Renewable Investment Opportunities in the Balearic and Canary Islands

Public Report

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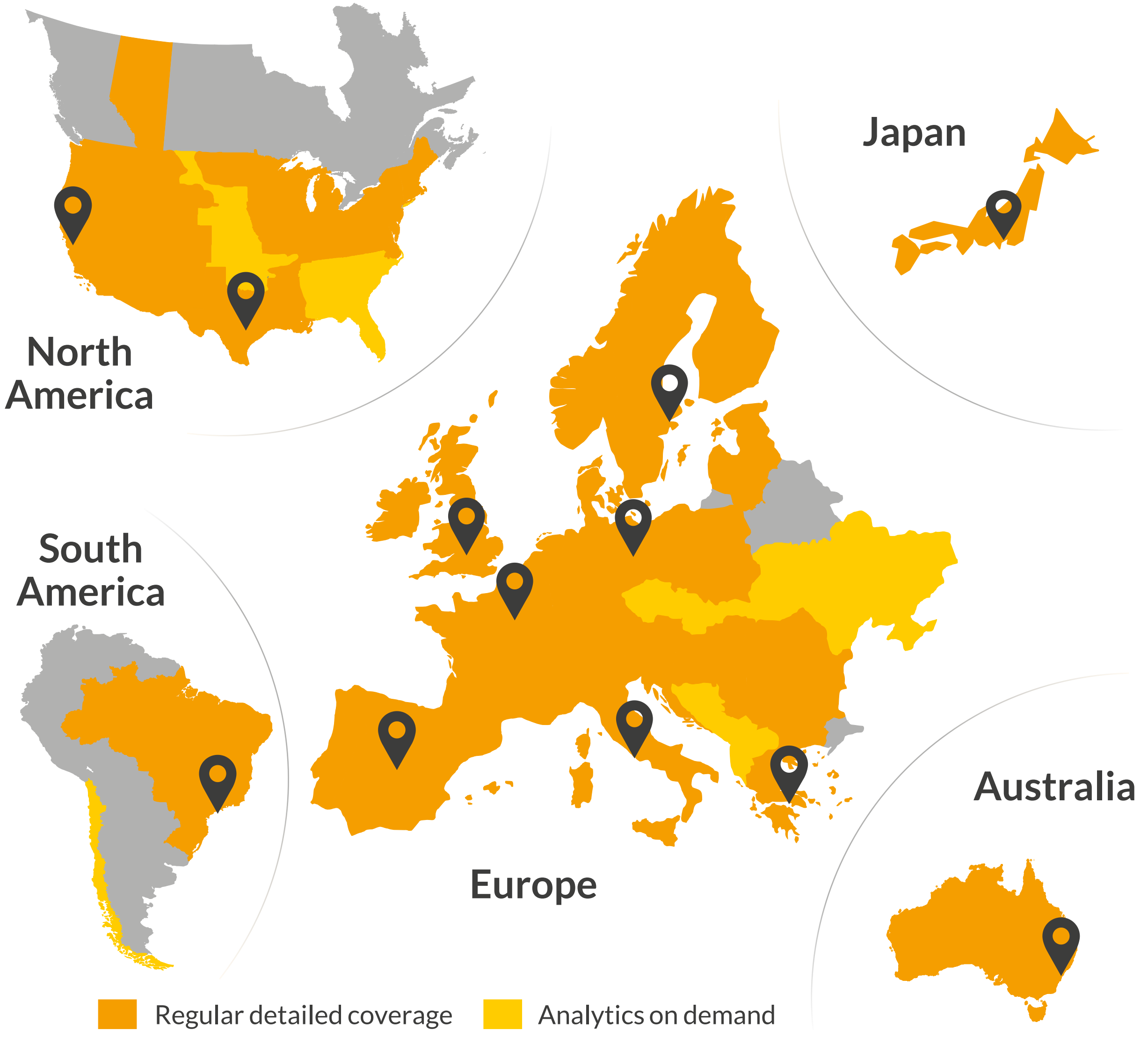

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Source: Aurora Energy Research

Introducing the Aurora team

Ana Barillas

Head of Iberia and LATAM

David Corcoles

Associate

Alexandre Danthine

Research Lead France and Iberia

Manuel Reveles

Analyst

Christina Rentell

Senior Associate

For more information on the Iberian power market, please contact:

Enilio Alvarez, Senior Commercial Associate

enilio.alvarez@auroraer.com

Agenda

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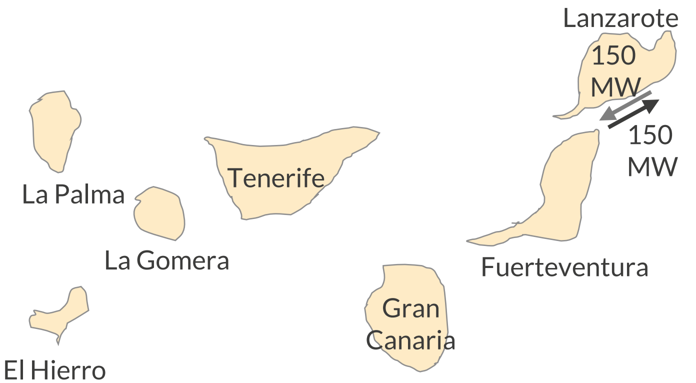
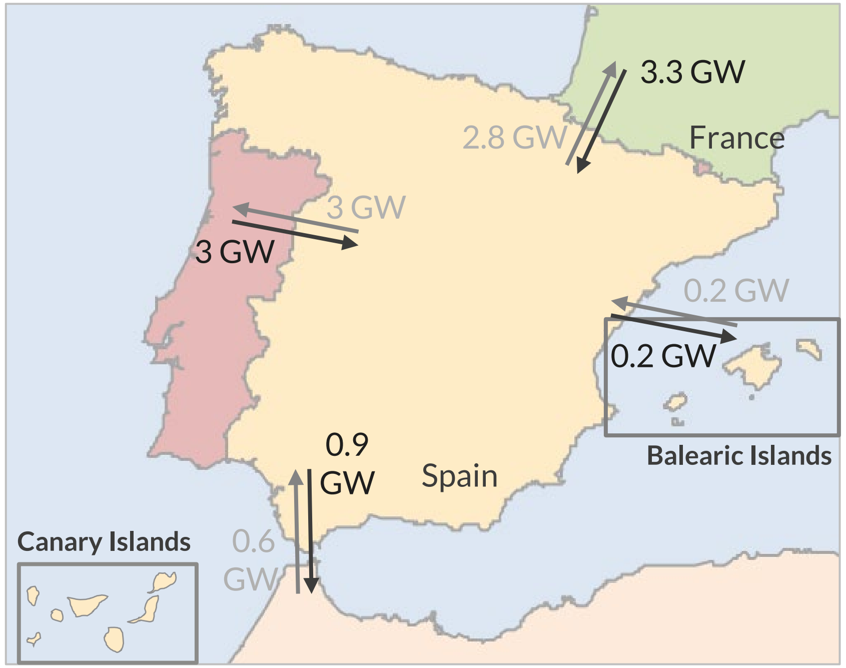
The Balearic Islands are interconnected with the rest of Spain and Europe; the Canary Islands remain isolated from the Spanish peninsula

Canary Islands



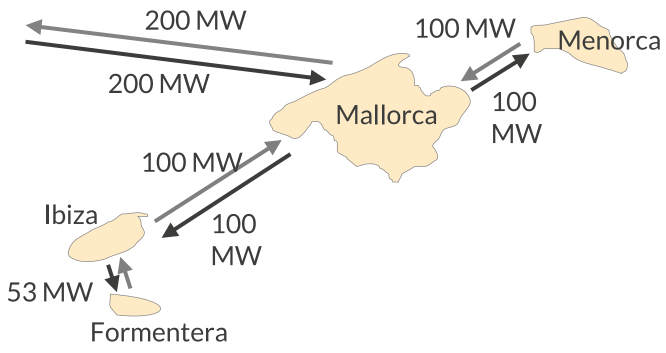
- The Canary Islands' electrical systems are completely isolated from the Spanish peninsula.
- As of now, there are six isolated electric systems; Lanzarote-Fuerteventura[1], and the remaining five islands.
- A new interconnection between Tenerife y La Gomera (40 MW) is planned for 2025.
- Other interconnections (Fuerteventura – Gran Canaria and Fuerteventura – Morocco) have been proposed but there is no targeted installation date.



