no-go moment, at which point a definitive decision can be taken. Market parties indicated that, if the government were to opt for a no-go, full reimbursement for the plan development phase must be provided. This relates to all decisions taken by the government alone, including allocation of the SDE+ subsidy. Proper distribution of risk, opportunities, and conditions precedent for a no-go are essential in this regard. Energy yields are, to a significant extent, dependent on water management and sea-level rise and whether or not an SDE+ subsidy is granted. It is a consideration to focus on availability, as is typical in a DBFM situation, whether or not in a combination of SDE+ subsidy for energy production.

5.2 Risks and opportunities

The market indicated its preparedness for risk-bearing participation under certain conditions. For this, it would be essential for the basic principles, designs, and models to be worked through jointly in the plan development phase, with a go/no-go moment built in. Agreements must be made as to the conditions under which a go or no-go decision would be made. The following provides an overview of the key risks and opportunities that play an essential role in this.

Table 3: Summary by factor

Factor	Finding
Risks	■ Level and duration of the SDE+ subsidy. ■ Turbine investment costs. ■ The influence of water-level management on energy production. ■ The influence of sea-level rise on energy production. ■ Development of the electricity price following expiry of the SDE+ subsidy. ■ Obtaining permits. ■ A go/no-go decision at the end of the plan development phase is an important reference point, and there must be conditions precedent for both partners, such as in relation to finance. In the event that there is a feasible business case and the government opts not to go ahead with the project, including the tidal power plant, for whatever reason, there must be full reimbursement of the engineering costs at that point.

Opportunities	■ Innovative delta technology with global export value. ■ Open and transparent collaboration is an important opportunity for ensuring success during the plan development phase. ■ Capitalizing on the innovative strength of the market by jointly seeking the best solution during the plan development phase. ■ An integrated design in the plan development phase. ■ Reductions in lead time, prompt shortlisting, and minimizing tender costs. ■ Various technological solutions are available for the secondary objective of energy generation. ■ Expansion of the scope of the project to even out the risks. ■ Integration of the energy generation, water-level management, pump, and water safety functionalities.

On the basis of the risks in the table above, it can be concluded that the market is unable to bear all of the risk, as some of the risks rest with the government. Yields cannot be determined by market parties themselves in view of the fact that the basic principles, such as water-level management and storm closure, have not yet been established. The capacity to operate is broadly recognized but cannot be determined in detail. Market parties recognize a number of opportunities that may be seized as part of joint elaboration during the plan development phase. An open and transparent partnership is an important success factor during the plan development phase.

Appendix 1 References

The following references are, in part, digitally bundled and form part of the Grevelingen Tidal Project file, tidal power plant variant, for the 2018 market consultation.

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- Video presentation, market consultation day 8 November, plenary session
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Documents

The following documents are available via TenderNed:

- Loor 2018, Determining the Discharge Coefficient of a Flood Barrier in the Brouwersdam
- Kleissen 2015, Testing the Hydraulic Calculation Model
- Kleissen 2018, Assessing the Hydro-Energy Model
- Berkel 2015, Optimized TTP Brouwersdam Pro-Tide
- Berkel 2018, Hydro-Energy Model
- Berkel 2018, Hydro-Energy Background Document

- Meijnen 2015, Two Propeller Turbine Configurations
- Cubic Square 2018, Background Document for Design Drawings for the Tidal Power Plant Variant
- Cubic Square 2018, Background Document for 3D Drawings for the Tidal Power Plant Variant
- Cubic Square 2018, Background Document for the Design and Quantities for the Tidal Power Plant Variant
- RWS-PZH 2018, 2018 Brouwersdam Tidal Power Plant Example Calculation Model
- Market consultation about a flood barrier variant with tidal power plant
  - Procedure marktconsultatie 2018
  - Description of 2018 tidal power plant variant (February 2019)
- Presentations, market consultation day 8 November, plenary session

Appendix 2 Participants

Registrations for the market consultation day

The following organizations registered for the market consultation day (ordered alphabetically).

Table B1: Participation in the market consultation day

Organization	Organization
ABB	Huisman
Agidens Infra Automation	IV-Infra
Arcadis	MET support
BAM Infra	Ministry of Agriculture, Nature and Food Quality
BAM PPP	Ministry of Economic Affairs and Climate Policy
Bepack	Mobilis
Besix	Pentair Fairbanks Nijhuis
BlueTurbines Projects	Province of Zeeland
Bosch Rexroth	Province of South Holland
Boskalis	PZEM
BT Projects	REAC Energy
Bureau de Bont	Ministry of Infrastructure and Water Management
Bureau Marnix	Sacyr
CroonWolter&Dros	SCHOTTEL HYDRO
CRS Consultancy	ShareNRG
Cubiqsquare	SPIE Nederland
DMEC	Staatsbosbeheer
Dutch Marine Energy Centre	Tidal Bridge
Entry	Tidal Power Tocardo
Fanny Bod Com	Topsector Water en Maritiem
Fluor Infrastructure	TU Delft
Heijmans Infra	Van Hattum en Blankevoort
HOCHTIEF	Van Oord
Hollandia Infra	Vereniging van Waterbouwers
Horvat Partners	Water2energy

Participants in individual discussions

Thirteen market parties responded in writing to the questions in the 'Grevelingen Tidal Project market consultation document'. Those parties took the opportunity to attend individual discussions on 11, 15, and 17 January 2019 as part of the market consultation.

Table B2: Participation in individual discussions

Organization	Organization
Agidens Infra Automation	Dutch Marine Energy Centre
BAM Infra	HOCHTIEF
BAM PPP	Mobilis
Tidal Bridge	Pentair Fairbanks Nijhuis
Besix	ShareNRG
BlueTurbines Projects	Van Oord
Boskalis	Water2energy

Colophon

Grevelingen Tidal Project
is a partnership between:

provincie ZUID HOLLAND

Provincie Zeeland

Ministerie van Landbouw, Natuur en Voedselkwaliteit

Rijkswaterstaat
Ministerie van Infrastructuur en Waterstaat

Ministerie van Economische Zaken en Klimaat

gemeente Goeree-Overflakkee

Gemeente Schouwen-Duiveland

staatsbosbeheer

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