



## REDAWN – Reducing Energy Dependency in Atlantic area Water Networks

# Financing Micro Hydropower

### Work Package 3: Capitalisation

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## Executive Summary

This report attempts to outline how micro hydropower (MHP) installation can be financed given the analysis by the REDAWN project. MHP is a small generator unit, which typically produces between 5kW and 100kW of energy. An overview of MHP is provided in Pal and Khan (2021). The use of micro hydropower (MHP) for the purposes of electricity generation has been outlined in previous studies of the REDAWN project ([www.redawn.eu](http://www.redawn.eu)). This technology constitutes a capital improvement for the firms (organisational or corporate entities) that are engaged in their installation.

The potential market value of MHP installations ranges between €457.6m to €707.9m depending on location, devices and the general environmental conditions. This low-cost solution to energy recovery and carbon-offset in the water sector could avail of standard financial instruments, especially if firms, households and municipalities could ensure that the savings generated would translate into a ongoing cashflow for repayment of a loan. Complex financial instruments for MHPs may be difficult unless it was part of a wider package of capital investment. The aim of this report is to outline the financial approach to the deployment of MHP.

This report explores Green Finance as one pathway for deploying MHP. The importance of the European Green Deal created a demand for so-called ESG (Environmental, Social and Governance) investments in Europe and globally. The challenge of ESG investment is ensuring that it is compliant with the requirements of ESG criteria. ESG investments, when placed in the fixed income market, are commonly referred to as "Green Bonds". Green Bonds are investments whose proceeds are directed towards projects with environmental benefits.<sup>1</sup> The European Central Bank (ECB) has aligned 3.5% of its investment portfolio to green bonds as part of its asset purchase programme in 2019 and intends on expanding its role in the support of the European Union's Green Deal policies.

In this report we recommend that while a pathway to Green Bonds would be optimal, the MHP's may not meet the criteria, requiring alternative pathways. Even those alternative pathways require reporting. The International Capital Markets Association (ICMA) provides a clear and continuously updated manual for the reporting requirements of Green Finance. The ICMA clearly states that under the wider Green Bond issuing guidelines, which are more encompassing than those provided by the EU, that sustainable water and wastewater management, including sustainable infrastructure for clean and/or drinking water, wastewater treatment, sustainable urban drainage systems and river training and other forms of flooding mitigation are projects that fall under the remit of a green bond. This would mean that generally a green bond could be created for MHP projects.

Given some of the constraints of the Green Bond principles for the EU, a series of alternatives are investigated, including the Danish Nycredit model. This model is attractive

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<sup>1</sup> Please see the European Central Bank: [https://www.ecb.europa.eu/pub/economic-bulletin/focus/2018/html/ecb.ebbox201807\\_01.en.html](https://www.ecb.europa.eu/pub/economic-bulletin/focus/2018/html/ecb.ebbox201807_01.en.html)

as it is an existing structure that allows for capital improvements and real estate development that is low cost, socially-orientated and does not require meeting green bond principles or EU taxonomy requirements.

As a commercial prospect, MHP for an individual firm will need to highlight how it will successfully bring about or add to the operating surplus of a going concern. In the case of a municipality, the requirements for an operating surplus are less essential as the existing water systems may be seeking to deliver a service to citizens and will seek to have that service subsidized as there exists a market failure. In such cases where a subsidy is in place to support the water system, that can be divided into an operational expenditure subsidy or a capital expenditure subsidy or a mixture of both. MHP's capacity can provide a powerful basis for cost reduction on the part of municipal water systems, which ultimately reduces the need for subsidization or cost-induced price increases for consumers. For an individual firm, funding to an MHP will be based on a simple cost-benefit analysis of the MHP itself and an evaluation of the impact on the balance sheet of the going concern in a purely commercial banking transaction; that would apply to firms, households and municipalities.

If all ESG or green finance options are unavailable, MHP does offer opportunities for Public-Private-Partnership (PPP) investment with careful oversight and management.

MHPs do offer an economically viable solution to reduce energy consumption by actors in the water sector.

# 1. Introduction

The use of micro hydropower (MHP) for the purposes of electricity generation has been outlined in previous studies of the REDAWN project. This technology constitutes a capital improvement for the firms that are engaged in their installation. MHP is a small generator unit, which typically produces between 5kW and 100kW of energy. An overview of MHP is provided in Pal and Khan (2021). The aim of this report is to outline the financial approach to the deployment of MHP.

The reason for the deployment of MHP is to provide an offset of energy consumption required to operate water services as well as positive effects of reducing water pressure in the system, which will reduce the number of leaks in the overall water system. This is not an insignificant amount of energy, estimated to be 4% of global energy consumption (Picazo et al. 2020). Previous work in this space has focused on the delivery of MHP from the viewpoint of engineering and economic viability. Pardo Picazo et al. (2020), García et al. (2019), García et al. (2021), Ramos et al. (2020) and Fabiani et al. (2019) found that the introduction of MHP into water and irrigation systems can be done in a way that is economically justifiable in terms of electricity generated. Importantly, studies by Merida Garcia and Mc Nabola (2021) with Ramos et al. (2020) discuss the amount of carbon off-set from these activities. This has a new-found importance in the world of investment under the title of ESG - Environmental, Social and Governance.

ESG investment has grown rapidly during the period of COVID-19. In the case of large capital projects, bond financing (otherwise known as fixed income investment) is a method of investment that is attractive, especially in the currently low interest rate environment. In terms of provision of MHP, this would be most applicable to larger projects underwritten by corporate entities as opposed to individual households, farms, smaller municipalities or small and medium-sized enterprises. The potential for the successful financing via the ESG pathway has improved over the last 18 months. As of May 2021, ESG assets under management stood at \$374bn, tripling in value over the past 3 years. In terms of comparison, the wider ESG bond investment only grew 12% in comparison to the 66% for ESG in 2020. Mooney (2021). This report explores the development of MHP as a component of ESG investment delivery.