Concept: Non-Peninsular Territory (NPT)

Defined as a Spanish territory that it is not located in the Iberian Peninsula. The four NPTs are: the Balearic Islands, the Canary Islands, Ceuta, and Melilla.

Balearic Islands



- The Balearics was interconnected with the Peninsula in early 2012. The Balearics are also interconnected to each other, forming a unique electric system.
- The electrical interconnection of the Balearic Islands provides a more secure supply and reduces the risk of power outages.
- A second interconnection with the Peninsula (400 MW) is planned for 2026.

1) Lanzarote and Fuerteventura were interconnected in 1977 (15 MW). In 2005, the existing cable was replaced by a new one (50 MW); in 2022, a new interconnection between Lanzarote and Fuerteventura was installed (100 MW).

Sources: Aurora Energy Research, REE

The cost of producing electricity is much higher than in the Peninsula, whereas the price paid by consumers remains similar

In Spain, all consumers must pay the same power price, independent of their location. However, in the NPTs, the generation prices might be higher.

- The generation price is defined as the division between the sum of generation costs, and the total energy produced:

$$Generation\ price = \frac{Generation\ cost}{Energy\ generation}$$

- Generation costs are defined as the sum of the following components:

Wholesale Market Price in the applicable system[1], i.e. the generation costs from plants that aren't eligible to receive any additional retribution

Focus of our forecast

+

Generation costs from the Additional Retributive Regimen, payable to Type A technologies

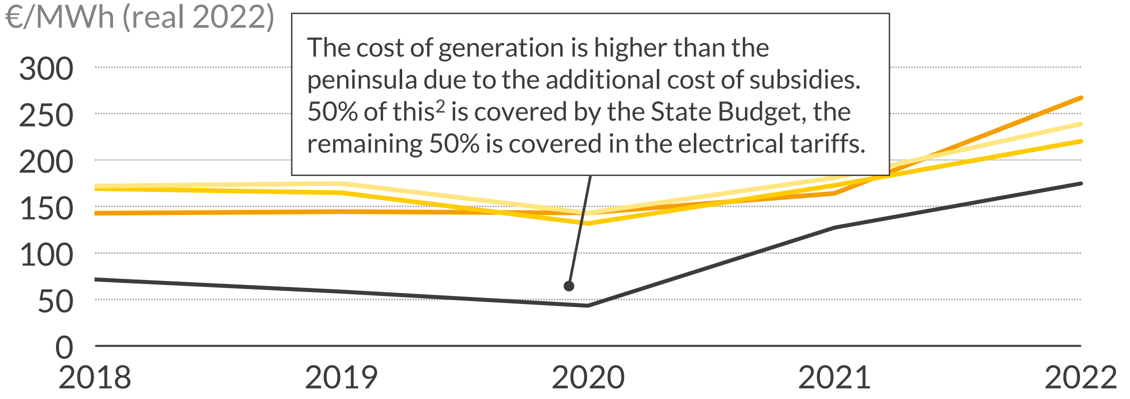
Generation costs from installations that receive the Specific Retribution Regime (RECORE plants[1])

Ancillary Services costs

Price has increased in line with the peninsula's price. The cost of generation is on average 80% higher than the price paid by demand

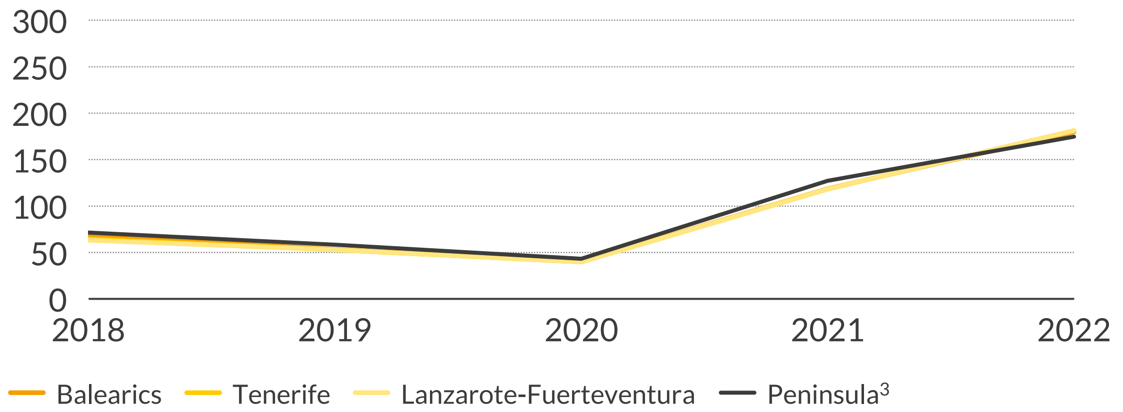
Annual average of the cost of generation

€/MWh (real 2022)



Annual average price paid by demand

€/MWh (real 2022)



1) This is not the same price as the peninsula, more detail on slide 7. 2) This difference between the demand and generation prices is denominated "excess NPT costs". 3) Peninsula final price which includes the costs of grid constraints, capacity payments and intraday market.

Sources: Aurora Energy Research, REE, MITECO

The regulated formulas aim to adjust the peninsula price to hourly demand to incentivise generation during those hours

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Power price formula in Non-Peninsular Territories

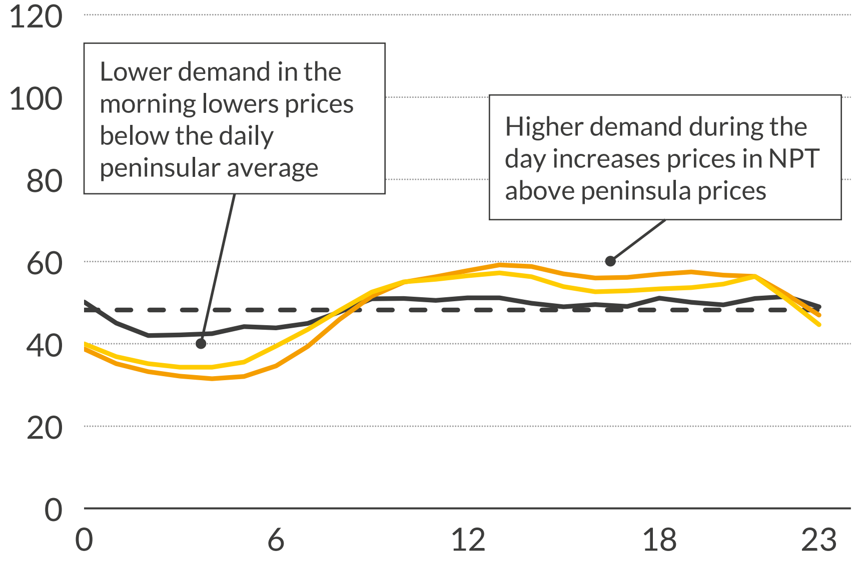
A(h) coefficient

$$\text{NPT } \textbf{generation} \text{ hourly power price} = \text{Weighted average daily peninsula price}^{1} * \boxed{\frac{\text{Hourly demand in the NPT}}{\text{Average daily demand in the NPT}}}$$

$$\text{NPT } \textbf{demand} \text{ hourly power price} = \text{Average daily peninsula consumer price}^{2} * \frac{\text{Hourly demand in the NPT}}{\text{Average daily demand in the NPT}}$$

