

Tidal Lagoon Schemes and Regional Development:

Work Package 2: Report

How might prevailing business models around electricity generation need to change to support tidal lagoon projects



Welsh Economy
Research Unit

Yr Uned Ymchwil
i Economi Cymru

Welsh Economy Research Unit

Cardiff Business School

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This report was written by, Calvin Jones, Max Munday, Reza Ahmadian and Aled Singleton from Cardiff University. This report was supported by Welsh Government through the Tidal Lagoon Challenge funds.



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TABLE OF CONTENTS

SUMMARY	2
1 TIDAL LAGOON CHALLENGE PROJECT	4
2 WP2: DEVELOPMENT & FINANCIAL MODEL CONSULTATIONS	7
3 CHALLENGING DEVELOPMENT CONTEXT OF TIDAL RANGE SCHEMES	25
4 MOVING THE DEVELOPMENT DIAL ON TIDAL RANGE PROJECTS	29
5 PROGRESS THROUGH TO WP3	34

Summary

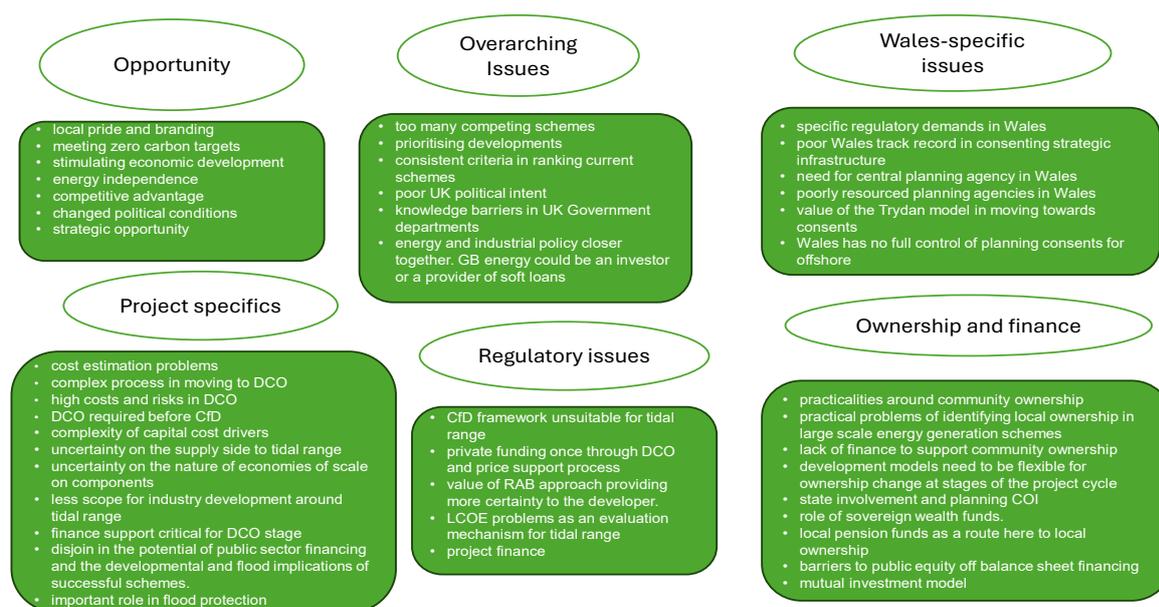
This report is part of the Welsh Government Tidal Lagoon Challenge project. We address the objectives of the Challenge Fund by examining potential financing and ownership options for novel tidal range renewables on the coast of Wales. The research seeks to examine how different approaches might better support the long-term prosperity and wellbeing of the people of Wales.

The first report (WP1) examined extant ownership/financing models for energy generation infrastructure to date in Wales and in comparator regions, and assessed their outcomes in terms of sustainable economic development, supporting regional wellbeing, and improving ecosystems condition and functioning.

This second report (WP2) examines how far existing developmental and financial models are practicable for potential tidal range schemes given capital requirements, operational timescales, uncertainties and risk, and potential future electricity prices (and pricing schemes).

This report also summarises the findings from our consultations undertaken in the final quarter of 2024 and January 2025. The WP1 review material informed the framework for our consultations with a cross section of participants in industry, developers, banks and finance institutions, Welsh and UK Government, and with staff in regulatory agencies. The Figure below summarises key themes from the consultations.

Figure: Key themes from the consultations



The report finds:

First, that it is difficult to see any meaningful tidal range progression in the current developmental context without public-private partnership during the development expenditure phase, and here with the emphasis on a public sector strategic (if not financial) lead.

Second, that the public sector will need to choose and promote specific projects - and this requires a prioritisation. Currently much of the debate has centred on tidal range as a potential source of renewable energy in different places, but there needs to be faster movement towards endorsement of specific projects.

Third, with projects prioritised, there is scope for a special purpose vehicle to move a project to a consent and contract stage. Elements of the debate to date have argued that a public-private partnership model might be required through each part of the tidal range project the life cycle (development, construction, operation etc.). On the evidence reviewed and through our consultations we conclude it is too early to come to this conclusion. The barrier that comes up again and again in consultations (and not just for this project) surrounds getting tidal range over the development hurdle. There could be an argument that once projects have consents, that private capital will flow forward in the presence of an appropriate and flexible RAB framework (and it is noted that the RAB framework could include elements that allow for supply chain uncertainty and the environmental benefits of projects). We find the model espoused in the Trydan Gwyrdd Cymru framework a valuable one and elements of this approach would be useful in the case of tidal range projects. However, a special vehicle for a 'Welsh' tidal range project would require elements of public and private sector support, but (as with Trydan) at arm's length from planning and consenting authorities.

If such a vehicle can bring a project to consent and prepare the ground for contract, then there is scope for the private sector interests in the vehicle to continue through to construction and then with an option for a degree of public equity considered at that stage. This type of vehicle reduces private sector exposure during the riskiest stage of the project, and with the public sector able to finance at a lower cost of capital; the framework would also allow for ownership transfer (another important component of the Trydan model). This type of framework is not new, but here it is focused on the development phase prior to the private sector taking over construction and operation.

1 Tidal Lagoon Challenge project

1.1 The overall project

This report is part of the Welsh Government Tidal Lagoon Challenge project. We address the objectives of the Challenge Fund by examining potential financing and ownership options for novel tidal range renewables on the coast of Wales. The research seeks to examine how different approaches might better support the long-term prosperity and wellbeing of the people of Wales, for example through:

- Increased local receipts from the sale of tidal generated electricity, for example through joint equity ownership or regulatory/fiscal instruments,
- Financing approaches that lock-in a higher level of local economic engagement, through direct employment or along supply chains,
- Novel ‘multifunctional cluster’ financing and development whereby predictable and secure, guaranteed power is used for industrially or socially high value activities (e.g. powering data centers or Green Hydrogen) thus opening a wider set of viable financing opportunities,
- Multifunctional economic use of tidal range infrastructure e.g. lagoons used for recreation, flood mitigation, aquaculture or housing.

Our Tidal Lagoon Challenge project has key objectives that map directly to five work packages (WPs) as follows:

WP1: To examine extant ownership/financing models for energy generation infrastructure to date in Wales and in comparator regions, and to assess their outcomes in terms of sustainable economic development, supporting regional wellbeing, and improving ecosystems condition and functioning.

WP2: To examine how far existing developmental and financial models are practicable for potential tidal range schemes given capital requirements, operational timescales, uncertainties and risk, and potential future electricity prices (and pricing schemes).

WP3 To develop a simple economic model through which the consequences of different ownership and financial models can be explored with respect to effects on the Welsh economy.

WP4 To provide a framework matrix whereby an indicative typology of different financing, development and ownership models can be reconciled with a range of potential regional socio-economic, community acceptance, supply chain, environmental and climate outcomes.