## 2. Understanding the Value Chain: Green Finance

The importance of the European Green Deal has been outlined in European Commission (2021) and elaborated upon by Claeys et al. (2019), Elkerbout et al. (2020) and Leonard et al. (2021). This has created a demand for so-called ESG investments in Europe and globally. The challenge of ESG investment is ensuring that it is compliant with the requirements of ESG criteria. ESG investments, when placed in the fixed income market, are commonly referred to as "Green Bonds". Green Bonds are investments whose proceeds are directed towards

projects with environmental benefits.<sup>2</sup> The European Central Bank (ECB) has aligned 3.5% of its investment portfolio to green bonds as part of its asset purchase programme in 2019 and intends on expanding its role in the support of the European Union's Green Deal policies (Ilzetzki and Jia 2021)

The European Union has provided a useful framework for European Green Bond Standards. Investments must align to activities which substantially contribute to one or more of six environmental objectives. These are climate change mitigation; climate change adaptation; protecting marine and water resources; transitioning to a circular economy; preventing pollution; and protecting or restoring biodiversity and ecosystems. ESG data disclosure in this space will be necessary as of 2022 to avail of the green bond taxonomy.

There are some major challenges to this approach. Namely that the EU's encouragement of Green Bonds and green finance generally changes the nature of finance in Europe. Views summarized by Ilzetzki and Jia (2021) in a recent VOXEU.org article, highlight how the work of the ECB can be considered as detrimental to the legislated aim of price stability. It highlights that the tools for price stability in the Eurozone and those needed for the implementation of the Green Bond strategy are profoundly different.

At present, the EU Green Bond Standards have yet to be implemented but this has not prevented major institutional investors from dramatically increasing their demand for ESG bond funds. Approximately, 81% of Nordic and Dutch pension funds are now invested in green bonds (Mooney 2021). The challenge for ESG investment is data transparency. Concerns have been voiced that existing ESG investment practices are following a pattern of "Greenwashing" their investment portfolios.

"Greenwashing" is a pejorative description of investments that appear on face value to be supporting ESG goals, such as the UN Sustainable Development Goals, but are in fact nothing more than traditional investments subject to a re-branding exercise. The figure below, from the Urban Land Institute, highlights the changing understanding of how capital is to be used in the context of sustainable investment. The move towards a more sustainable approach to finance reflects the adoption of the UN Sustainable Development Goals by many during the COVID-19 pandemic as the foundation of the "Building Back Better" movement (Urban Land Institute 2021).

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<sup>2</sup> Please see the European Central Bank: [https://www.ecb.europa.eu/pub/economic-bulletin/focus/2018/html/ecb.ebbox201807\\_01.en.html](https://www.ecb.europa.eu/pub/economic-bulletin/focus/2018/html/ecb.ebbox201807_01.en.html)





Source: Impact Investing Institute, Bridges Fund Management and Impact Project Management

Figure 1: The New Spectrum of Capital. Source: Urban Land Institute (2021).

The sustainability financing plan of the European Commission with the European Investment Bank (EIB) can be found in Figures 2-4. The Commission's plan is to support over €1 trillion in sustainable investment over the next decade (European Commission (2020; 2021). The EIB has already stepped forward to support this policy objective with 40% of lending being directed towards environmental sustainability (European Investment Bank 2021; Figure 2).



Figure 2: The European Union Green Deal. Source: Figure 1: The Investment Plan within the European Green Deal. European Commission (2020).

The aim of this exercise is to ensure that the European Union achieves the goal of a 55% reduction in GHG emissions, with the targeted investment of €260bn per annum by 2030 (European Commission 2021; Figure 3-4). The ECB has the potential to bring sufficient liquidity to the table so as to ensure that a viable and liquid market for financial instruments orientated towards ESG is developed and the objectives of EU policy are achieved.

The bottom line is that it is perfectly possible for the ECB to use the instrument of money creation to favour environmental investments without endangering price stability. Of course, one could also argue that the ECB could use its monetary instrument to favour other worthwhile projects, such as poverty reduction. If a majority of the population were to desire this it should be done. But it would create the risk that the ECB was loaded with too many social responsibilities which it could not handle properly.

Given the existential threat of the degradation of the environment, including climate change, the priority should be to use the ECB's money-creation capacity towards the support of environmental projects. This can be done without creating inflation.<sup>3</sup>



**Figure 3: European Investment Plan for the Green Deal.** Source: Figure 2: The Sustainable Europe Investment Plan. European Commission (2020).

<sup>3</sup> DeGrauwe, Paul. "Green Money Without Inflation." *Social Europe*. <https://socialeurope.eu/green-money-without-inflation>