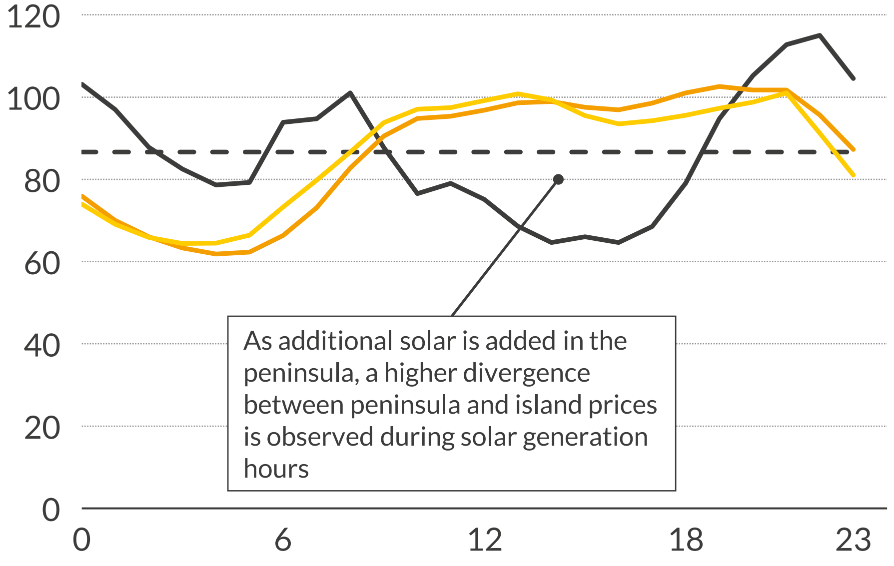
Generation power prices 01/08/2019

€/MWh



Generation power prices 01/08/2023

€/MWh



Average daily peninsular power prices — Peninsula Day-Ahead price — Balearic Islands — Canary Islands

- The pricing is linked to the mainland market price by a formula that adjusts the peninsula Day-Ahead price to hourly insular system demand.
- Due to their isolation, NPTs must ensure price signals that reduce peak demand.
- This formula has historically led to higher prices around noon, compared to the peninsula.
- When demand is higher, energy is sold at a higher price, however the price the demand pays is lower than the cost of generation, therefore demand reduction is not fully incentivised.
- Between 2019 and 2023[3], the average demand coefficient inflated the peninsula wholesale price by an average of 13% between 10:00–14:00 hrs. and 20% between 19:00–22:00 hrs.

1) Regulation does not specify by what this average is weighted with. Aurora has assumed generation for the calculation. 2) Minus regulated costs such as imbalance costs and capacity mechanisms. 3) Data until 16 November 2023.

Sources: Aurora Energy Research, REE

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Despite recent growth in installed renewable capacity, the generation mix remains dominated by fossil fuels in the Balearic and Canary islands

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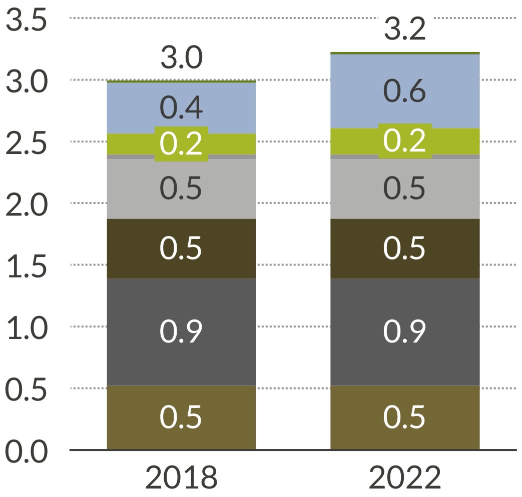
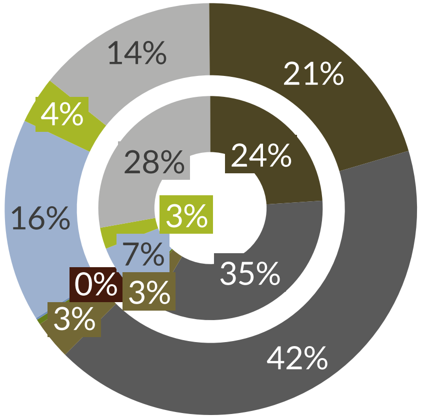
Canary Islands

Installed capacity, GW

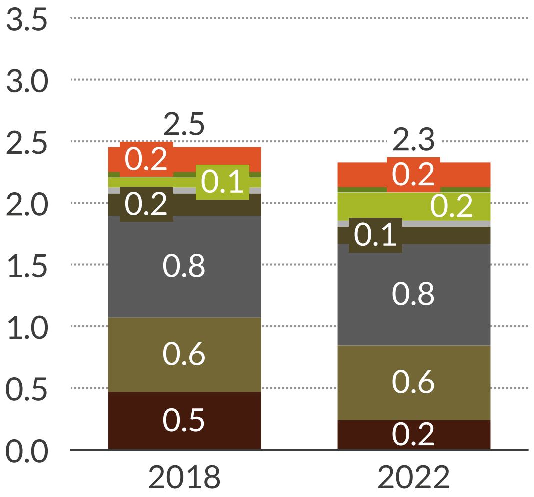


Generation mix[1], 2018 (inner circle), 2022 (outer circle), %

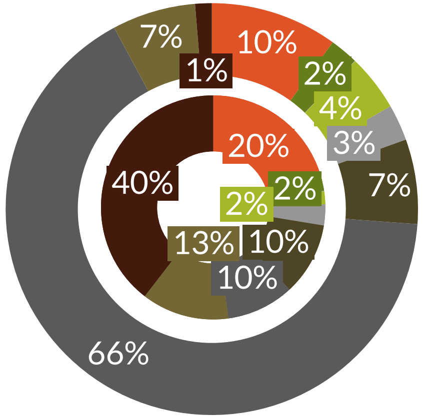


Balearic Islands

Installed capacity, GW



Generation mix[1], 2018 (inner circle), 2022 (outer circle), %



- The deployment of RES[2] capacity increased by 8.5% on average in 2018-2022, and RES generation nearly doubled in that period (11% in 2018, 20% in 2022).
- There have been no retirements of thermal capacity in the Canary Islands between 2018 and 2022.
- Steam turbine generation halved between 2018 and 2022. This generation is primarily compensated by increased wind and CCGT generation.
- The generation mix varies within the six electric systems.

- Solar PV capacity nearly tripled from 2018 to 2022, although renewables only accounted for 7.4% generation in 2022.
- In 2020, the Balearic system retired more than 200 MW of coal capacity, leading to an increase in CCGT generation in the following years.
- Increased interconnection with the Peninsula would increase the security of supply and further reduce the utilisation of the existing oil and gas generators.