WP5 To reflect on the scope for, and barriers to, a range of more innovative financial, development and ownership models that involve regional stakeholders, and increase positive local engagement across private, public and third sectors.

Our work seeks to contribute directly to Welsh Government research priorities, with a central focus on revealing and addressing the barriers to tidal development in ways that improve socio-economic and environmental outcomes.

1.2 Research methods WP2 report

In developing this second report (WP2) we focus on examining how far existing developmental and financial models are practicable for potential tidal range schemes given capital requirements, operational timescales, uncertainties and risk, and potential future electricity prices (and pricing schemes). However, in the first part of this report we summarise the findings from our consultations undertaken in the final quarter of 2024 and January 2025. The WP1¹ review material informed the framework for our consultations with a cross section of participants in industry, developers, banks and finance institutions, Welsh and UK Government, and with staff in regulatory agencies. The series of consultations (together with the review material from our WP1 report) assists us in answering questions on how far current regulatory and ownership trends might support tidal range schemes at larger scale.

¹ WP1 report: Tidal Lagoon Schemes and Regional Development: Work Package 1: progress report Electricity Generation Infrastructure in Wales: Ownership, financing and regulation.

1.3 WP2 Report Structure

The next section of the report summarises the structure and main themes arising from the consultations. The third section then comes to conclusions, using material from the consultations and the WP1 report, in respect of how far financial, ownership and regulatory models employed for renewable and conventional energy generation projects in the past are suitable for future tidal lagoon projects. We then in section 4 of the report provide recommendations on where changes might be made to prevailing financial, regulatory and ownership models to better support tidal lagoon development in the UK. The final section concludes with showing how the work then links through to the WP3 report around economic modelling of Wales level effects connected to changes in prevailing business models.

2 WP2: Development & Financial Model Consultations

2.1 Background

In the consultations the overall aim was to discuss:

- Extant ownership/financing models for energy generation infrastructure to date in Wales and comparator regions, and to assess their outcomes in terms of economic development, supporting regional wellbeing and improving environmental condition and functioning,
- How far existing developmental and financial models are practicable for potential tidal range schemes given capital requirements, operational timescales, uncertainties and risk, and potential future electricity prices (and pricing schemes),

Participants were provided with an outline of the research project and consultation questions prior to the meetings. The detailed themes covered in consultations varied according to the nature of the consultee but included:

- Context setting (particularly where respondents were developers on tidal range projects) and here there was an opportunity to discuss scheme progress and barriers to development.
- Discussion around regulatory hurdles facing schemes and how these regulatory factors affected progress.
- Finance of schemes (and again here with consultees that were involved in developments able to discuss plans here for financing), and the main factors to be considered in different methods of financing.
- How developers were seeking advice on scheme financing options.
- The general scope, strengths and weaknesses for private-public partnerships in the development and financing of tidal range schemes.
- The role of community involvement in tidal range development including in terms of financing and ownership of developed assets.
- The regulatory environment and financing options for tidal range schemes.
- The scope for genuinely new innovations in the regulation and financing of tidal range schemes.
- The expected links between changes in regulation, finance and ownership models and local economic development outcomes and with this element informing the WP3 economic modelling report.

A total of 16 consultations were completed between October 2024 and March 2025. These conversations were held online over Microsoft Teams. A total of 23 participants featured as two people were present in two cases, and three in two cases. In many cases participants were recruited through existing networks and some were referred from other participants.

Though most consultations represented a specific organisation/developer including public sector, five represented a mix between public, private and third sector interests. For example, a private company which was owned by public sector organisations and companies owned by voluntary sector organisations. Two participants did not currently represent a specific body but had gained significant insight from public roles. It was also interesting that some of the consultees had changed roles from developer to regulator and vice versa. As such this consultation benefits from those with an ability to consider the barriers to tidal lagoon project development from different organisational perspectives.

In what follows we seek to summarise the findings from the consultation around key themes. We accept that it can be difficult to disentangle factors speaking to ownership, finance and regulation with these interrelated.

2.2 Tidal range seen as a strategic opportunity

The consultations demonstrated considerable enthusiasm for tidal range power and covered a broad spectrum of reasons why politicians and communities have an interest in tidal range technology. These include debates around local pride and branding, meeting zero carbon energy generation targets, stimulating economic development, and achieving local and national energy independence. One consultee [#15] noted that people who live in coastal areas were positive about tidal range:

“People seem to recognise that we are losing something by not using the tides, so public acceptance of tidal range might be higher than it is for things such as onshore wind or solar.”

There was an acknowledgment that Wales and the Severn Estuary represented an abundant source of energy. Some of the consultees showed that countries such as Italy and Germany did not offer such energy opportunities. One consultee [#4] went so far as to place tidal range schemes in terms of gaining competitive advantage – citing the differences that shale gas had made to the USA economy:

“We need to harness 10s of Gigawatts of energy available on the doorstep and for the long term.”

and in terms of strategic arguments:

“The real objective here is to become genuinely energy independent and not requiring imports of energy from other places. In Norway and Canada ... there are high levels of energy independence. So, part of the rationale for net zero ... is energy sovereignty such that [our industries] are not dependent on imported electricity resources to progress.”

Indeed, one consultee argued that in Wales there was a tendency to frame things in terms of movements towards net zero rather than the more important issue of energy sovereignty. An underlying driver for new power generation sources was that:

“For 2050 we are predicted to require at least three times the energy that we use now” [#12].

Another factor reinforcing the potential strategic opportunity with tidal range was the change in UK Government in 2024. One consultee said that:

“What has changed now is that we have a new government. Ed Miliband is more supportive; he wants a convention on tidal. Also, the industry [tidal range] is better organised now.”

Finally here a series of consultees made arguments that tidal range schemes at scale needed to be understood in terms of wider industry and regenerative development. For one consultee:

“Any tidal range scheme would also be a regeneration project for the area with associated property development. That is going to be a problem because environmental interests may not like the associated property development.”

There were some caveats around the strategic regeneration opportunity offered by tidal range projects. One consultee argued that tidal range would be different from onshore and offshore wind in its scope to support industrial development. In the latter industry cases:

“The cost reduction that occurred was largely for engineering reasons not least in terms of the growth of the turbines in terms of the sweep of the blades. So the technology has improved and the scale has increased such that an onshore wind industry has been associated with an industrialisation. In terms of tidal range given the size of the projects we might get some optimisation in terms of turbines and civil works, but we would not necessarily expect it to follow the same route as with onshore wind and photo-voltaic.”

Some consultees showed that significance of the strategic opportunity provided by tidal range schemes was not universally understood. For example, it was noted that politicians at levels below UK Government were helping to push certain projects forward. For example, Welsh Government supported the Dragon Island and Blue Eden project in Swansea after it was rejected at UK Government Level. At a City Region level, it was emphasised by one consultee [#6] that:

“Places like Mersey have somewhat of an advantage because they have their own sources of funding”. A different consultee stated that Mersey Tidal had *“political clout”*, was backed by public money and that it *“falls into the remit of GB Energy”* [#12].

The work of the Severn Estuary Commission was considered as a case in point for some consultees of where the public sector was providing development support. This was perceived as helping with preliminary marketing and scoping of schemes that was not always available to other schemes around the UK. The Commission, initiated by Western Gateway in 2024, is investigating potential sites which could have benefits for both England and Wales. The Commission reported in March 2025.. One consultee explained that the commission is looking at tidal range projects principally in terms of power generation rather than as adjunct to other development projects.

One consultee [#2] suggested that the strategic importance of schemes was clouded because of problems in prioritising developments:

“We need to have clear criteria such that projects can be accurately ranked one up against another. The problem at the moment is that individual developers have a self-interest in perhaps inflating their projects contribution on different criteria. So there needs to be consistent criteria through which we actually rank these projects.”