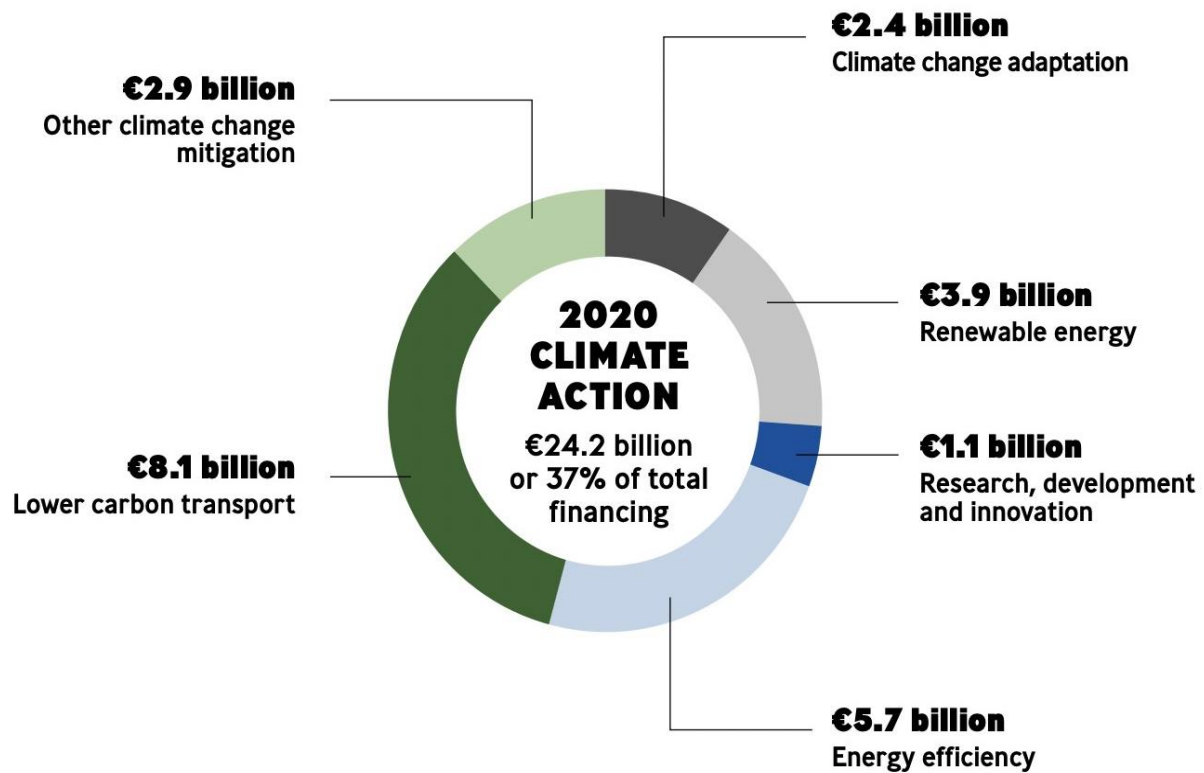


Figure 4: The European Investment Bank. Source: European Investment Bank (2021).

The EU policy in this space has been enhanced since March 2021 with the publication and subsequent approval of the EU Taxonomy arising from the EU Taxonomy Climate Delegated Act. The Taxonomy regulation took effect from 12 July 2020<sup>4</sup>. It is important to note that MHP is part of this taxonomy but it is not entirely clear that MHP will always meet the minimum criteria.

This taxonomy is part of the first deliverables for the EU Green Finance framework, which has given rise to three key regulations:

- (1) To create a sustainable taxonomy for the EU (Regulation (EU) 2020/852);
- (2) To make disclosures relating to sustainable investments and sustainability risks clearer (Regulation (EU) 2019/2088); and
- (3) To establish low-carbon benchmarks (Regulation (EU) 2019/2089), setting the requirements for ‘EU Climate Transition Benchmarks’ and ‘EU Paris-aligned Benchmarks’.

The criterion for electricity generation as it relates to hydroelectric is that the activity complies with either of the following criteria:

- The electricity generation facility is a run-of-river plant and does not have an artificial reservoir

<sup>4</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT>

- The power density of the electricity generation facility is above 5 W/m<sup>2</sup>
- The life-cycle GHG emissions from the generation of electricity from hydropower, are lower than 100gCO<sub>2e</sub>/kWh.

\* The life-cycle GHG emissions are calculated using Recommendation 2013/179/EU or, alternatively, using ISO 14067:2018(162)ISO standard 14067:2018, Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification<sup>5</sup>, ISO 14064-1:2018(163)ISO standard 14064-1:2018, Greenhouse gases — Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals<sup>6</sup>. or the Gres tool(164)Publicly available online tool developed by the International Hydropower Association (IHA) in collaboration with the UNESCO Chair for Global Environmental Change<sup>7</sup>.

- Quantified life-cycle GHG emissions are verified by an independent third party.

This also applies to infrastructure enabling low carbon transport of water. The activity complies with one or more of the following criteria<sup>8</sup>:

- The infrastructure is dedicated to the operation of vessels with zero direct (tailpipe) CO<sub>2</sub> emissions: electricity charging, hydrogenbased refuelling
- The infrastructure is dedicated to the provision of shore-side electrical power to vessels at berth
- The infrastructure is dedicated to the performance of the port's own operations with zero direct (tailpipe) CO<sub>2</sub> emissions
- The infrastructure and installations are dedicated to transshipping freight between the modes: terminal infrastructure and superstructures for loading, unloading and transshipment of goods.
- The infrastructure is not dedicated to the transport or storage of fossil fuels.

## 2.1 Green Bond Criteria of the International Capital Markets Association

The International Capital Markets Association (ICMA) clearly states that under the wider Green Bond issuing guidelines, which are more encompassing than those provided by the EU, that sustainable water and wastewater management, including sustainable infrastructure for clean and/or drinking water, wastewater treatment, sustainable urban drainage systems and river training and other forms of flooding mitigation are projects that fall under the remit of a green bond. This would mean that generally a green bond could be created for MHP projects.

There are currently four types of green bonds supported by the ICMA that align to the Green Bond Principles (GBP):

1. Standard Green Use of Proceeds Bond: a standard recourse-to-the-issuer debt obligation aligned with the GBP.

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<sup>5</sup> See: <https://www.iso.org/standard/71206.html>

<sup>6</sup> See: <https://www.iso.org/standard/66453.html>

<sup>7</sup> See: <https://www.hydropower.org/gres>

<sup>8</sup> Please see the MS Excel tool found [here](#)

2. Green Revenue Bond: a non-recourse-to-the-issuer debt obligation aligned with the GBP in which the credit exposure in the bond is to the pledged cash flows of the revenue streams, fees, taxes etc., and whose use of proceeds go to related or unrelated Green Project(s).
3. Green Project Bond: a project bond for a single or multiple Green Project(s) for which the investor has direct exposure to the risk of the project(s) with or without potential recourse to the issuer, and that is aligned with the GBP.
4. Green Securitised Bond: a bond collateralised by one or more specific Green Project(s), including but not limited to covered bonds, ABS, MBS, and other structures; and aligned with the GBP. The first source of repayment is generally the cash flows of the assets.

The final version, the green securitised bond, will be returned to later in this report as an option for the financial support of MHP.