Coal | OCGT[3] | CCGT[4] | Oil | Steam turbine | Other[5] | Solar PV | Onshore Wind | Offshore Wind | Other RES[6] | Interconnectors[7]

1) Total generation: Balearics: 6.06 TWh (2018), 6.04 TWh (2022); Canary: 8.84 TWh (2018), 8.54 TWh (2022). 2) Includes Solar PV, onshore and offshore wind, and other RES. 3) Open Cycle Gas Turbine 4) Combined Cycle Gas Turbine. 5) Includes non-renewable waste, conventional CHP, and emergency ancillary generators. 6) Includes hydro, hydrowind, biomass, biogas, renewable waste, geothermal, and marine energy. 7) Refers to interconnectors between the Balearics and peninsular Spain.
Sources: Aurora Energy Research, REE

Agenda

I. **Market and Policy Outlook**
   1. Introduction to the regulatory framework
   2. Historical market overview
   3. Decarbonisation targets

II. **Model inputs**

III. **Results**

IV. **Key Takeaways**

V. **Appendix**

Specific Energy and Climate plans target full decarbonisation for 2040 and 2050 for the Canary and Balearic islands respectively

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Both sets of islands have decarbonisation plans that build on national targets; final plans are pending to be approved at both peninsula and national level

Integrated National Energy and Climate Plan (PNIEC)

National climate plan that includes specific measures for island systems

Canary Islands

Law 6/2022

Regulates measures to mitigate the effects of climate change and defines the strategies to be elaborated.

Two strategies define the climate action planning in the Canary Islands:

1. Climate Action Strategy[1]
2. Just Transition and Climate Justice Strategy[2]

Balearic Islands

Law 10/2019

Outlines specific targets for renewable energy in the generation mix and final consumption, and greenhouse gas emissions reduction[3].

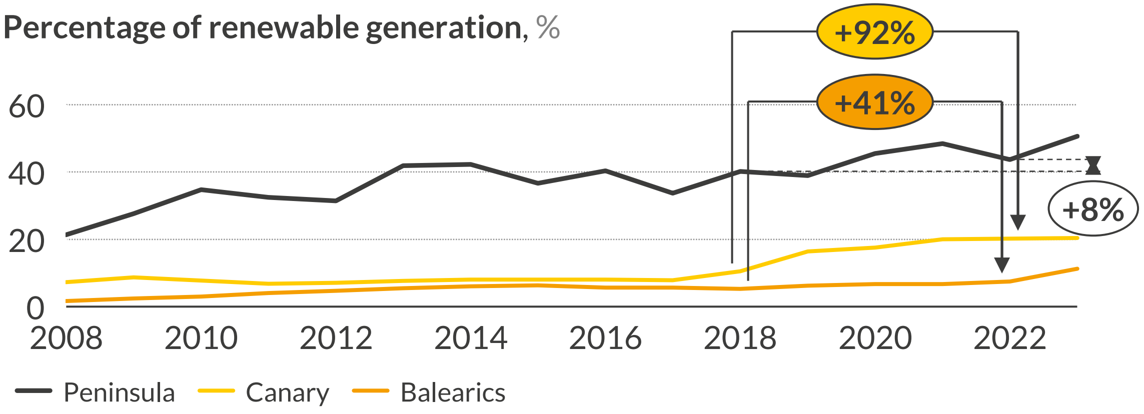
Investment Plan for the Balearic Islands Energy Transition

Within the PRTR[4] funds available, various programmes are outlined, aiming to accelerate the energy transition.

To support these decarbonisation plans, PERTE schemes managed by IDAE allocate 499mn € to finance sustainable energy strategies for the islands

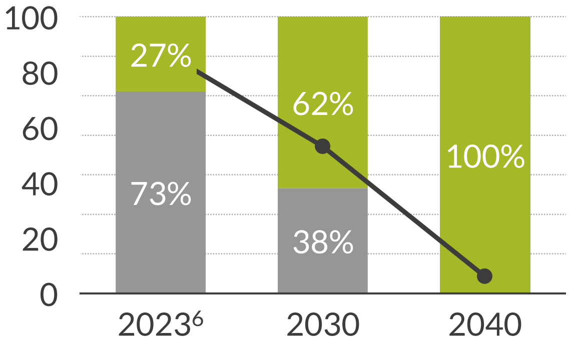
Targets for the Canary islands are more ambitious than the Balearic Islands, targeting full decarbonisation of final energy consumption by 2040

Percentage of renewable generation, %



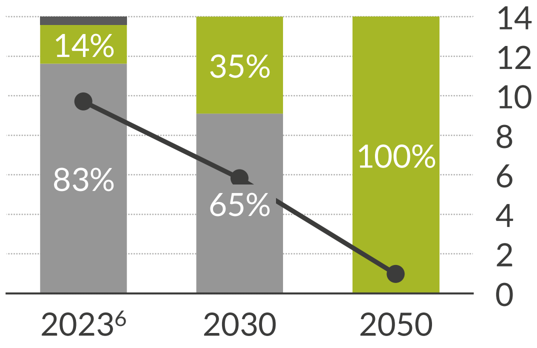
Canary Islands

Final energy consumption share of renewable generation[5], %



Balearic Islands

CO_2 emissions
Mt CO_2eq



CO_2 emissions   Fossil fuel generation   Renewable generation   Other[7]

1) Estrategia Canaria de Acción Climática, made up of: Climate Action Plan, Insular and Municipal Climate and Energy Action Plans, and The Energy Transition Plan. 2) La Estrategia Canaria de Transición Justa y Justicia Climática. 3) Foresees the elaboration of an Energy Transition and Climate Change Plan,;currently pending to beapproved. 4) Plan de Recuperación, Transformación, y Resiliencia. 5) In the Canary Islands, refers to numbers from Alternative 2. 6) Data until Oct. 7) Non-renewable waste.
Sources: REE, Canary and Balearic regional governments, OECan, Estrategia Canaria de Acción Climática, Inventories of greenhouse gas emissions in the Balearic Islands

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Aurora's forecast for long-term demand in the insular systems considers the expected increase in demand and distributed solar capacity

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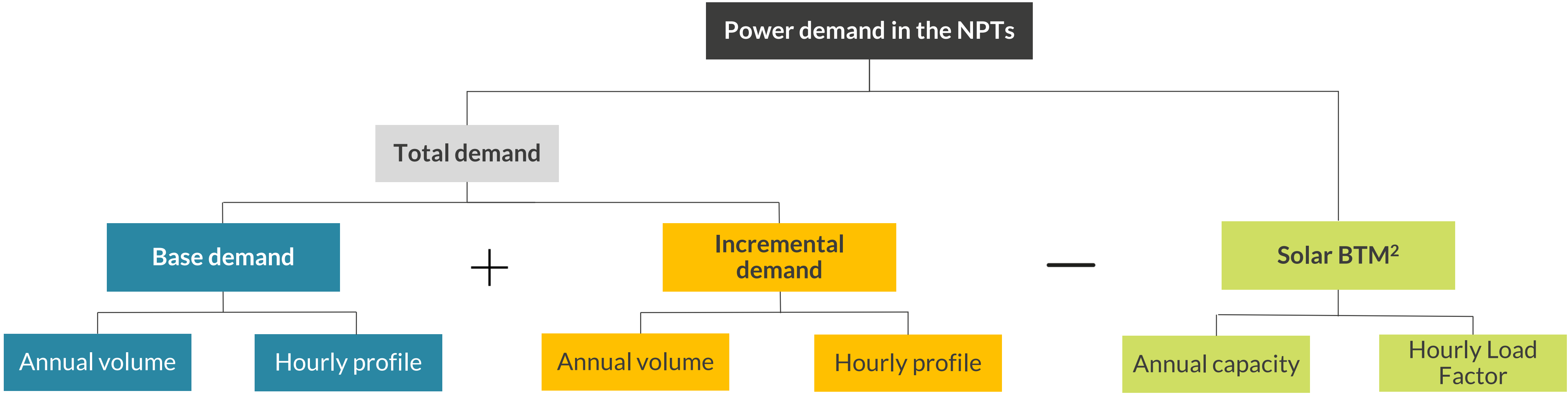

- Base demand includes residential, commercial, industrial and primary-sector demand. It includes power transport losses, and it excludes electric heating and cooling.
- This type of demand is generally inflexible and is expected to grow in line with population, GDP[1] growth, and increased energy efficiency.