Part of the context for this concern is that it is difficult to rank potential projects because their socio-economic and environmental impacts are expected to vary considerably.

2.3 Barriers: Previous scheme failures

The Swansea Tidal Lagoon gained a Development Consent Order (DCO) in 2015 and remains the closest that Wales and UK have got to developing a tidal lagoon range project. The proposal for support through Contracts for Difference (CfD) mechanism was rejected in 2018, mostly on the grounds of a comparison of costs to other sources². However, it was clear that some of consultees felt that political reasons influenced the decision not to support the Swansea scheme. One [#5] argued that:

“The Swansea scheme was effectively tossed away. This was a political decision because there was no Tory intent.”

² BEIS Tidal Lagoon Programme: Factsheet, 2018
<https://assets.publishing.service.gov.uk/media/5b3109a5e5274a55b88ed307/tidal-lagoon-programme-factsheet.pdf>

Other consultees pointed to specific 'Swansea' issues in terms of marine licences and also difficulties with Associated British Ports owning and controlling the port infrastructure.

One consultee [#15] provided an insight into the politics, stating that one key minister in the UK Government: *"Was not willing to solve the problems to get the project underway"*. A key identified issue here was limited technical knowledge of the potential for tidal lagoons within the decision-making UK Government departments. Officials *"Did not have the bandwidth to look at another [renewable electricity] sector"* as they were simultaneously taking forward offshore wind and nuclear and *"Perhaps saw tidal as a distraction"*. One consultee specified that the lack of tidal power knowledge in the Department for Energy Security and Net Zero had partly informed the decision not to back the [Swansea] project.

Selected consultees argued that the failure of the Swansea scheme [#6] had had repercussions: *"A Problem with the Swansea scheme sinking was that investors were burned, local authorities were let down and the community was hurt also [which] reverberate to this day"* and wider confidence had suffered.

2.4 Barriers: Project development hindered by problems in cost estimation and consents process

An issue raised by a series of consultees were difficulties in respect of cost estimation for tidal lagoons, and with this conclusion even important for estimates of costs of gaining an initial DCO. Clearly a related issue was that there are no working examples of a tidal lagoon that exist in the UK, and only one project had moved significantly into the pre-development phase leading to a DCO. One consultee showed that:

"We already know how to build a wall; it is just getting from nothing to something people might give cash for a project. But how do you get to that position?" [#12] and another:

"A persistent problem [is] the difficulty of getting the initial funding to get projects towards planning; this is where several projects have stalled."

The drivers of the final capital cost were seen to be quite complex, and with some elements of cost expected to be very different across schemes because of different construction methods (for example use of caisson technology or otherwise), or assumptions on the supply of key components. While the engineering was not seen to be complicated, one consultee [#4] explained that:

"There is little experience in developing these projects at scale so there is no standard design and no standard means of constructing these projects."

The 240MW Swansea Tidal Lagoon gained Development Consent Order³ in 2015 and provides an indication of the complexity involved. However, one developer argued that it was difficult to benefit from prior research and engineering work undertaken to support projects. Here, for example, a developer seeking to resurrect a scheme in a location which has previously been subject to detailed feasibility studies [#1] may have to commission a completely new set environmental reports due to changing fish movements, consideration of flood risks, port access etc. in spite of the fact that detailed survey work had already been undertaken. Then even marginal changes in project proposals can have major ramifications on the project pipeline in terms of progress toward a DCO.

A familiar theme in the consultations was also the scale of the 'upfront costs' in moving towards a DCO. One consultee explained that they: "*need funding just to enter the formal process*" of negotiating with the National Grid or to discuss Marine Management Orders.

Two consultees [#6 and #10] independently outlined a three-stage model for developing proposals (i.e. moving from initial feasibility work (broad technical and engineering investigations, including landing points), then through to environmental studies and then finally legal and contractual development). This process in moving to DCO was estimated to cost from anywhere between £50m-£100m and with this not an insignificant proportion of the total project cost. Critically the funding in this pre-construction was risky because it might be committed and then with no certainty of a DCO being granted. The magnitude of pre-construction costs was seen as marking tidal range out from a series of other renewable electricity generation projects. A series of consultees were adamant that the process of moving to DCO was a critical element for tidal range and that with a DCO projects would be able to attract finance for the construction phase. For example, one consultee showed:

"The main problem is it can cost 10s of millions of pounds to get through to planning; the asset at the end of the process is worth a great deal of moneythe usual suspects in terms of infrastructure funding would always say to us "we'll come back when you have the permissions"."

³ Swansea Bay Tidal Lagoon Development Consent Order 2015
<https://infrastructure.planninginspectorate.gov.uk/projects/wales/tidal-lagoon-swansea-bay/>

The future role of Welsh Government in the consenting process for tidal lagoons is still unclear, but is expected to be based on scheme size and geography. That said, Natural Resources Wales has issued specific guidance on tidal lagoons in 2020⁴. Some consultees felt that the specific regulatory demands in Wales were too onerous [#11]. The issue here was that the prior negative experience of developers in technologies such as onshore wind might impact prospects for tidal lagoons even were these to be consented at UK Government level. For example,

“Wales has not got the best track record with respect to planning particularly compared to other parts of the UK. There are also concerns about requirements to lay cables underground and the nature of the grid.....If we can't do infrastructure projects for the smaller and with known technologies, how would we cope with things such as tidal lagoons in Wales where there is much greater uncertainty.”

There was a related issue here that for energy projects that Wales competes with other regions of the UK, irrespective of the technology involved. Anything that worked to make projects in Wales more expensive or cumbersome was seen as giving an advantage to other parts of the UK.

One consultee [#5] suggested that Wales: *“Needs a central planning resource for energy that would cover generation as well as grid connections and transmission network”*. This, it was suggested, could be an agency which sits above local government. Indeed, it was suggested that a central planning resource could provide a means of introducing other factors into consents such as scheme ownership parameters. While under current law there are limits on the role that local authorities and Welsh Government can play in the permissions process on potential large tidal range schemes, one consultee noted that while Wales (meaning here local and Welsh Government) did not have full control of planning consents for offshore developments, it did have control over where coastal schemes came to ‘land’. This type of overlap of powers means: *“they could effectively hold up schemes”*.

⁴ Information to support Environmental Assessment of tidal lagoon developments in Wales
<https://naturalresources.wales/media/696812/gn60-information-to-support-environmental-assessments-of-tidal-lagoon-development-in-wales-zm0523.pdf>

In terms of planning and permissions one consultee [#5] identified a further ‘Wales’ problem that: “*Some of the organisations linked to the planning phases of tidal range schemes are severely under-resourced*”. A separate source showed that NRW had spent over £0.5m working on the Marine Licence application for the Swansea Tidal Lagoon⁵. The planning fee covered approximately 40% of the costs, meaning public money had subsidised elements of the pre-development costs. One consultee suggested a radical way to counter:

“There is almost a need for those applying for measures to actually fund employees in the public organisations such they could assist in the permissions.”

Such a course of action clearly risks conflicts of interest. The potential burden on the planning process was identified by a series of consultees. Then they suggested rather than having a number of smaller pathfinder schemes going through the process it was better that resources were consolidated to get one scheme at scale through to the DCO. Finally, here one consultee recognised the role of organisations in Wales such as Trydan. Much of the concerns voiced by consultees were around the process of moving towards consents. However, although Trydan (see later) has not yet been involved in tidal range projects, it was seen to represent an interesting model as it focused in on the development phase and getting renewables projects towards the development consent and completing environmental impact assessments. Here then there is a model of a limited company backed by Welsh Government resources pushing projects towards a DCO, but then once a project gained consents perhaps selling on to the private sector or maintaining a share during the construction and operations phases.