Crucially, MHP projects would need to develop a framework of key performance indicators to indicate that they are compliant with the green bond principles. At the core of enabling any form of Green Finance is reporting. The International Capital Markets Association (ICMA) provides a clear and continuously updated manual for the reporting requirements of Green Finance. The principles of which are outlined in Figure 5.<sup>9</sup> Usefully, underwriters and originators tend to put in place clear structures of reporting. A useful practical example is provided by the DNB group, a Norwegian financial services group. Their green covered bond framework aligns to the EU Taxonomy but addresses some of the data gaps that currently exist on the precise definition of a near-zero energy building. The most important measurement for these bonds related to energy demand for the building stock. In the context of the DNB Group portfolio, the aim is to achieve Norwegian building code of TEK 10 or TEK 17, indicating a maximum energy consumption of 126kWh/m<sup>2</sup>. At present, the existing housing stock consumes on average 256kWh/m<sup>2</sup> and projects under the DNB green covered bond consume on average 122kWh/m<sup>2</sup> per annum, 53% less than average and well within the criteria laid down by the ICMA and the European Union. MHP, while producing carbon offsets, do not result in such dramatic reductions as those required by the DNB or the European Commission.

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<sup>9</sup> The manual can be found [here](#) on the ICMA Group website.

## The Principles

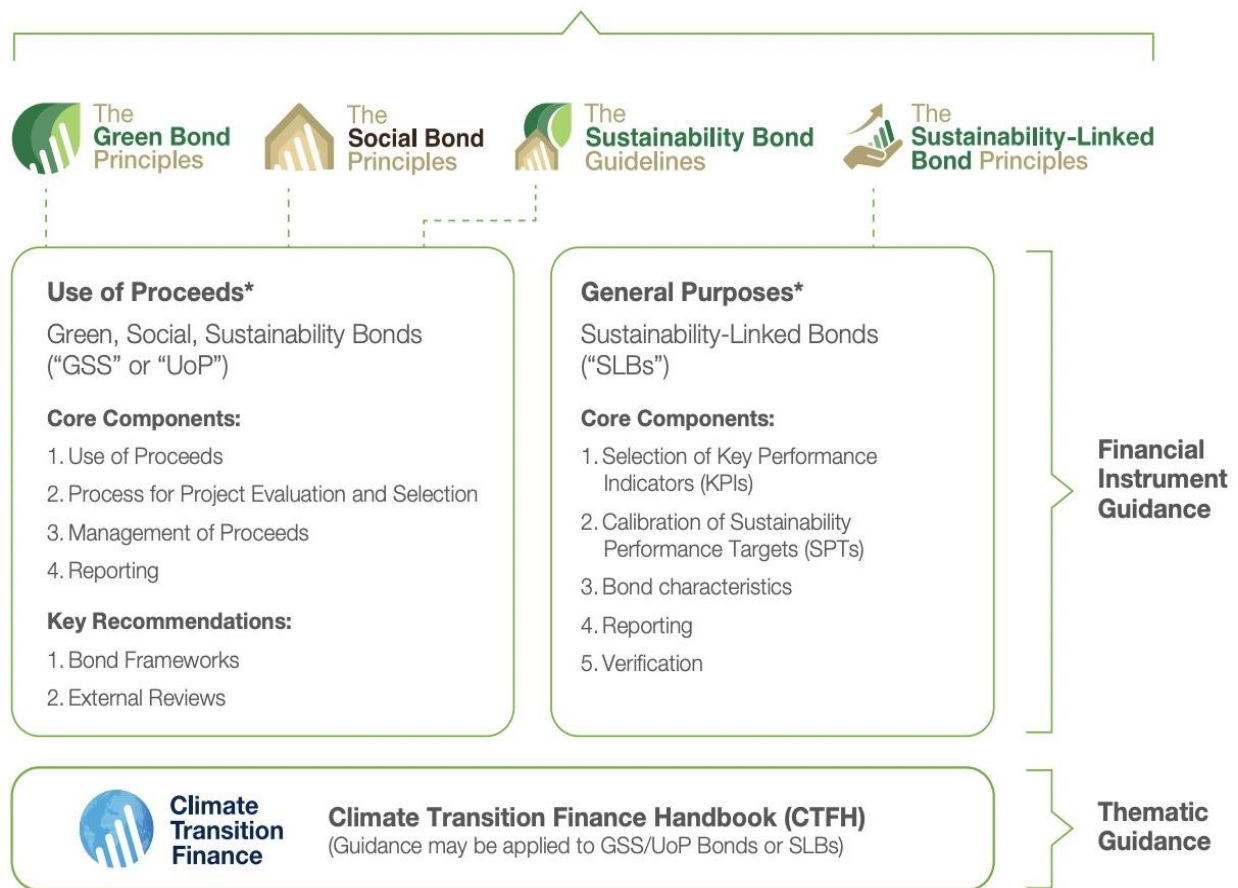


Figure 5: ICMA Principles. Source: Green Bond Principles June 2021 <https://www.icmagroup.org/assets/documents/Sustainable-finance/2021-updates/Green-Bond-Principles-June-2021-140621.pdf>.

[//www.icmagroup.org/assets/documents/Sustainable-finance/2021-updates/Green-Bond-Principles-June-2021-140621.pdf](https://www.icmagroup.org/assets/documents/Sustainable-finance/2021-updates/Green-Bond-Principles-June-2021-140621.pdf).

## 2.2 Financing opportunities and limitations for Micro Hydropower

As stated earlier, MHP falls more within a framework of long-term capital improvements, this would be in keeping with existing structures for SME lending, which can be securitised in the form of a green covered bond. Nassrand Wehinger (2015) covered bonds are also useful for municipalities and utility providers, aligning well to existing financing avenues. Saha and d'Almeida (2017).