- Incremental demand refers to new demand sources which include Electric Vehicles, hydrogen and heat pumps.
- This demand can be flexible or inflexible. For simplicity, in this analysis we have considered inflexible demand considering peninsular hourly patterns.

- Behind-the-meter solar will reduce total demand whilst it is generating.
- We consider historical build-out rates and the expected installed capacity for each NPT, as well as government support.
- We assume that generation from self-consumption will increase over time in line with the increase in installed capacity.

1) Gross domestic product. 2) Behind-the-meter solar PV.

Sources: Aurora Energy Research

Increased demand during the day, mainly due to an increase in EV demand is counteracted by increased solar BTM generation

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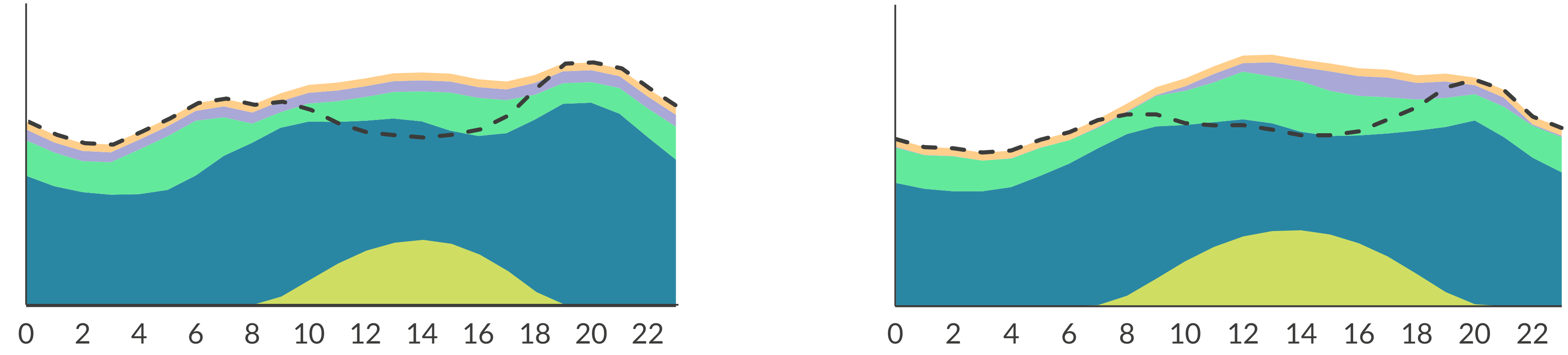
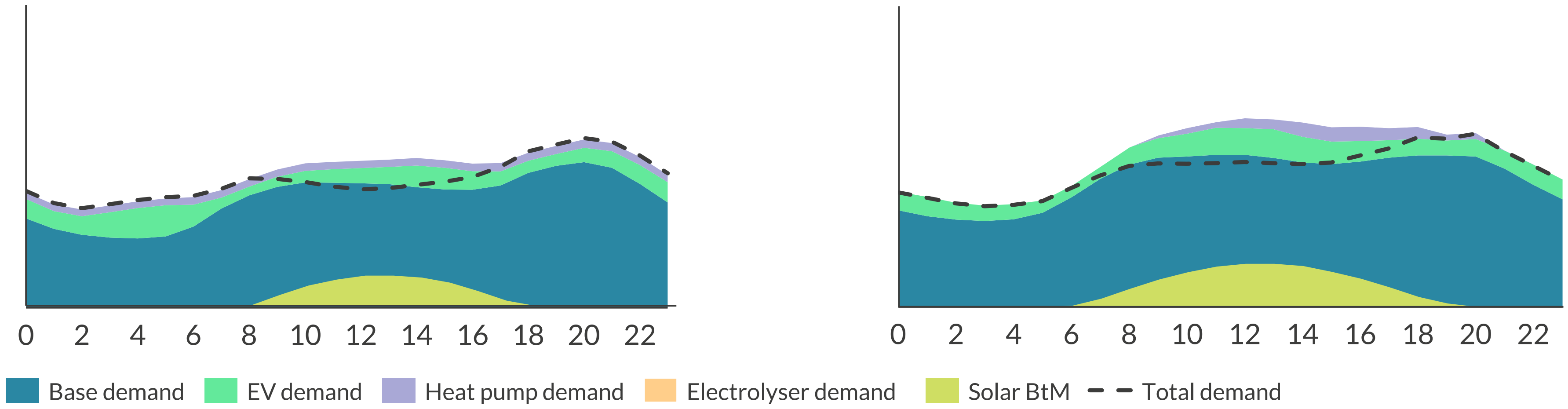
Average hourly demand by segment in January and June 2040 – Canary Islands, GWh

Canary Islands



Average hourly demand by segment in January and July 2040 – Balearic Islands, GWh

Balearic Islands



- Base demand and power demand from electric vehicles have similar shapes driven by morning and evening peaks.
- Power demand from heat pumps peaks during summer afternoons and winter, driven by increased cooling and heating demand during those times.
- As the prices in NPTs are directly linked to demand rather than power generation costs, the hourly profile results in considerably lower prices during nighttime due to minimal industrial activity.
- With the increase of solar BTM generation, peak demand is shifted from the middle of the day to evening periods, leading to lower prices during solar energy production hours.

Sources: Aurora Energy Research

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I. Market and Policy Outlook

II. Model inputs
1. Forecast methodology and price formation
2. Technology assumptions

III. Results

IV. Key Takeaways

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CAPEX and OPEX values are expected to be higher than the Peninsula values, however several factors should be considered

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1 **For estimating the Capex and Opex in the NPTs, we assume values that are a 15% higher than in the Peninsula for all the components[1]**