2.5 Ownership of future tidal range schemes

The conversations around ownership threw up a number of complex issues. Important among these were:

- The extent to which local authorities and Welsh Government could/should have an equity stake in projects.

⁵ UK Parliament: costs for Marine Licence application submitted by Tidal Lagoon Power
<https://www.parliament.uk/globalassets/documents/commons-committees/business-energy-and-industrial-strategy/Correspondence/nrw-response-evidence-session.pdf>

- The practicalities around community ownership and the difficulties of being prescriptive around local ownership because of problems with the free flow of capital, and the practical problems of identifying the level of local ownership in large scale energy generation schemes.
- Ownership change of projects at different stages in the development process, for example, public ownership through to development consent and then a change to more diversified ownership through construction and operation of the assets.
- The extent to which ownership could be diversified in terms of the developed assets i.e. one party owning one part of the infrastructure while another party owned a different part, and with ownership prefiguring the different roles that infrastructure could play i.e. power generation versus flood protection and tourism-facing assets.
- The importance of innovative models with the West Anglesey Demonstration Zone cited as involving a local organisation as an agent of the Crown Estate in managing planning permissions and gaining rents that could be used for local economic development purposes.

In terms of the potential for local and devolved authorities becoming involved in the ownership and financing of schemes directly, one consultee (#1) pointed to prior evidence of this (Robin Hood Energy) but argued that:

“There are fears here of a legacy for taxpayers...previous schemes involving local authorities in renewable energy did not always have a good track record.” However, there was shown to be an important potential role for local authorities, in particular, in the management of the community benefit elements of projects and the development of associated Community Trusts in which local agencies could usefully have more engagement. This pattern has been observed in the case of onshore wind in Wales (see Cowell et al., 2012).

Another consultee (#2) also saw very limited scope for local authorities or Welsh government to become directly involved in tidal lagoon schemes but believed that:

“They do need to be involved in the ecosystem, but it would be difficult for them to have a financial stake. However, large scale tidal range projects might be of more interest to sovereign wealth funds.”

A related issue here was potential planning conflicts of interest should organisations such as Welsh Government or Crown Estate be more directly involved in projects; for example Crown Estate are also a planning authority. In this respect some consultees pointed towards organisations such as Trydan in Wales being understood in terms of an: *“Arm’s length delivery function which would gather better returns for Welsh government”*. Trydan Gwyrdd Cymru⁶, aims to use the Welsh forestry estate to develop a minimum of 250MW of new renewable energy generation capacity by 2030 and an additional 750MW of new capacity by 2040.

It is noted that in addition to Trydan, Cardiff Capital Region (CCR), a consortium of ten local authorities in Southeast Wales, purchased the former coal-fired Aberthaw Power Station from RWE. Aberthaw is located on the Severn Estuary and is considered to have potential for tidal range⁷. Private company CCR Energy was formed by CCR members in 2023 to scope out Aberthaw’s energy generation potential.

As noted in WP1, there has been a reluctance for the UK state to enter the supply side of the market since privatisation. One consultee, however, in discussing the potential for state ownership of schemes pointed to the potential role of the new GB Energy:

“It would be helpful and reduce construction risk and cost of capital. It does not have to be 100% state involvement. Private companies have the skills and international wealth funds have the money available if there was confidence. Involvement from GB Energy could help in terms of consenting. There is also a need to bring [UK] energy and industrial policy closer together. GB energy could be an investor or a provider of soft loans.”

Several consultees made comments about the role of sovereign wealth funds in major tidal range projects. Consultees explained that foreign states have significant ownership in companies which operate in the UK, such as EDF, Statkraft and Vattenfall. One consultee showed that:

“Nowadays it is not so much public versus private in terms of developing Wales renewable capacity but it’s often public versus perhaps firms like Vattenfall where they are state owned firms; so it would be a foreign state investing in the Welsh economy; so it could be public versus public, but clearly not public in Wales fundamentally.”

⁶ Trydan Gwyrdd Cymru <https://www.trydangwyrddcymru.wales>

⁷ Aberthaw, CCR Energy <https://ccrenergy.com/project/aberthaw/>

Selected consultees questioned the scope for any significant local or community ownership of scheme infrastructure. A critical context here for many of our consultees when considering questions of community/local ownership of the electricity generation resource was simply: *“the money is not there”*. Communities were believed incapable of raising the packets of finance that would be needed to get a share of the gigawatts of capacity that could be developed in offshore schemes or tidal lagoons.

Another consultee highlighted that the technology involved in tidal range projects could preclude community ownership. The consultee argued that:

“Denmark is a good template here where many communities have a share in the local wind farm. With tidal range schemes their location might be a break on community ownership. So, for example, it might be easier for the city of Liverpool for people to have a stake because of a population size in the reference area. This would be very different, for example, in the North Wales [tidal power project] case.”

One consultee explained the case of the not-for-profit Menter Môn Morlais Limited acting as third-party agents for the Crown Estate’s to manage the 35Km² West Anglesey Demonstration Zone for tidal energy. With financial support from the Welsh European Funding Office, Menter Môn Morlais Limited gained a Marine Licence from Natural Resources Wales in 2021 and led a planning application – and the construction in 2023 – for a substation and power link from the National Grid at the former Anglesey Aluminium plant.⁸

As third-party managers they will offer a *“plug and play”* space for energy generation companies to locate their turbines and effectively “de-risk” the scenario for developers through having the planning permission, grid connection and Marine Licence. Four companies have gained CfD support for 38MW total capacity and will pay rent charged on a per MW basis.

Welsh Government have recently gained equity in the company in return for an £8m investment⁹ designed to increase capacity. Of note, this remains a scheme to test technologies, albeit with the intention to sell electricity via the National Grid.

⁸ See more details on page 7 https://www.gov.wales/sites/default/files/publications/2023-10/west-wales-and-the-valleys-european-regional-development-fund-erdf-annual-implementation-report-2022-summary_1.pdf
Making waves in North Wales as Cydnerth project gets final approval <https://ambitionnorth.wales/news/making-waves-in-north-wales-as-cydnerth-project-gets-final-approval/>

⁹ Major north Wales tidal energy project expands to support green growth <https://www.gov.wales/major-north-wales-tidal-energy-project-expands-support-green-growth>

One consultee showed that local pension funds might be a route here to local ownership but that they typically invested little in Wales. One consultee also showed that debates about local ownership of large tidal range schemes might be misplaced and that questions of local ownership might be better targeted on grid infrastructure (a very live debate at the time of writing in February 2025 due to strongly contested Bute Energy proposals to development new grid infrastructure in the Towy Valley, and with Bute Energy having a Wales registered office) which could be associated with a lower level of risk but a fairly constant set of economic returns.

One consultee while also pointing out the practical difficulties of communities engaging with large renewables schemes made the point that for community organisations:

“If you want to share of a project it might be better to actually invest in the company rather than the project and then you get the diversification of the portfoliothe communities typically do not have sufficient funds to invest in projectsit's better that if I want to share of ownership that they buy part of [of the listed business] indeed this happened with the Norwegian sovereign fund taking a share in Orsted, it's better that they invest in the company rather than the project then they can avoid the development risk.”

Clearly in the UK context local authorities and communities do not have direct access to sovereign wealth funds.

Looking to precedents in wind, one consultee cited Thrive Renewables, which had spun out from Triodos Bank. Thrive acts as a broker for the general public to invest in renewable projects across the UK¹⁰. Alternatively, the consultee pointed towards a precedent whereby the general public can: *“Own shares in National Power [as was] then it is spread across different locations”*.

Several consultees showed that while Welsh government could make ownership elements a material issue in planning the problem was that Wales did not have full control of planning consents for offshore.