There are possible pathways for financing the installation of MHP, which will work under the existing EU green finance framework. This is to rely on existing and newly developed covered bond structures. The challenge for MHP is to meet the thresholds associated with Green Lending. MHP will not meet the necessary thresholds for many of the existing green finance performance indicators but falls within the taxonomy criteria. According to current analysis provided by García et al. (2019), Merida Garcia and Mc Nabola (2021), García et al. (2021) and Ramos et al. (2020) the MHP provisions from the demonstration sites (water and irrigation networks) will not meet these green finance thresholds. Unlike for residential buildings which would comply under the following circumstance:

- new residential buildings where the net primary energy demand of the new construction is at least 20% lower than the primary energy demand resulting from the relevant NZEB (near-zero energy building) requirements, and/or
- renovated residential property where the renovation achieves savings in net Primary Energy Demand of at least 30% in comparison to the baseline performance of the building before the renovation.
- Alternatively, holding a BREEAM<sup>10</sup> 'Outstanding' or 'Excellent' or LEED<sup>11</sup> 'Platinum' or 'Gold' Certification, and/or be a New or existing commercial buildings belonging to the top 15% of buildings in the country in question terms of energy performance.

Existing surveys of SME financing can be found in Mateev et al. (2013) and with respect to sustainability finance in SME in Klewitz and Hansen (2014).<sup>12</sup> In the context of MHP, in many cases the decision to invest will be on the basis of a small municipality, small or medium-sized enterprise (SME) or an individual household or farm. Such groups tend not to have access to bond or equity finance and rely upon borrowing from banking entities for finance. Reliance on bank finance is particularly prominent in Europe.

Therefore, the nature of MHP costs and installation will require investment decisions to follow a standard pattern of project appraisal as laid out in the decision flow charts in Figures 6 and 7. These models orientate the decisionmaker towards the use of cost-benefit analysis. At the core of a cost benefit analysis is the use of the net present value calculation. A net present value calculation represents the discounted cash flows generated from the project over the life of the project, inclusive of the negative cashflow incurred for the initial investment. When the net present value is positive, the investment decision is to carry out the project. When the net present value is negative, the investment decision is to reject the project. The discounted cash flows are sensitive to the choice of the discount rate, taken as being the prevailing interest rate for the economy in question. In the UK, the Treasury Green Book recommends a rate of 3.5%. In most circumstances, rates are not a constant and will reflect market conditions and monetary policy decisions. In the current context of unconventional monetary policy to support the Eurozone and mitigate the impact of COVID-19, prevailing ECB policy has created an ultra-low interest rate environment, rendering viable projects that would otherwise be ended.<sup>13</sup>

In the context of the requirements of EU green finance additional criteria need to be added to the investment decision that exist outside of the traditional form of project appraisal.

Does the investment meet one of the following environmental objectives:

- 1) Climate change mitigation;
- 2) Climate change adaptation;

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<sup>10</sup> BREEAM is a recognised sustainability assessment method for masterplanning projects, infrastructure and buildings [www.breeam.com](http://www.breeam.com).

<sup>11</sup> LEED (Leadership in Energy and Environmental Design) is a widely used green building rating system <https://www.usgbc.org/leed/why-leed>

<sup>12</sup> This reflects the existing knowledge of SME finance that the cost of borrowing increases with the increasing levels of asymmetric information. In addition SME's become more effective at sustainability innovations the more they interact with third parties, especially research institutes. Given the nature of MHP deployment, many implementers would be SMEs.

<sup>13</sup> European Commission protocols on cost benefit analysis can be found here: [https://ec.europa.eu/regional\\_policy/sources/docoffic/2007/working/wd4\\_cost\\_en.pdf](https://ec.europa.eu/regional_policy/sources/docoffic/2007/working/wd4_cost_en.pdf)

- 3) Sustainable use and protection of water and marine resources;
- 4) Transition to a circular economy, waste prevention and recycling;
- 5) Pollution prevention and control;
- (6) Protection of healthy ecosystems.