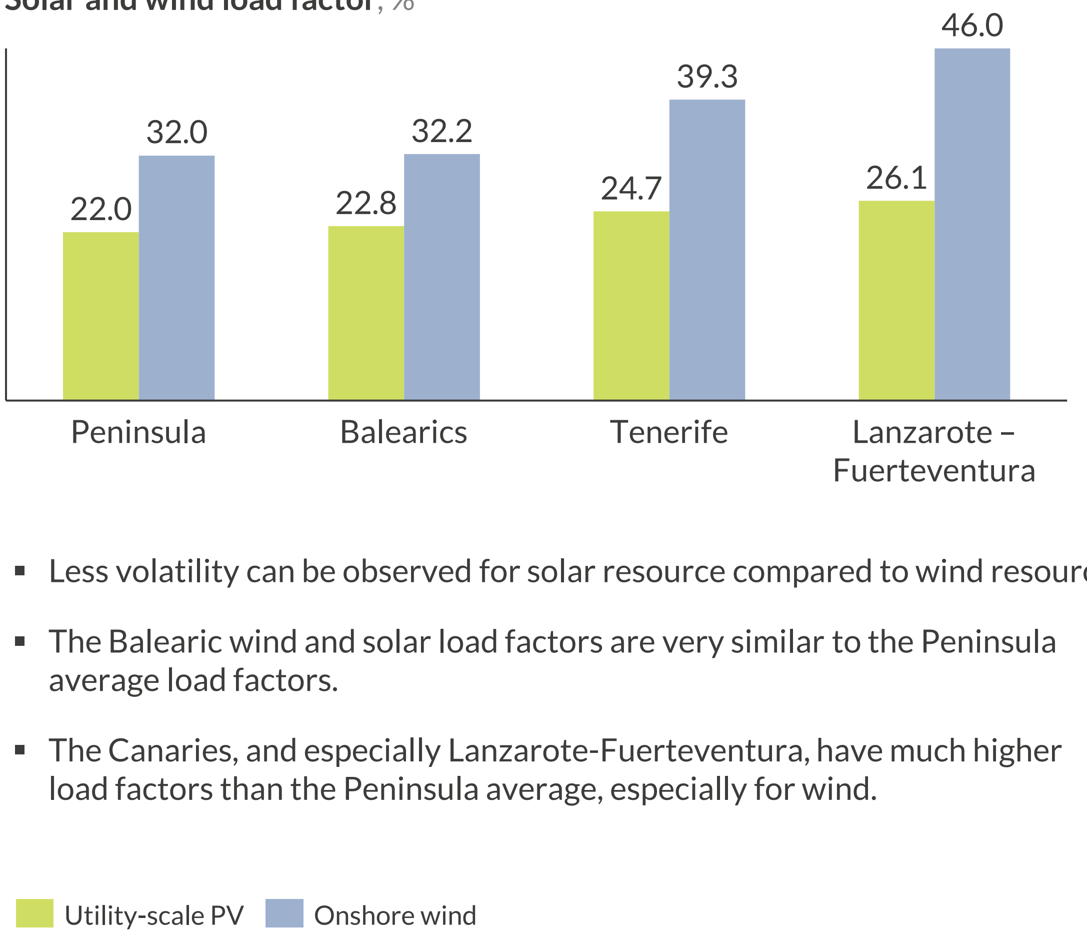
	CAPEX$_{2025}$, €/kW *(EUR 2022)*	OPEX$_{2025}$, €/kW *(EUR 2022)*
Solar asset	750 – 800	20 – 25
Wind asset	1,400 – 1,500	35 – 45

Material costs are dependent on various factors:

- Project size, as larger projects are able to take advantage of economies of scale.
- Type and size of developer, as larger developers can buy components in bulk for different projects, obtaining overall lower prices for the components.
- Technology and project specifics (e.g. if the terrain is complex, or if the project uses trackers or not, etc.).
- Contracting type. The developer:
  - May have supply agreement in place for many projects, or a fully wrapped EPC contract for the specific project.
  - May have a full scope O&M contract or carry out preventive maintenance and have a maintenance reserve account for unexpected issues arising, given some of the specifics of the island terrain and resource.

2 **Renewable resources are higher in the Canaries than in the Peninsula, the Balearics have similar levels as in the Peninsula**

Solar and wind load factor, %



- Less volatility can be observed for solar resource compared to wind resource.
- The Balearic wind and solar load factors are very similar to the Peninsula average load factors.
- The Canaries, and especially Lanzarote-Fuerteventura, have much higher load factors than the Peninsula average, especially for wind.

1) Except for the grid connection CAPEX and social bonus (OPEX), which assumed at the same levels as in the Peninsula. 2) Lanzarote-Fuerteventura.

Sources: Aurora Energy Research, Everoze

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I. Market and Policy Outlook

II. Model inputs

III. Results

   1. Price forecasts
   2. Investment cases for wind and solar

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Although the demand coefficient varies on an hourly basis, yearly values average one, leading to the same annual baseload price for all NPTs

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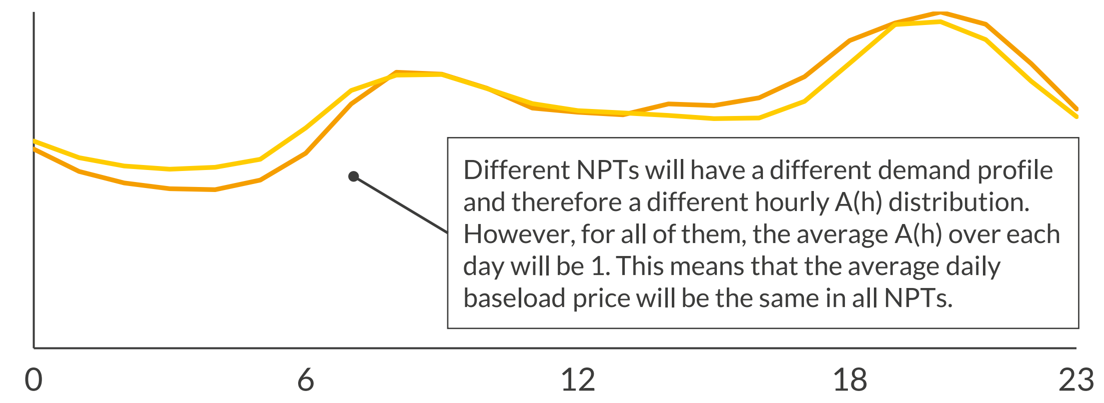
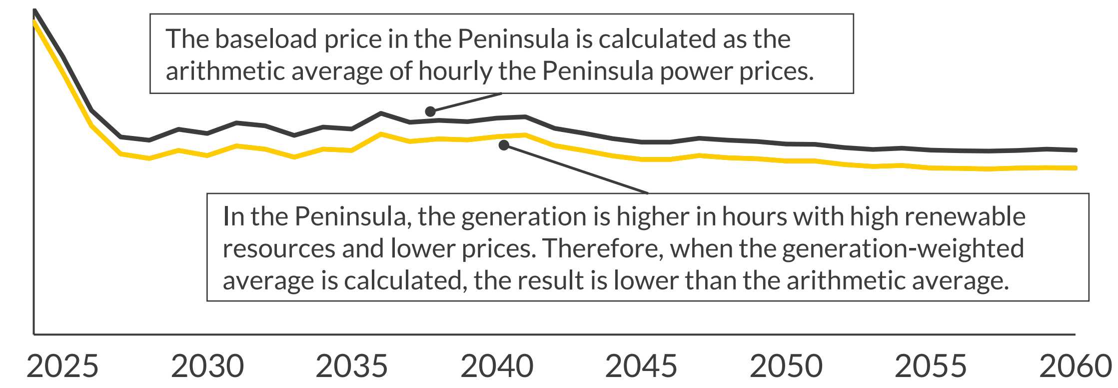
The average daily A(h) coefficient is equal to one, although hourly values vary for each NPT. Baseload prices in the NPTs are lower than in the peninsula

A(h) coefficient for an example day (15 January 2027)



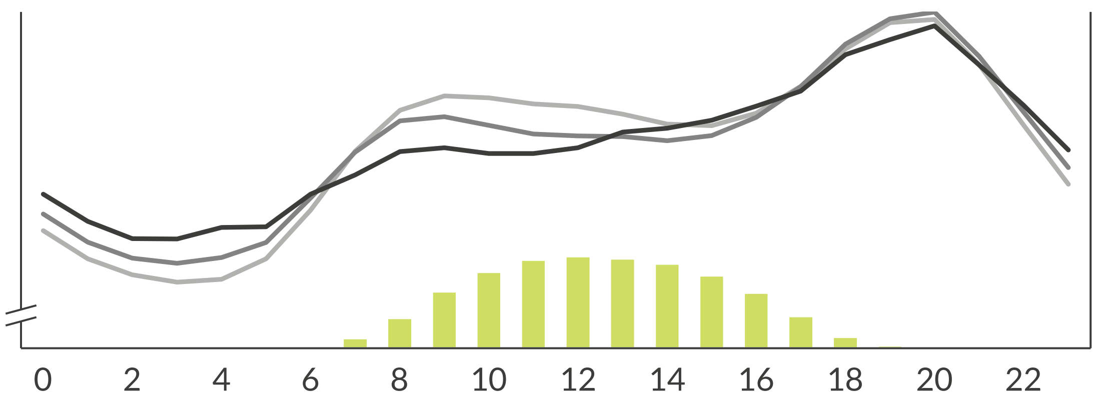
Aurora Central and NPTs baseload prices[1], €/MWh (real 2022)