¹⁰ Thrive Renewables <https://www.thriverenewables.co.uk/>

The complexity of ownership was revealed by another renewable energy developer. Here the consultee showed that when large firms financed renewables projects it might be on balance sheet, but that this could include elements of general corporate debt and corporate equity and perhaps green bonds. However, the developer showed that in some circumstances parts of renewable energy infrastructure projects could be sold on at different parts of the process even prior to generating infrastructure being commissioned. In this sense a number of consultees pointed to the dynamic nature of energy generation infrastructure ownership. A further consultee pointed to the mutual investment model that was being employed by Welsh Government in the case of A465 improvements at Hirwaun, and that this could have important lessons for developing tidal range schemes particularly when multiple schemes owned by different developers might need to work in sync¹¹ so as to derive benefits to the grid.

2.6 Regulatory models

Within the consultations the issue of the potential underlying regulatory framework was discussed in terms of price supports, rather than discussion around environmental regulations which are somewhat out of scope in this Tidal Lagoon Challenge project. That said a common issue in discussion was how systems of price supports/subsidies actually worked in the context of the different economic development returns and environmental costs and benefits levered by schemes. While a series of consultees focused on the pre-construction challenge, the issue of price support was still seen to be important. There were concerns about the Contract for Difference framework in the context of large-scale tidal range development.

In this respect one consultee showed that:

“Much for the hurdle in terms of finance was overcoming the initial development phase which could be long. Once planning permission is gained that were few hurdles to overcome in terms of private money coming into a project. It is likely then that some sort of RAB financing scheme would be a necessity in order for the developer to gain funds during the [pre] operational phase.”

¹¹ See for example on this issue Zhang et al., 2022 A day ahead scheduling model of power systems incorporating multiple tidal range power stations. IEEE Transactions on Sustainable Energy, 14.2 see <http://dx.doi.org/10.1109/TSTE.2022.3224231>

Another consultee made the point that the nature of the regulatory mechanism currently prevalent in the UK meant that it was likely that only very large international firms could get involved in the process. One developer showed that the CfD or RAB frameworks focused overmuch on the levelized cost of electricity and that:

“The Treasury still thinks the cost [tidal range] is high under levelized cost of electricity estimates, but problem is this methodology just might not be appropriate for tidal range schemes. The ability of schemes to alleviate flood risks needs to be internalised in the process of how we value them and the discount rates which we use.”

Some consultees were not convinced a system of supports was required in all cases. Selected consultees reflected on a new scheme in Swansea which did not wish to use the CfD mechanism. This is a planned two-phase project, where a 300MW solar scheme is followed by a second phase which would generate 380MW from tidal energy and additional solar. The combined energy sources are designed to power a vehicle charging facility, a 300MW battery factory, and potentially a district heating scheme. One consultee showed that:

“If one goes to the grid you would definitely need a contract for difference, but if [one] sells to users on the site then surplus would just go to the grid.....too many projects are over focused on contract for difference. There is always a problem here because tidal lagoons are not a proven technology like nuclear. The problem is development costs to get to DCO.”

Another developer made related arguments in that once a development consent order was achieved then the contract for difference framework for onshore wind actually works very well, but would be expected to work less well for large scale tidal range projects. Here they cited the case of the nuclear development at Hinkley Point where the CfD framework had placed the developer EDF Energy under considerable pressure from cost overruns:

“However with Sizewell B they've gone for RAB the beauty of that is that if the asset base changes it becomes the opening RAB this places a responsibility upon Ofgem to ensure EDF are managing the project efficiently but clearly Ofgem and the consumer are taking more of the risk.”

In terms of background to the above, the UK Government in 2022 bought out the 50% share of Sizewell C, which was previously owned by the Chinese state-owned CGN. The other 50% share belongs to EDF, who operate and develop all of UK's existing nuclear power stations. One consultee [#11] explained that RAB places a responsibility upon the energy regulator OFGEM to ensure that EDF [developer] manages the project efficiently. If the cost base increases over time, OFGEM and the consumer take on more risk and cost. In turn this provides more certainty to the developer. Here, the state owning an equity stake can support development costs such as land assembly, design and other studies¹². These are critical to ascertaining eventual capital costs and gaining necessary consents.

This theme of CfD versus RAB was picked up by another consultee who made the point that:

“Contract for difference would have worked well with a small scheme but a large project would probably have to go for a RAB model. Large tidal range are key pieces of infrastructure. Contract for difference works well for a 50 to 60 year scheme...but if we are talking about 120 to 150 years then contract for difference would still need to get money back within 40 years...so RAB would be a better model in terms of pushing things forward.”

In respect of the above there was also an issue raised that whether a CfD or RAB framework was applied that part of the decision had to revolve on whether a technology was actually proven or not. It seems that OFGEM has recognised the changes required by the energy system and for energy security and in turn introduced new schemes such as the Long Duration Electricity Storage (LDES) cap and floor scheme. Such adjustment to the regulatory model might be needed for development of tidal range schemes.¹³

2.7 Project finance

Issues of project finance are tightly linked to issues of ownership and regulation. Many of the consultees were clear on the risks facing prospective financiers of tidal range projects, and with this coupled to problems in estimating costs, uncertainty on the potential supply side to tidal range development and uncertainty on the nature of economies of scale as the industry around tidal range schemes developed.

¹² Funding Sizewell C <https://www.sizewellc.com/proposals/funding-sizewell-c/>

¹³ See <https://www.ofgem.gov.uk/publications/cap-and-floor-regime-handbook-2024> see also <https://www.enerdata.net/publications/daily-energy-news/ofgem-uk-sets-out-long-duration-electricity-storage-l-des-cap-and-floor-scheme.html>

However, the bulk of comments around finance were not so much around the financing of the developed infrastructure but rather in terms of support finance for the pre-construction phases of projects. There seemed to be some agreement that once projects had gone through development consents and gained regulatory support then capital from diverse sources would be available, and with models such as RAB even permitting financial returns to investors through the pre-development phase. However, the key issue was recognised in projects actually getting to an investable stage.

Various types of finance were discussed to bridge these gaps. However, very often this discussion was in a context of severe funding restrictions in the public sector. Some consultees mentioned the potential of state-backed loan schemes, such as through Business Wales and the Development Bank of Wales. However, the sums involved in moving projects through to consents were considerable and one consultee argued that organisations such as the Development Bank only willing to invest in new technologies at readiness level 8 (TRL8) or above. This means that a technology is completed and qualified through test and demonstration. In the case of tidal range, the individual technologies are proven but there remains a question of how they come together. One [#3] explained that:

“So for capital in terms of technology development the Development Bank Wales is historically not a place one would go.”

A common theme in discussions was the disjoin in the potential of public sector financing and the developmental and flood reduction potentials of successful schemes. For example one consultee showed that a concern:

“was getting this seed money to get projects to planning; this could be as much as to a £20 million. ...the [project] would have important economic development benefits in terms of employment and employment in ancillary operations around the tidal lagoon.”

Some consultees referred to the refocusing of local government pension funds into bigger pots as a potential opportunity. One consultee [#4] cautioned that *“Pension funds might be a route here but they typically invest little in Wales”*. Another consultee [#11] explained that investment companies such BlackRock may own shares in energy companies, and therefore indirectly represent many pension funds. However, energy projects on a community scale have struggled to attract investment from pension funds in Wales because what they do is not recognised as a regulated offer [#13]. Some of the bigger pension funds required share offer to be regulated in order to offer recommendations

One consultee [#5] explained that the Association of British Insurers has an Investment Delivery Forum which may be interested in different types of energy schemes.