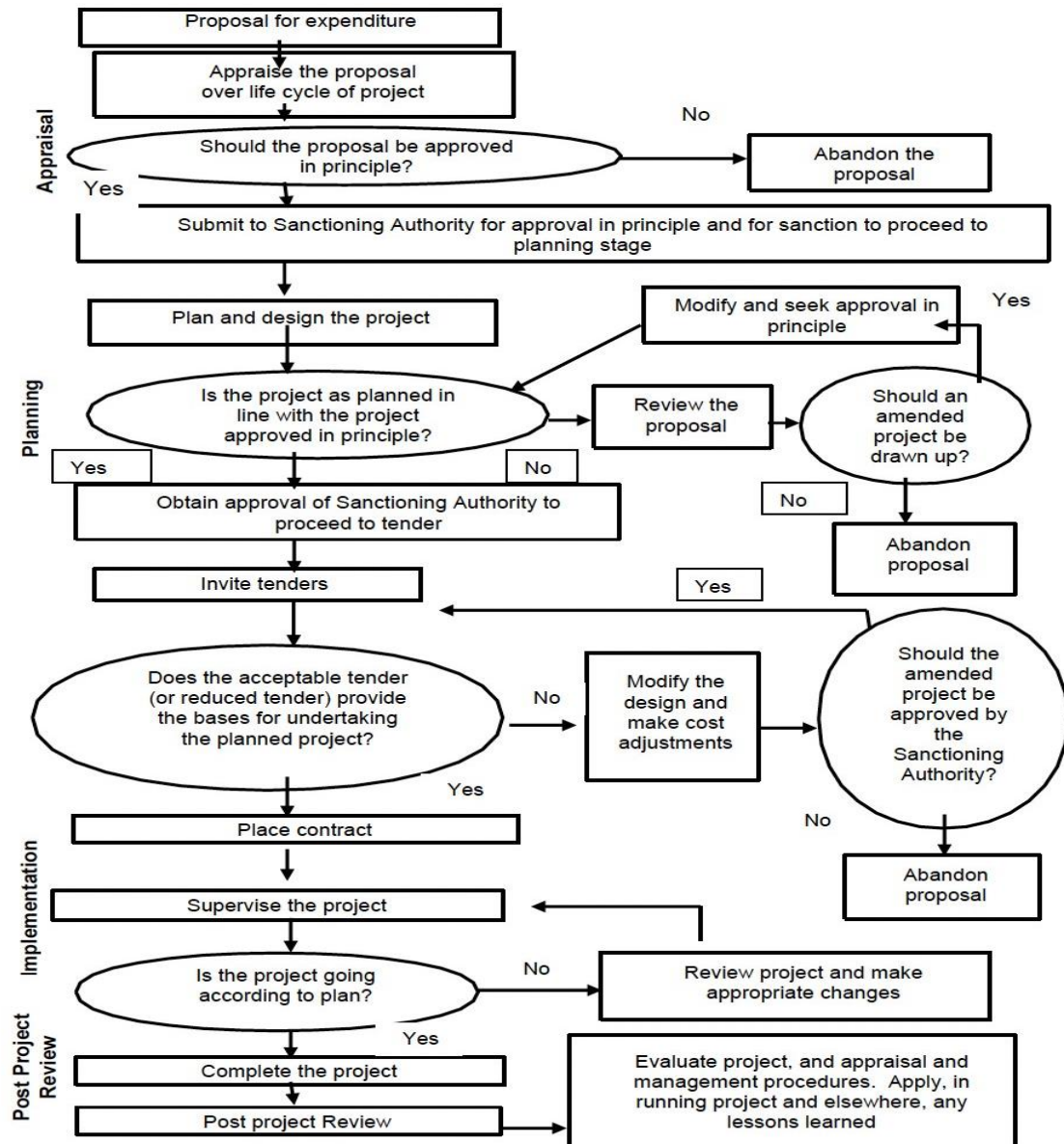
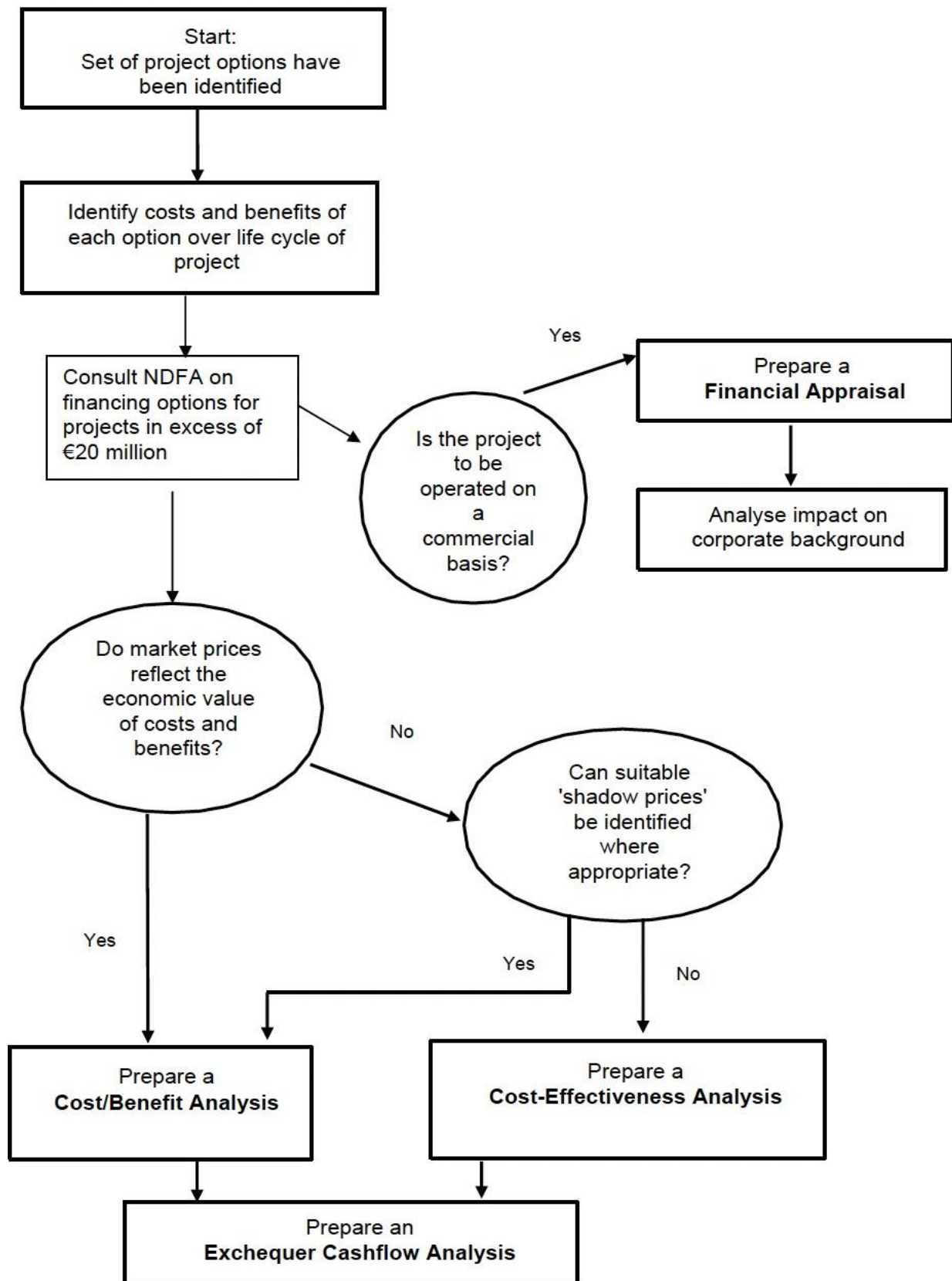


Figure 6: Flow Chart of Project Appraisal from the Department of Finance Ireland. Source: Figure 1: Overview of the Project Appraisal and Management Process. Ireland Department of Finance (2005)





**Figure 7: Correct Cost Evaluation Method Choice.** Source: Figure 6. Identifying the Appropriate Type of Analysis of Costs. Ireland Department of Finance (2005).

