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The Importance of Technical Decision-making for PV tenders: Optimizing the Projects and Managing Risks

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Abstract

Effective technical decision-making is a key tool in developing successful PV projects. The core subject of present thesis is to analyze how to take adequate technical decisions and demonstrate their impact on the development of an energy project, in the context of public tendering processes. Taking the example of tenders in Ireland and Ecuador, the two main impacts of accurate technical choices are analyzed: optimization and risk management. The results highlight the positive effects of correctly managing the technical aspects of the projects and provide tools for succeeding in doing it.

***Keywords*:** energy projects, photovoltaics, technical decisions, optimization, risk management

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1. Introduction

Effective technical decision-making is a key tool in developing successful energy projects. In particular, the PV industry is being constantly challenged with supply chain issues, technological breakthroughs, and more and more competition entering the market all over the industry's value chain. This makes technical choices even more important.

Having been developed while being on a professional mission in the Competence Center of Neoen, a successful and innovative independent power producer, the core subject of the present thesis is to analyze how to take adequate technical decisions and demonstrate their impact in the development of an energy project, in the context of public tendering processes. Taking the example of tenders in which Neoen participated during 2022, it focuses on the two main concepts where technical aspects take the biggest relevance: optimization and risk management. The RESS 2 tender in Ireland was used as a case study for the presenting how technical optimizations can boost the projects conditions, and the ERNC Block I in Ecuador was used for studying how risks can be successfully managed through targeted studies.

1.1. Neoen – A leading player in renewable energies

Neoen is a French independent power producer of exclusively renewable energy and a relevant player on a global scale. Through a develop-to-own business model, it is involved in the whole lifecycle of the power plants, participating in their development, construction, maintenance, and operation. Its strong involvement is explained by the company's long-term vision that translates into a clear strategy: to produce competitively priced renewable energy, in a sustainable way and on a large scale.

Founded in 2008, in 2009 Neoen was already commissioning its first PV plant in France. In 2009 it started its international expansion with their first solar projects in Portugal. The opening of offices in new countries continued during the following years, launching operations in Australia and Mexico. Nowadays, one can find Neoen's name all over the world: Argentina, El Salvador, Jamaica, Sweeden, Finland and Ecuador are some of the 16 countries where the company is present.

The focus of the company is on three main technologies: onshore wind, photovoltaics, and battery storage systems.

1.2. The Competence Center

The Competence Center is the department that concentrates the technical expertise within Neoen. It acts as technical support for the departments of Development, Procurement, Construction, Asset Management and Finance, providing a technical view of the projects or specific subjects. Moreover, the Competence Center has the knowledge to analyze and explain the "business" impacts of the different industrial choices that are made.

Its priority is to intervene in the different solar and wind projects in all the locations covered by the Neoen group.

1.3. The tendering process and the Competence Center's role

Energy tenders consume time and resources. Different subjects must be covered such as design, costs, finance, insurance or legal, to name some. It is because of this that a clear and efficient process needs to be defined in order to optimize resources and submit the bid under the right conditions.

At Neoen, a tender team is assembled each time, gathering the local team as well as people from transversal functions of the company: Financing, Competence Center, Legal and Procurement. The whole group has regular meetings to bring up updates on the tender, follow up on the preparation of the offer and bring up any issues that may have arisen since the previous meeting.

The Competence Center is responsible for the technical aspects of the projects. Its main responsibility is to define the technical hypothesis for developing the business plans. Under this premise, it is the Competence Center that provides the annual energy production values and the uncertainties that serve as inputs in the financial modelling in the form of the P50[1] and P90[2]. All the technical studies to be done fall under its scope, overseeing and being the point of contact for external technical advisors that are hired for these purposes. In addition, the team participates in all the technical decisions that shall be necessary, such us the choice and sizing of modules and inverters or the general parameters of the plants' layout. Finally, the Competence Center acts as

[1] The P50 is the most probable annual energy production. There is a 50% probability of exceeding or falling short of the given value during any year of the plant's life.

[2] The P90 is the annual energy production that presents a 90% probability of being exceeded during any year of the plant's life.

internal technical advisor during all the tender process, giving support to the whole team, but specially to the Project Managers and Procurement Managers.

2. The Irish tender

2.1. Context

Ireland would not be the first choice for someone to carry on solar PV projects. It is well known as a cold and cloudy country, and anyone's first impulse would be to develop wind power more than PV. However, there is more than irradiation when it comes to developing PV projects.

Ireland is an attractive destination for foreign investment that knows how to take advantage of technological changes. Its political system is stable, and it has a well-structured regulatory and tax regime. Ireland's economy has shown to rapidly adapt to new economic and technological trends, reflected by the increase in the average real wage by 50% since 1990, a growth highly superior to the average of the OECD, for example.