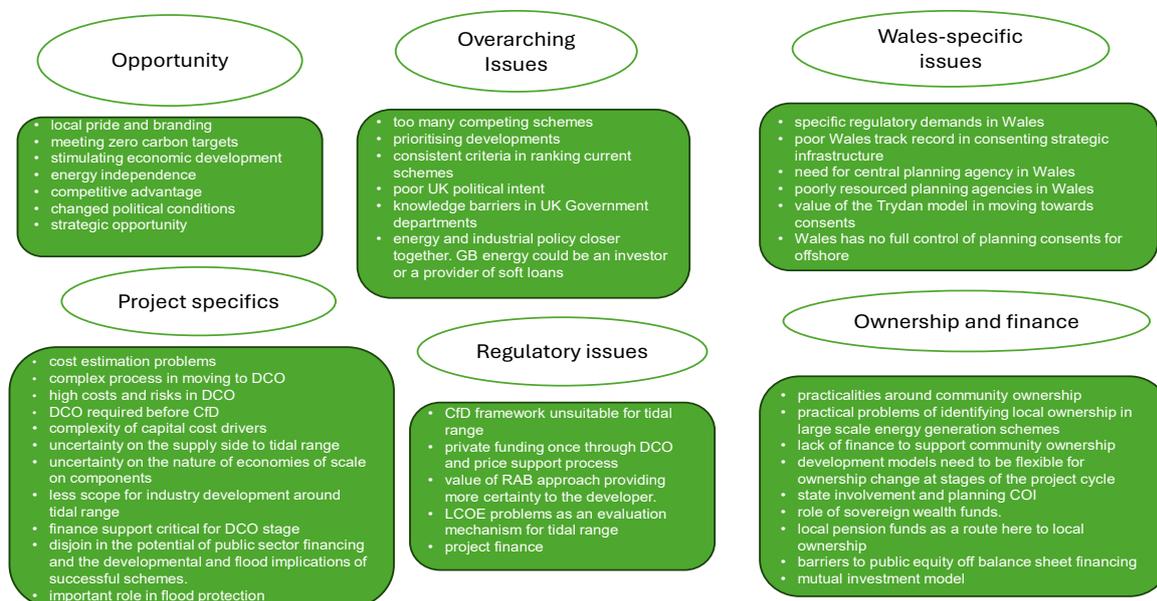
However, the overall messaging from the consultations was in terms of direct or indirect state support to seed selected tidal range projects.

2.8 Opportunities: Flood defences and mitigation

A number of consultees felt strongly that tidal lagoons could have an important role in flood and coastal protection. One consultee [#5] cited the following scenario: “For south Wales, with climate change, we may have to relocate people, so might need to build walls around lagoons up to 2-3 metres. Or do we simply abandon some of our coastal areas? It is important that infrastructure is built in such a way to be adaptable.”

There were other people who had similar views. The new scheme for the Swansea Tidal Lagoon notes that flooding seems to be caused by rivers backing up; the walls of their potential lagoon would be designed to take pressure off the river outlets. The Swansea scheme is estimated to offer £600 million in flood defences for the local area [#6] and the North Wales proposal (from Llandudno to Prestatyn) offering £1.5–3bn worth of benefits.

Figure 2.1 Key themes from the consultations



2.9 Conclusions from the consultations

In Figure 2.1 is an attempt to summarise key findings from the consultations in terms of strategic opportunity, overarching issues surrounding development of tidal range schemes, Wales specific issues for tidal range schemes, and then project specific issues, regulatory and ownership issues. In the next part of the report, we seek to bring together themes from the consultations together with those from the WP1 context report to examine how far existing developmental and financial models are practicable for potential tidal range schemes given capital requirements and operational timescales.

3 Challenging development context of tidal range schemes

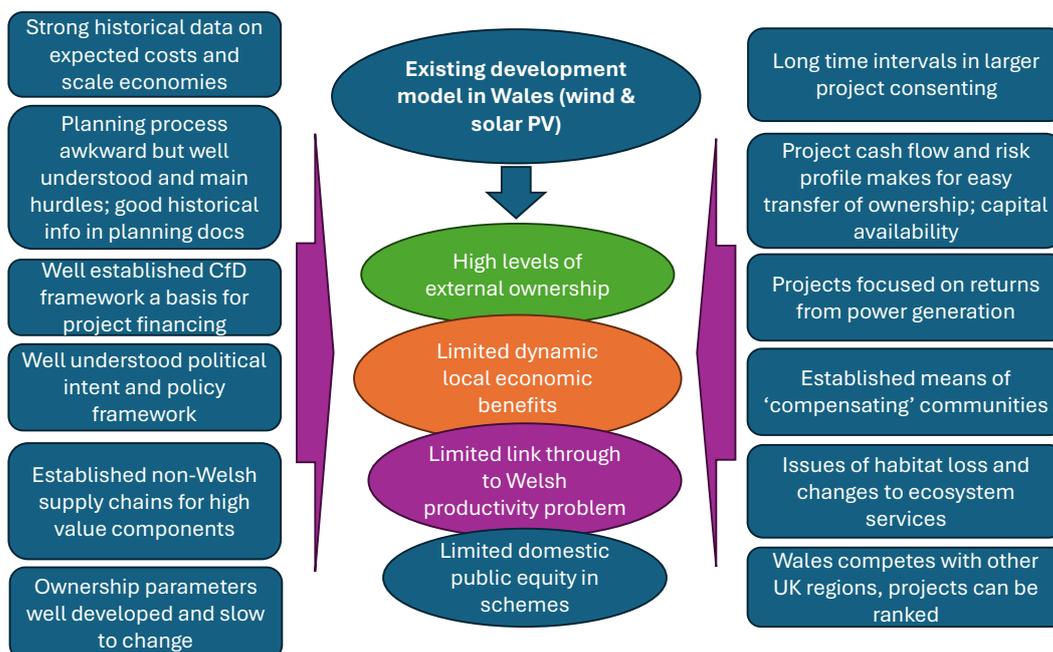
The objective of the WP2 stage of the Tidal Lagoon Challenge project was to examine how far existing developmental and financial models are practicable for potential tidal range schemes given capital requirements, operational timescales, uncertainties and risk. The findings from the WP1 context report and the consultation reveal that unless significant parts of the renewable electricity generation context change (in the UK and Wales) it is difficult to see even smaller scale tidal range projects becoming operational before 2040 unless the renewables financing model changes in the UK and Wales. Currently, Grid pricing mechanisms do not reward the predictability, flexibility and reliability which gives tidal schemes advantages over other renewables, which means even at very large scales, novel lagoon schemes and pump and storage hydro will find it difficult to compete with more established renewables technologies. Furthermore, current pricing mechanisms seem to suit short-term projects with a 20-30 years life span as compared to long-term projects with a life of over 100 years.

Prior to coming to conclusions on what might need to change to enable tidal range projects, it is useful to reflect on the current development model in Wales in terms of technologies such as wind and solar PV. We accept that some elements of what follows in Figure 3.1 would be contested, but fundamental to a current stream of projects in these technology areas in Wales is extensive historical knowledge on the development costs of schemes, design parameters, and very critically the expected costs of the highest value components. This knowledge base has been built up over 30 to 40 years and with a steady industry progression based on experience/learning effects in both the supply of components and the development process.

Coupled to this, for current developers in Wales there is a well-established contracting process and a well understood UK political intent. These factors make for less uncertainty in terms of the net cash flows of projects, project progression, and operational and maintenance fundamentals - and consequently encourage a ready flow of capital into projects, although in the Welsh case much of this capital is externally owned and controlled¹⁴. Furthermore, in wind and solar the focus is understandably overwhelmingly on electricity generation alone rather than potentials in terms of broader benefits, such as reducing flood risk or improving local tourism prospects.

In large measure, the development model here allows for the ready transfer of ownership should this be needed, limited need for direct public equity in schemes and then with a paucity of local economic effects and with the operation of successful projects having limited linkages with Welsh economic development, or productivity growth.