\*NDFA = National Development Finance Agency

### 3. Product Platforming: Using an Existing Alternative for Financing – The Danish Model

The Danish model is attractive as it is an existing structure that allows for capital improvements and real estate development that is low cost, socially-orientated and does not require meeting green bond principles or EU taxonomy requirements. Emulating the Danish model for socially beneficial and green investments allows for a solution for investments that while not meeting the EU green investment criteria are nonetheless green-orientated. This structure of covered bonds would assist the EU in meeting the overarching objectives of climate action and enable many small bank-originated green and transition-orientated loans across the European Union to be packaged. This structure could be facilitated via the European Investment Bank as the underwriter into the structure presented in Figures 8 and 9.

This does not mean that MHP project will not need to undergo normal forms of project appraisal or make performance returns that indicate the ESG key performance indicators agreed with the loan originator are met. What this method will allow is a more flexible set of criteria that will ensure that MHP will fall within the wider context of ESG finance even when it operates at the edge of the Green Bond Principles.

#### 3.1 What is the Danish system?

The Danish system, founded in 1797 and referred to as Nykredit in Denmark, is highly robust due to very extensive regulation that spreads outside of the just the mortgage credit market and into the wider banking sector.

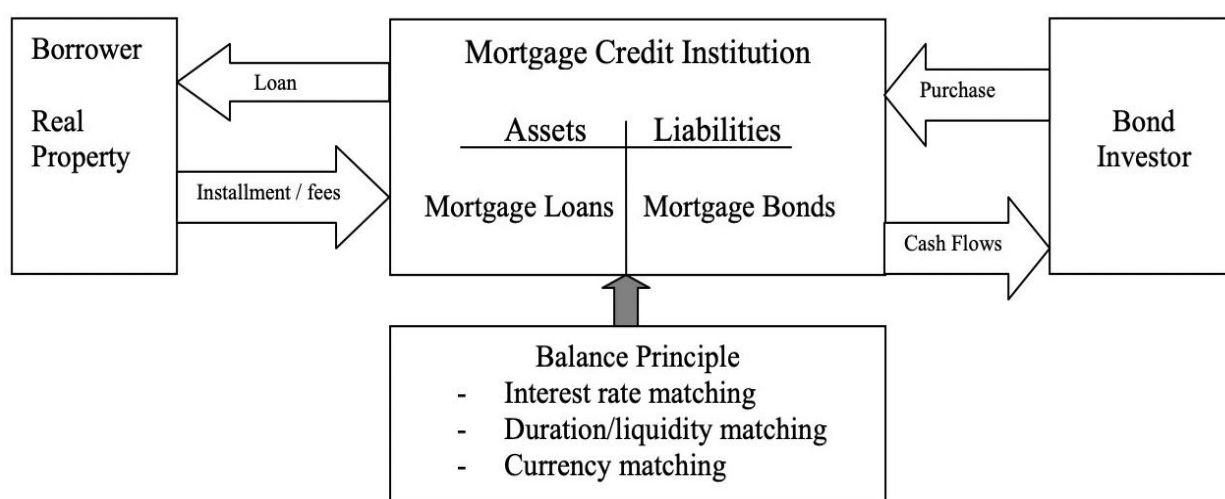


Figure 8: Balance Principle. Source: Figure 1. The Balance Principle. International Monetary Fund (2007).

The Nykredit structure is an ESG-orientated system that existed before the terminology became commonplace. The system was necessary as a solution to the housing crisis in Denmark following the destruction of the Napoleonic Wars and it has evolved into a structure to aid social cohesion and government policy objectives. This model has been very

effective at ensuring the stability of the housing market and the realization of public policy objectives in Denmark (International Monetary Fund 2007). This makes it ideally suited to deployment for green and transition-oriented investment

The balance principal in Figure 8 links the mortgage to the market via the bank. The mortgages are issued to borrowers under the regulations. The mortgages are then securitized and sold in the market. There is a straight line between the borrower and the market.

These are long tenor bonds that are designed to repay over 30 years, and there are many secondary instruments that are available to allow the markets to be flexible for interest rate risks, early repayment and equity release. This system regularly produced securities that trade at lower interest rates due to the stability of these bonds, which regularly trade below the Danish sovereign bond and below the 30 Year US Treasury (which is the global riskless asset). The low risk profile is due to strict borrower assessment criteria and the rigorous application of macroprudential policies resulting in less than 1% default risk in Danish case, and less than 2% max default risk if the global figures are taken (International Monetary Fund 2007).

These bonds are desirable! AAA/AAA+. They will allow for investment in MHP systems with larger sunk costs.

	Covered Bonds	Danish Mortgage Bonds	Asset/Mortgage-Backed Securities
Mortgage Loan Production	Bundled Process	Bundled Process	Unbundled Process
Type of Securitization	On-Balance sheet	On-Balance sheet	Off-Balance sheet
Source of Cash Flows	Issuer cash flows	Issuer cash flows	Collateral cash flows
Risk exposures:			
- Credit risk	Issuer	Issuer	Investor/credit enhancer
- Prepayment risk	Issuer	Investor	Investor
- Market risk	Investor	Investor	Investor
Structure of loan pools	- Dynamic pool, with substitutable and mainly heterogeneous assets - Eligible assets defined by law	- Dynamic pool, with substitutable, and mainly heterogeneous assets - Eligible assets defined by law	- Generally static pool, with not substitutable and mainly homogeneous assets - Eligible assets not necessarily defined by law
Over collateralization	Usually defined by law	Usually defined by law	Required to achieve high rating
Credit quality	Asset quality, strength of the originating institution and legal framework	Asset quality, strength of the originating institution and legal framework	Asset quality and over collateralization, Strength of the issuing structure, and quality of the guarantor
Investor protection (bankruptcy of the issuer /originator)	Bankruptcy privilege and asset segregation	Bankruptcy privilege and asset segregation	Bankruptcy Remoteness

Figure 9: Characteristics of Balance Principle Covered Bonds. Source: International Monetary Fund (2007).

### 3.2 Product Platform II: Using an Existing ESG Alternative for Financing via Public-Private Partnership

The alternative to this approach is to treat MHP as a non-ESG investment opportunity. This would diminish the ease at which these projects would be financed using European Investment Bank or EU-supported funds.