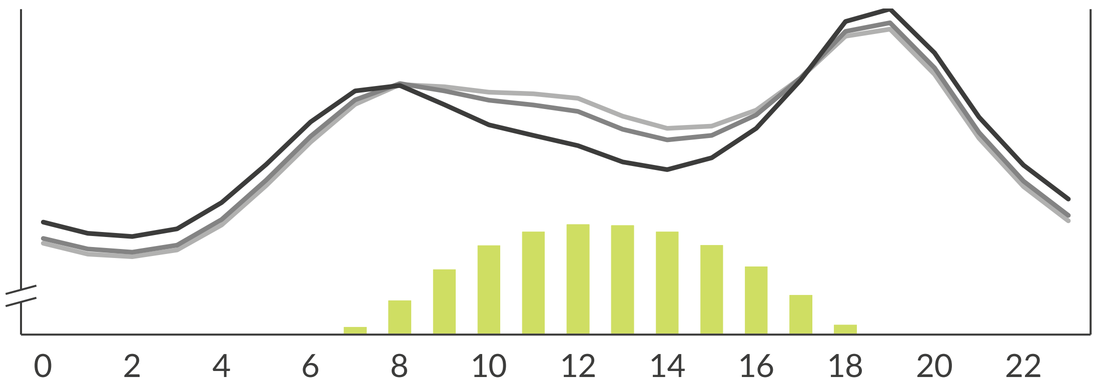
Balearic Islands — Canary Islands — Peninsula

Increasing Solar BTM[2] generation causes the A(h) coefficient to decrease over time during solar hours; demand increases during morning hours

A(h) coefficient, Balearics[4] — **Average demand covered by solar BTM,** %



A(h) coefficient, Canary Islands[4] — **Average demand covered by solar BTM,** %



2024 — 2030 — 2060 — Solar BTM share of daily production (2060)

1) Because of how it is calculated, the baseload price is the same in all the NPTs. 2) Behind-the-Meter Solar PV. 3) Capture prices. 4) The hours on the chart refer to local time zone (UTC in the Canary, UTC+1 in the Balearics) for the whole year.

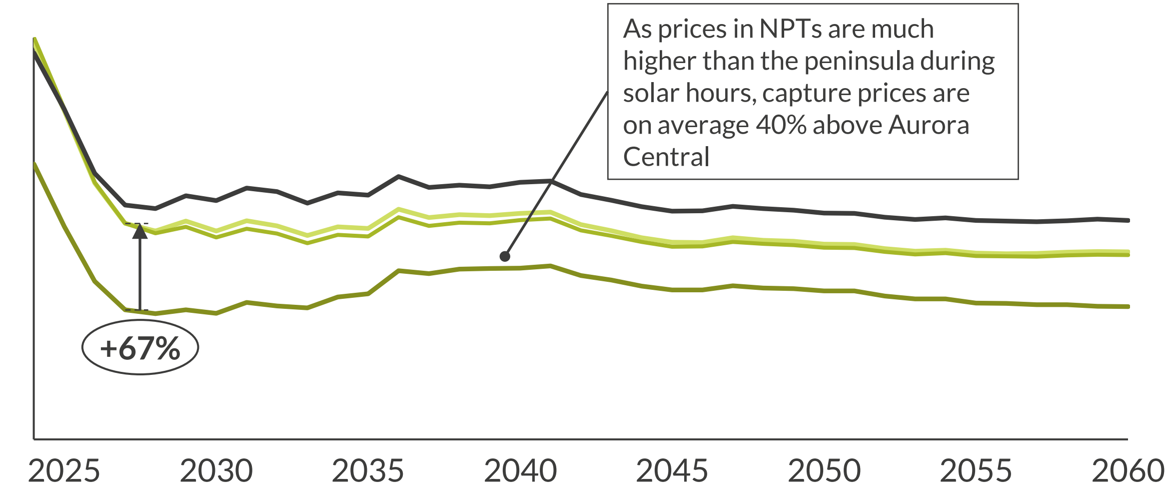
Sources: Aurora Energy Research, REE

Although NPT baseload prices are lower than the peninsula, capture prices are significantly higher, resulting in a lower discount to baseload

Rapid solar buildout between 2024 and 2030 leads to low capture prices in the peninsula; whilst NPT capture prices remain high

Aurora Central peninsular and NPTs solar capture prices

€/MWh (real 2022)

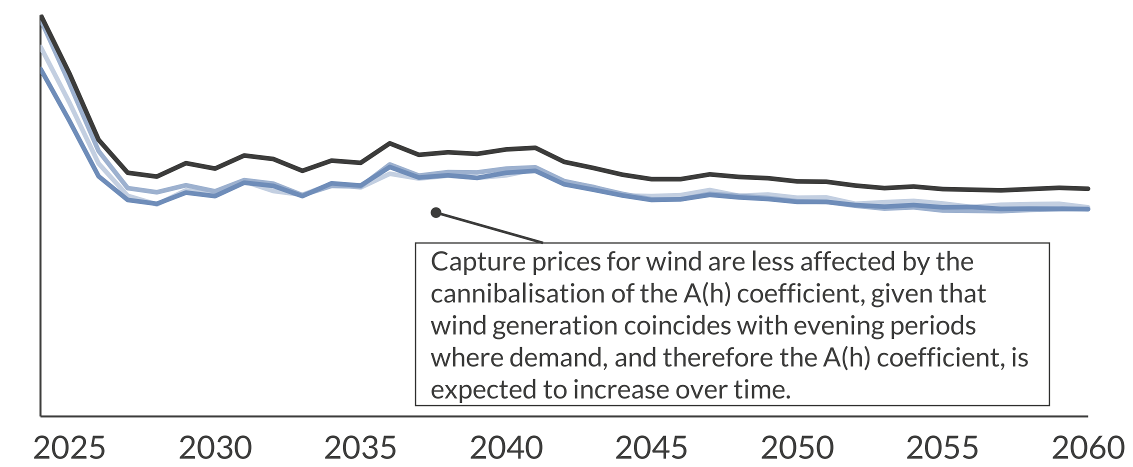


Average discount to baseload[1]	2024-30	2031-40	2041-50	2051-60
Peninsula	41%	39%	34%	37%
Canary Islands[2]	-1%	7%	7%	7%
Balearic Islands	-2%	3%	5%	6%

Low wind cannibalisation, and a lower impact of decreasing A(h) coefficient during central hours, causes NPT capture prices to be similar to the peninsula

Aurora Central Peninsula and NPTs wind capture prices

€/MWh (real 2022)



	2024-30	2031-40	2041-50	2051-60
Peninsula	12%	9%	9%	8%
Canary Islands[2]	-3%	-1%	-1%	0%
Balearic Islands	2%	0%	-1%	-3%

Solar Balearic · Solar Canary · Solar Peninsula · Wind Balearic · Wind Canary · Wind Peninsula · Baseload Peninsula

1) Discounts to peninsula and NPTs baseloads are calculated based on corresponding capture prices: NPT discounts consider NPT capture prices and baseload, while Peninsula discounts involve Peninsula capture prices and Peninsular baseload. 2) Average of Tenerife and Fuerteventura-Lanzarote subsystems.