Figure 3.1 Elements of the existing development model for Welsh renewables (Solar PV and Onshore wind).



¹⁴Jones, C., & Munday, M. (2020). Capital ownership, innovation and regional development policy in the economic periphery: An energy industry case. *Local Economy*, 35(6), 545–565. <https://doi.org/10.1177/0269094220968048>

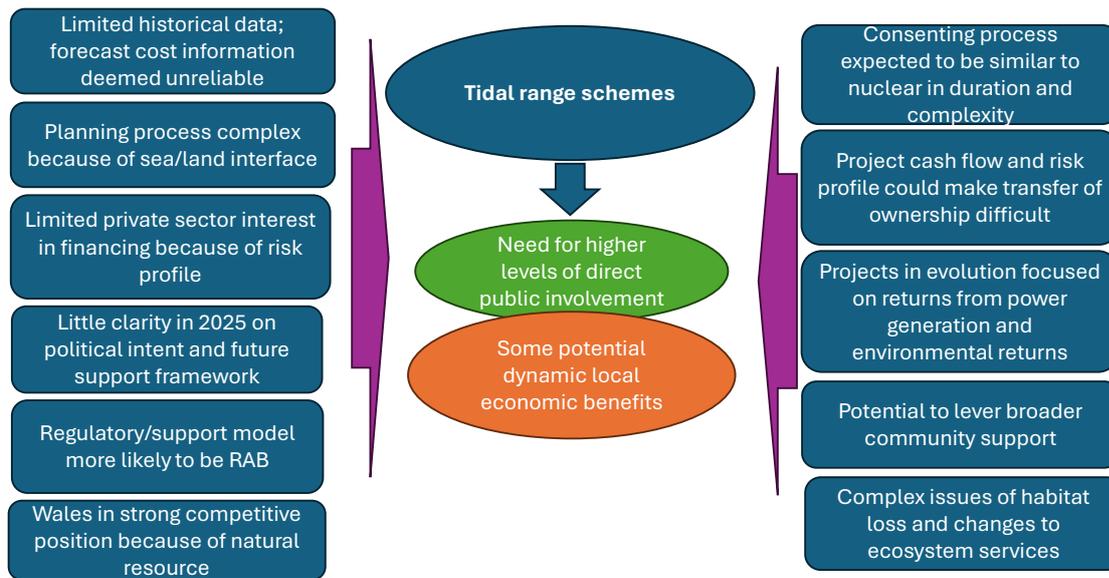
The situation summarised in Figure 3.1 might be contrasted with the current developmental context and future opportunity set around tidal range schemes. Figure 3.2 here picks up on some significant elements of this context. Our consultations and analysis show that a lack of information is a major barrier. It is difficult to generalise on scheme costs based on the small number of schemes in other parts of the world where the economic, regulatory and indeed environmental context can be very different and assessment by the developers might be conducted on different basis leading to incompatible outcomes. A major hurdle here is better information on the expected cost of electricity generation equipment and construction.

While detailed data was available from the Swansea Tidal Lagoon Power project that is now out of date¹⁵. There are a series of cost models in the academic literature¹⁶, but these and related estimates are making assumptions about a supply side being available and are quite difficult to defend. This uncertainty spills over into the expected scale of costs during the process of gaining development consents, and makes contracting for the price of the generated electricity very difficult.

¹⁵BEIS (2018). *TLP Tidal Lagoon Programme: Factsheet*. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/719189/tidal-lagoon-programme-factsheet.pdf; see also Hendry, C. (2017). *The role of tidal lagoons*. Hendry Review. <https://hendryreview.files.wordpress.com/2016/08/hendry-review-final-report-english-version.pdf>

¹⁶ See Vandercruyssen, D., Baker, S., Howard, D. and Aggidis, G. (2023). Tidal range generation: combining the Lancaster zero-dimension generation and cost models. *Proceedings of the Institution of Civil Engineers-Energy*, 177(2), 49-62. <https://doi.org/10.1680/jener.22.00077>; Vandercruyssen, D., Baker, S., Howard, D. and Aggidis, G. (2022). Tidal range electricity generation: A comparison between estuarine barrages and coastal lagoons. *Heliyon*, 8(11). 11381. <https://doi.org/10.1016%2Fj.heliyon.2022.e11381>

Figure 3.2 The develop context for tidal range in Wales



Moreover, and as revealed in the WP1 report, there is still little clarity in terms of the strength and intent of political support. Selected consultations suggested that the lack of consistent political support over time and across Welsh/UK Government departments (in addition to limits in technical capacity) has hindered project evolution. Understandable risk aversity in the public sector, limitations on the amounts of public funding currently available, a relatively complex ‘expected’ planning and consent framework then means that there is little scope for private capital to come forward. Critically the consultations suggested that there might be more appetite in terms of public and community support for tidal range projects, than that shown by governments.

4 Moving the development dial on tidal range projects

What needs to change in the business model? Our consultations, together with a growing body of academic and report evidence, have revealed the tidal range private incentive problem. In short, a contract for difference framework that only provides rewards for the developer once a project is commissioned and generating electricity, and pays only for kilowatts not reliability, flexibility or predictability, is unlikely to bring forward private capital given the issues revealed in section 3 of this report. The underlying problem here is the risk profile of tidal range projects which will feature (like nuclear) higher fixed/sunk costs than other renewables in development and construction and then lower marginal costs in operation. For the private sector large utility and infrastructure companies there is simply no incentive to lead on tidal range projects under this prevailing business model, and with plenty of more viable projects using other renewable technologies (such as offshore wind) which fit better with the CfD framework.

The expected cash flow characteristics of tidal range projects have led to calls for the development of a Regulated Asset Base (RAB) model to support new development. The UK Nuclear Energy (Financing) Bill 2021 revealed this as an option for new UK nuclear builds¹⁷. The RAB is not a new concept. The RAB model effectively means that a company gains a license from a regulator (here OFGEM) to charge a regulated price to consumers in exchange for developing and building the infrastructure. Then, unlike CfD, a RAB model means that developers in the private sector (or in the nuclear case at Sizewell B, a state owned French multinational) share construction-related risks with UK electricity consumers and with 'expected' reductions in the costs of capital associated with nuclear build such that consumers benefit in the long term.¹⁸

¹⁷BEIS (2022). *Guidance on development costs and the nuclear Regulated Asset Base model*. <https://assets.publishing.service.gov.uk/media/6384ae9ce90e0778a2122668/development-costs-nuclear-rab-model-guidance.pdf>

¹⁸ See [Future funding for nuclear plants - GOV.UK](#)

In *theory*, the RAB then provides more clarity on cash flows for developers in the construction period. Moreover, the RAB approach could be used to integrate environmental and local economic benefits into the development and construction process¹⁹, and solves the problem of developers having insufficient balance sheets to move forward on projects. But the approach leads to increased costs for consumers and there are attendant dangers of moral hazard in terms of developer behaviour once contracts are in place.

The consultations suggest that some type of RAB model would be required for tidal range projects but this might not be a panacea. For example:

- The proposed RAB framework for Sizewell B was developed on knowledge derived in the process of Hinkley Point C i.e. some elements of the cost and technology were known; this is less the case with tidal range. Indeed, we argue this uncertainty in respect of the responsiveness and availability of the domestic and international supply side to tidal range could be a problem.
- Any RAB would need to be project specific. There is, however, yet no clear priority tidal range development in the UK. Again the importance of having one project ‘close to development consents’ would seem to be critical.
- The RAB for Sizewell B was developed consequent on - and hence responded to - a key strategic issue with construction-related risks associated with the failure of projects on Anglesey and Tee-side led by Japanese multinationals (Toshiba and Hitachi). That clarity is lacking with tidal lagoons.
- It is unclear how far a RAB model would cover for the initial development costs in moving to the consents in the tidal lagoon case, and with consultees reporting this as a critical element of the current bottleneck.
- It is unclear how far ‘Wales’ would have any agency in the development of a RAB approach, via involvement of Welsh Government, wider stakeholders or the private sector.
- There is a lack of clarity on how environmental benefits or costs would be integrated within the RAB approach including benefits in terms of flood defences.