MHP, when removed from the ESG context would be a strong candidate for investment via Public-Private Partnership (PPP) where municipal or publicly-owned/funded entities are involved. The successful design and execution of the a PPP as well as the many pitfalls of the model have been outlined in Hodge and Greve (2017) and Osei-Kyei and Chan (2015).<sup>14</sup> It is important to note that unless very precisely contracted, there are significant tail risks<sup>15</sup> borne by the public entity in a PPP and this should be considered if this funding pathway is undertaken.

## 4. Market (Service innovation) Strategy for Commercialization Prospects

The case studies and detailed analysis of MHP devices outlined in García et al. (2019), Merida Garcia and Mc Nabola (2021), García et al. (2021) and Ramos et al. (2020) provide a clear articulation of the products at work. In terms of downstream products, the provision of MHP needs to be understood within the wider context of a going concern<sup>16</sup>. In this context, the capacity for the MHP to produce electricity and offset carbon emissions must be understood as part of a wider set of firm fixed and variable costs. The MHP devices have the capacity to improve firm performance on the basis of modifying existing firm variable costs, clearly creating the possibility of generating cost savings to the going concern. What is not entirely clear from the existing studies outlined above, is the ability of MHP to generate an operating surplus for the going concern.

As a commercial prospect, MHP for an individual firm will need to highlight how it will successfully bring about or add to the operating surplus of a going concern. MHP's capacity, in the correct configuration as outlined in Merida Garcia and Mc Nabola (2021), can provide a powerful basis for cost reduction on the part of municipal water systems, which ultimately reduces the need for subsidization or cost-induced price increases for consumers. In the case of a municipality, the requirements for an operating surplus are less essential as the existing water systems may be seeking to deliver a service to citizens and will seek to have that service subsidized as there exists a market failure. In such cases where a subsidy is in place to support the water system, that can be divided into an operational expenditure

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<sup>14</sup> These papers highlight the many risks related to the development and deployment of PPPs. While a method of bringing in access to off-balance sheet finance for the government and the potential for private sector efficiencies for the project it can result in a "hire purchase" style arrangement for the acquisition of capital and it requires dedicated project management and careful contracting. PPPs can also result in the government taking on unusually large risks if the project is in danger of failing or under-performing.

<sup>15</sup> Those risks that would occur outside of three standard deviations from the mean in a normal distribution. In more direct language, a rare event that would impose significant losses on the investor. If the distribution of returns is skewed then you can have so-called "fat tails". The most famous book on tail risks was by Nassim Taleb in *The Black Swan* (2007).

<sup>16</sup> A business operating to make a profit.

subsidy or a capital expenditure subsidy or a mixture of both. Funding to an MHP for an individual firm will be based on a simple cost-benefit analysis of the MHP itself and an evaluation of the impact on the balance sheet of the going concern in a purely commercial banking transaction; that would apply to firms, households and municipalities.

As outlined above, the ability of individual MHP projects to meet EU requirements for green finance is unlikely. In an aggregated context, MHP could be a successful green finance project. In such a context, financial engineering tools as outlined above would be best suited to an investment platform where MHP devices and their management are given over to a designated activity company (for ease described as MHP Co). This company would purchase, own, install, maintain, operate and manage the MHP devices in a country or countries within the European Union. Individuals households, farms and firms as well as municipalities (for ease Works Co) would enter into a service level agreement (SLA) with the MHP Co which would enable the MHP Co a continuous cash flow from the Works Co based upon the combined economic value of the savings generated by the MHP devices in terms of electricity generated and carbon offset. Works Co would have no requirement to own, install, maintain or manage the devices, as that would be the responsibility of the MHP Co. This would ensure that from the point of view of the end-user the decision to participate in an MHP project would be determined by the cash flow generated by the MHP to the MHP Co. The SLAs would be largely the same, exclusive of necessary local legal and regulatory considerations.

#### **4.1 What happens next?**

- 1) The MHP Co would then have an aggregated cash flow from the different SLAs which would form the basis of the cash flow for the repayment profile to:
  - a) bank lending (green or otherwise);
  - b) a specialized covered bond framework like that of the Danish system;
  - c) a unitary charge to a PPP Co.
- 2) Under this scaling structure, which is a fairly standard arrangement, the MHP Co would then have sufficient scale to avail of existing European Investment Bank (EIB) funding under the green finance criteria if following option (a).
- 3) In the case of option (b) cash flows would be sufficiently steady to build a green covered bond or avail of existing covered bond structures.
- 4) In the case of option (c), a municipality could put in place a PPP Co to finance an MHP Co to put in place an SLA with the Works Co ensuring the deployment of MHP within the water system. The PPP Co would be able to avail of the more sophisticated green finance options and allow for more efficient risk sharing between the municipality and the MHP provider.
- 5) Further downstream products could be deployed by the MHP Co as additional products to the core SLA with the Works Co.

## 5. Conclusion

MHP has the potential to reduce the energy consumption and carbon footprint of the water sector in Europe. While it falls within the taxonomy of green finance, the reduction in energy consumption achieved by MHP makes it difficult to place with the green bond principles, even for green covered bonds, which would be the effective method for a pan-EU financing of their implementation. Given the propensity for European firms to rely on bank finance.

The use of a covered bond solution modelled on a Danish Nycredit structure, which allows for the close evaluation of borrowers and has a proven design for achieving policy-objectives, could be implemented as a method of financing MHP. This can be achieved by linking ESG funding to the more commercial but still ESG-orientated activities of installing MHP devices into existing water and irrigation systems.

If all ESG or green finance options are unavailable, MHP does offer opportunities for PPP investment with careful oversight and management.

Ultimately, a service innovation approach facilitated through PPP, SLA and other tools offer viable financial strategies to for widespread commercialisation and capitalisation of MHP across the EU Atlantic Area. This would require a variation of the current EU ESG financial regulatory frameworks but will ensure a risk-free or less-risk approachh to the adoption and uptake of MHPs.

Thus, MHPs could offer an economically viable solution to reduce energy consumption by actors in the water sector.



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