Under these conditions, the Irish government published in 2019 their document Climate Action Plan to "tackle climate breakdown", where they set out renewable electricity as a central element. This led to the creation of the Renewable Electricity Support Scheme (RESS) to provide support to renewable electricity projects in the country. The main tools of the scheme are the successive renewable energy tenders that were and will continue to be launched.

The RESS 2 was the second renewable energy tender in Ireland, after the success of RESS 1. These tenders are technology neutral, covering both wind and PV proposals.

Neoen submitted 3 projects to the tender: Threecastles, Ballyedock and Ballinknockane.

The Ballinknockane project is taken as a case study hereunder to present the optimizations made for the tender.

Project	County	Interconnection power (MWac)
Threecastles	Wicklow	15
Ballyedock	Wexford	12
Ballinknockane	Limerick	50
Total		*77*

Table 1 - Irish projects submitted by Neoen for RESS 2

2.2. Lowering the LCOE

The LCOE represents the total cost of the energy that will be produced by a power plant. It concentrates the CAPEX, OPEX and energy production, so it is clear which factors play to lower its value.

At the starting point of this work, the three projects to be submitted were not reaching the competitiveness objectives and, consequently, different technical optimization stages had to be developed.

- More aggressive assumptions were defined in the energy production calculation. This decision was taken after a thorough analysis of the company's large track record on PV projects.
- Meteorological inputs were improved through on-site measurements.
- N-type PV modules were selected as the base case, optimizing energy production and the LCOE due to the higher power output this technology provides, which reduces the number of modules to be installed.
- Layout and general parameters of the plants were reviewed with external advisors to find the optimal design and improve the energy yield.

At the end of the process, the expected annual energy production was 13% higher than the initial estimation as it is shown in *Figure 1,* which translates almost directly into an increase in the expected revenues of the power plant.

After the tender closure, **Threecastles and Ballyknockane were successfully awarded, while Balleydock was not.**

The offers presented were considered a success given the difficult previous situation and the Competence Center gained more confidence towards the Irish development team. After realizing the value added that having a unit like this in the company brings, they continued to come to us for support and further optimizations that could be achieved.

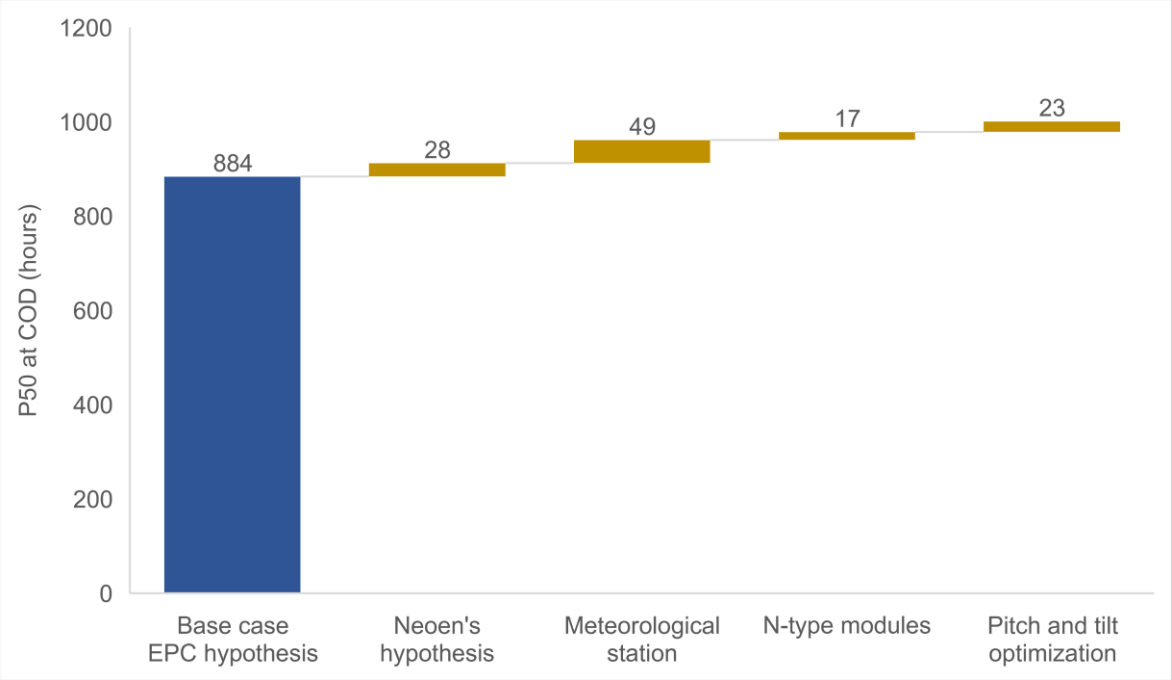

Figure 1 – Ballinknockane: optimization gains' summary.