¹⁹See also on this issue in respect of CfD DESNZ. (2023). *Call for Evidence on introducing non-price factors into the Contracts for Difference Scheme*. <https://assets.publishing.service.gov.uk/media/643cfd622ef3b000c66f2c2/cfd-non-price-factors-call-for-evidence.pdf>; DESNZ. (2023). *Government Response to the Call for Evidence on introducing non-price factors into the Contracts for Difference Scheme*. <https://assets.publishing.service.gov.uk/media/64f9c596a78c5f00142657f9/cfd-scheme-non-price-factors-cfe-government-response.pdf>

What might be done in this complex environment at the level of the Welsh economy to encourage tidal range projects, whether wholly within Wales or on the cross-border Dee and Severn Estuaries?

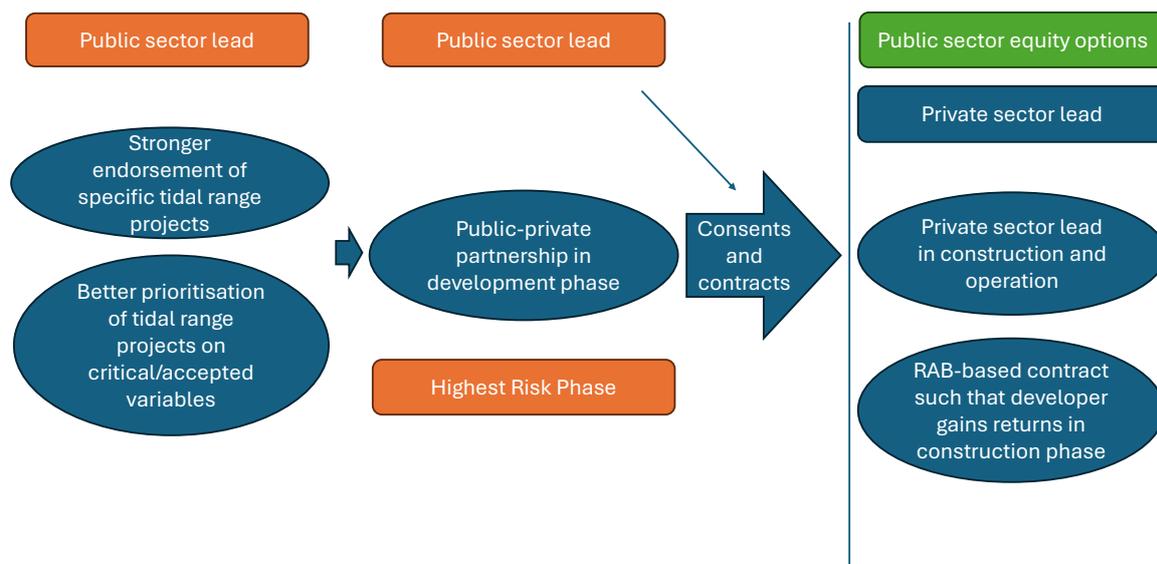
First, it is difficult to see any meaningful tidal range progression in the current context without public-private partnership during the development expenditure phase, and here with the emphasis on a public sector strategic (if not financial) lead. Here our consultations and analysis would align with the recommendations of the Severn Estuary Commission (2025). At the level of Welsh Government and local authorities there has been a commitment to renewable electricity generation but stakeholder views as to the desirability of tidal range are quite diverse, such that progression requires a firmer Wales commitment nested within a UK commitment.

There have been some stronger signals in terms of the UK government allowing tidal (smaller scale) projects in the fourth CfD auction, and the development of GB Energy, but moving towards a tidal range project at scale requires a clearer public signal and this would be expected to include direct investment, and with tidal range at scale linked to either a widening of the factors relevant within the CfD auction mechanisms, or to innovation policy (not least in the context of the uncertain supply side to the industry) as much as renewable energy policy.²⁰

²⁰UK Government has already published information in respect of the criteria for strong tidal range proposals. See DESNZ. (2023a). *Criteria for a well-developed tidal range proposal*. <https://www.gov.uk/government/publications/tidal-range-projects-criteria-and-how-to-submit-a-proposal/criteria-for-a-well-developed-tidal-range-proposal>

Second, the public sector will need to choose and promote specific projects - and this requires a prioritisation. Currently much of the debate has centred on tidal range as a potential source of renewable energy in different places but there needs to be faster movement towards endorsement of specific projects. Currently there are a plethora of projects under consideration in the UK (and a number of potential projects even within the Severn Estuary²¹), all of which are severely resource constrained and with little prospect of them finding private capital to go through the consents process. While there has been interest in the concept of a 'demonstration' project this might be considered a risk averse approach. There are already a series of what are effectively demonstration projects around the globe²², and then there could be limited merit in developing projects that are at a smaller scale; bluntly there is a need to take risk with the first UK project and build at scale.

Figure 4.1 Moving forward with tidal range projects



²¹ See for example, [Severn Estuary Commission - Severn Estuary Commission](#)

²² See for example IHA. (2016). *Technology case study: Sihwa Lake tidal power station*. <https://www.hydropower.org/blog/technology-case-study-sihwa-lake-tidal-power-station>

Third, with projects prioritised, there is scope for a special purpose vehicle to move a project to a consent and contract stage. Elements of the debate to date have argued that a public-private partnership model might be required through each part of the tidal range project the life cycle (development, construction, operation etc.). On the evidence reviewed under WP1 and in through our consultations we conclude it is too early to come to this conclusion. The barrier that comes up again and again in consultations (and not just for this project) surrounds getting tidal range over the development hurdle. There could be an argument that once projects have consents, that private capital will flow forward in the presence of an appropriate and flexible RAB framework (and it is noted that the RAB framework could include elements that allow for supply chain uncertainty and the environmental benefits of projects). The model espoused in the Trydan Gwyrdd Cymru framework is a valuable one and elements of this approach would be useful in the case of tidal range projects. However, a special vehicle for a 'Welsh' tidal range project would require elements of public and private sector support, but (as with Trydan) at arm's length from planning and consenting authorities. If such a vehicle can bring a project to consent and prepare the ground for contract, then there is scope for the private sector interests in the vehicle to continue through to construction and then with an option for a degree of public equity considered at that stage. Here then the local ownership parameter is in terms of the public sector involvement, or the involvement of separate and passive local investors – for example Welsh public sector pension funds, local communities and the private sector.

This type of vehicle reduces private sector exposure during the riskiest stage of the project, and with the public sector able to finance at a lower cost of capital; the framework would also allow for ownership transfer (another important component of the Trydan model). This type of framework is not new, but here it is focused on the development phase prior to the private sector taking over construction and operation.

5 Progress through to WP3

In the next part of the Tidal Lagoon Challenge project we will seek to use both the findings from the WP1 and WP2 reports to consider how the Welsh economy might be affected by the development of tidal range projects under different financial models. It is accepted here that the primary aim of tidal range projects is understood as power generation but there are expected to be benefits for the Welsh economy and the focus on WP3 is to examine scenarios of impact using the most recent economic model of the Welsh economy, but then to consider the decision variables that might have the greatest socio-economic consequences. The approach will also consider the benefits of marginal carbon savings. This discussion will be developed in the context of what is expected to be a very limited local supply side to support such Welsh tidal range projects.