3. The Ecuadorian tender – Lowering risks

3.1. Context

Anyone can relate Ecuador to solar energy. Being right under the Equator line, the first idea that comes to mind is that its irradiation levels must be one of the highest in the world. However, this is not necessarily true. Irradiation depends on many other factors apart from the latitude: altitude, air quality, clouds, and fog, also play a big role. This makes for example Chile one of the best countries in the world for solar power, although it is farther away from the Equator line.

Despite the different factors that come into play, there are several areas in Ecuador, in the surroundings the Mountain Range of the Andes, that present excellent annual irradiation levels, reaching up to 2200 kWh/m2.

On the general situation of the country, things are not as favorable. During the development of this thesis, different social and political events happened. In May 2021, Guillermo Lasso started his term as president of Ecuador in a complex economic and social situation following the impacts of the COVID-19 pandemic. During 2022, he faced an impeachment attempt from the opposition and

a strong conflict with the indigenous community which included country-wide protests and violent confrontation between the protesters and the police.

Although the social and political context is not stable, there is a strong will in the country to add renewable energy sources to their electricity matrix, as it was stated in their current Electricity Master Plan.

As part of their energy transition plans, they are planning to launch succesive renewable energy tenders separated by blocks and by technology. The first tender, called "ERNC Bloque I*"* is the one Neoen will be participating in and one of the core subjects of the present thesis. In the following years they are planning to launch three more tenders on an yearly basis.

The projects to be submitted for the ERNC I tender are: Ambi Solar, Imbabura Solar and Intiyana Solar. The three projects will be developed with East-West tracking technology to capture as much irradiation as possible.

Project	County	Interconnection power (MWac)
Ambi Solar	San Antonio de Ibarra	60
Imbabura Solar	Aloburo	60
Intiyana Solar	Parroquia de Tumbabiro	60
Total		*180*

Table 2 - Ecuadorian projects to be submitted to the tender

3.2. Managing risks

The three projects in are located near Quito, in a very mountainous area. This brings up clear risks: the uncertainty of the meteorological data, the installation problems that might arise due to the difficult topographies, and the possible energy losses generated by the shadings of the mountains surrounding the terrains. In addition, the regulatory conditions for the tender were not clear, which added another type of risk.

Taking the Imbabura project as an example, the risks were successfully mitigated by targeted technical studies:

- Site measurements helped lower the uncertainty of the meteorological model and shorten the range of possible energy production scenarios.

- Through a dedicated simulation software that evaluates with precision the impact of topography, a detailed layout and the most adequate structures were determined.
- Shadings were studied with a specialized company and its impact was correctly assessed, reassuring the energy production estimations calculated previously.

In addition, to mitigate the impact of having such a stringent regulatory framework, different technical scenarios were developed in order to submit a conservative project to the regulating authorities while keeping an internal and more aggressive scenario to structure the business plan and take investment decisions.

At the time of submitting the present thesis, the situation for the tender was very favorable for Neoen. The three projects to be submitted have shown to be competitive and feasible. The worked carried out by the Competence Center helped significantly in lowering the risks and not compromising the future profitability of the projects. Most of the possible issues they might have, were successfully studied with the right technical advisors and partners.

The tender is scheduled to close on October 28, although it is expected to be delayed by between one and three months because of the social manifestations that added significant difficulties for the interested companies to continue their development activities.

4. Conclusion

The aim of these thesis has been to justify the relevance of taking adequate technical decisions in PV projects, under the context of a tendering process, and presenting how to optimize the projects and manage risks through those decisions. It was demonstrated how technical aspects are key to succeed in submitting competitive projects without compromising their future execution, operations, and profitability.

The impact of technical decision-making was divided in two categories: optimization and risk management. Two tenders were used as case studies to analyze and justify the research hypothesis: the RESS 2 tender in Ireland and the ERNC Block I in Ecuador, respectively. In each one of them, one project was taken as an example to illustrate the tasks carried out and their results.

The present works brings some light over the important role technical decisions and a technical culture provide to energy projects. In such a dynamic and risky industry with so much competition,

giving a saying and having reliable technical experts is key to develop successful and profitable projects. This is especially true for independent players such as Neoen not to fall short while competing against large and traditional corporations.

PV and the renewable's industry is as interesting as it is challenging. The more competition, supply chain issues and technological breakthroughs continue to appear, the more relevance technical decisions should be given. They are key to manage risks and come up with practical solutions. Although the tendency nowadays shows more business-oriented and commercially driven strategies, the technical aspects should never be overlooked.

For Neoen, I would strongly recommend continuing to rely on the Competence Center as a legitimate partner for supporting development teams and building a technical culture within the company.