Sources: Aurora Energy Research

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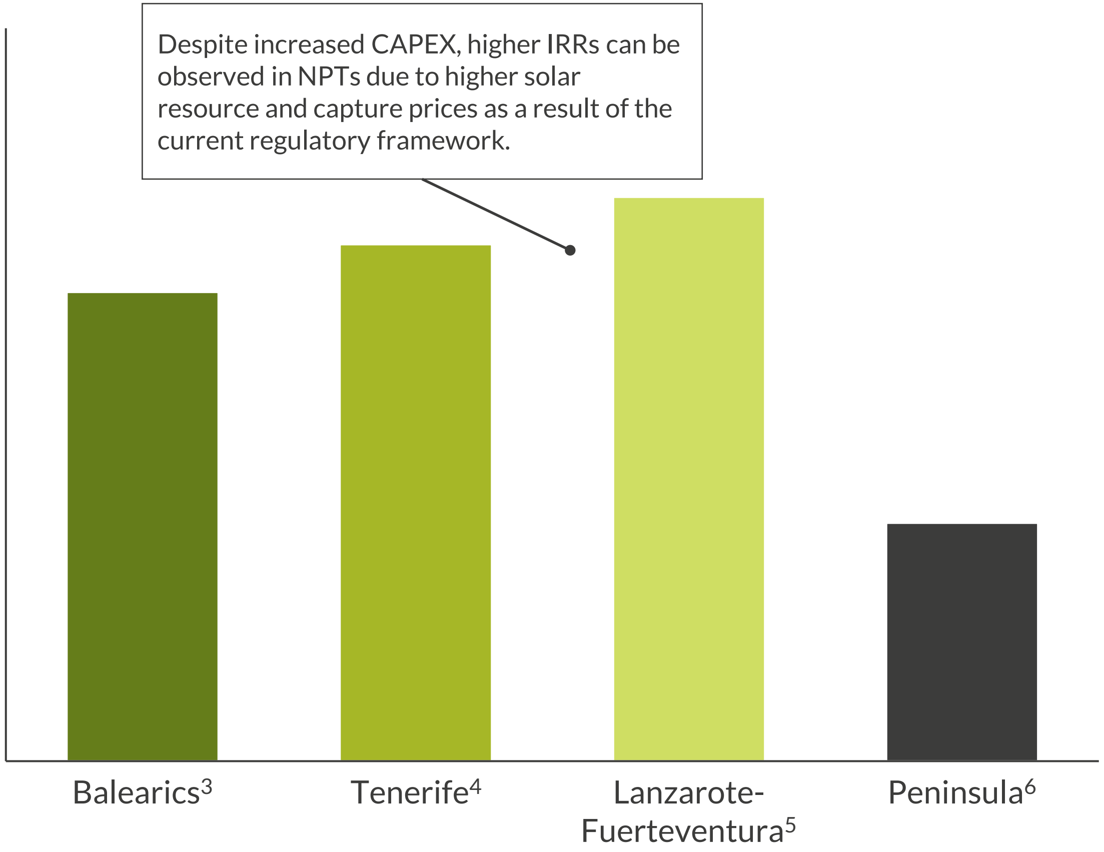
Under the current regulatory framework, solar PV projects in the islands have solid Internal Rate of Return (IRRs) ranging between 12 and 15%

With an average 38% discount to baseload throughout its entire lifespan, solar projects in the peninsula fall behind their counterparts in NPTs

Solar PV project (COD[1] 2025) IRRs by location[2]

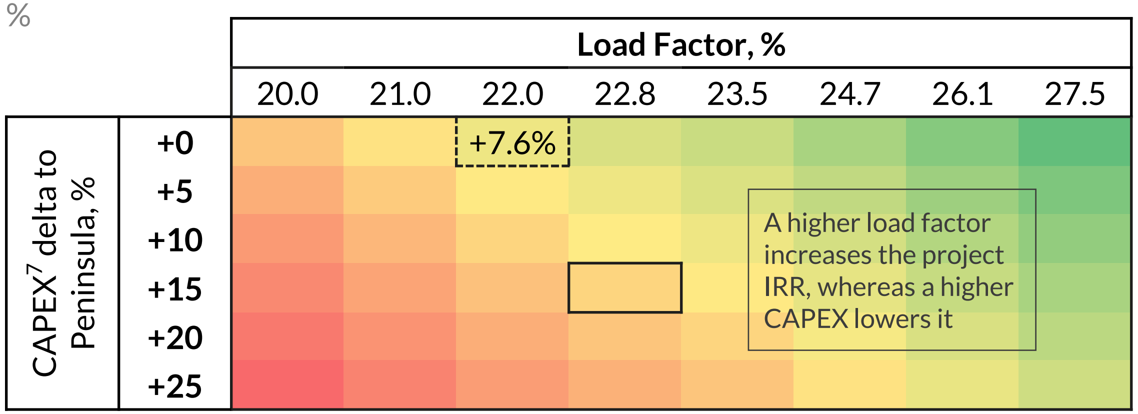
%



Considering peninsular solar capture prices, NPT revenues decrease significantly, reducing IRRs by 54% on average.

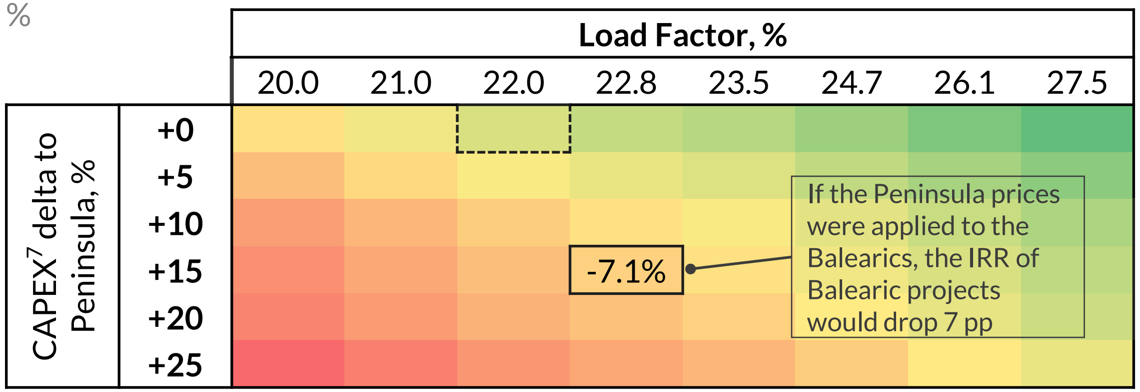
Solar project IRR with Balearic solar capture prices

%



Solar project IRR with peninsular capture prices

%



--- Peninsular IRR — Balearic IRR

1) Commercial Operations Date. 2) Given the variation in resource across islands, IRRs may vary significantly in different locations within the same island. 3) Balearics load factor: 22.8%. 4) Tenerife load factor: 24.7%. 5) Lanzarote-Fuerteventura load factor: 26.1%. 6) Representative IRR based on the average Aurora's solar load factor for the Peninsula: 22.0%. 7) Projections do not consider inflation. 15% increase is not applied to grid connection costs.

Sources: Aurora Energy Research

In contrast to solar projects, onshore wind is less affected by CPs and more reactive to resource availability and location

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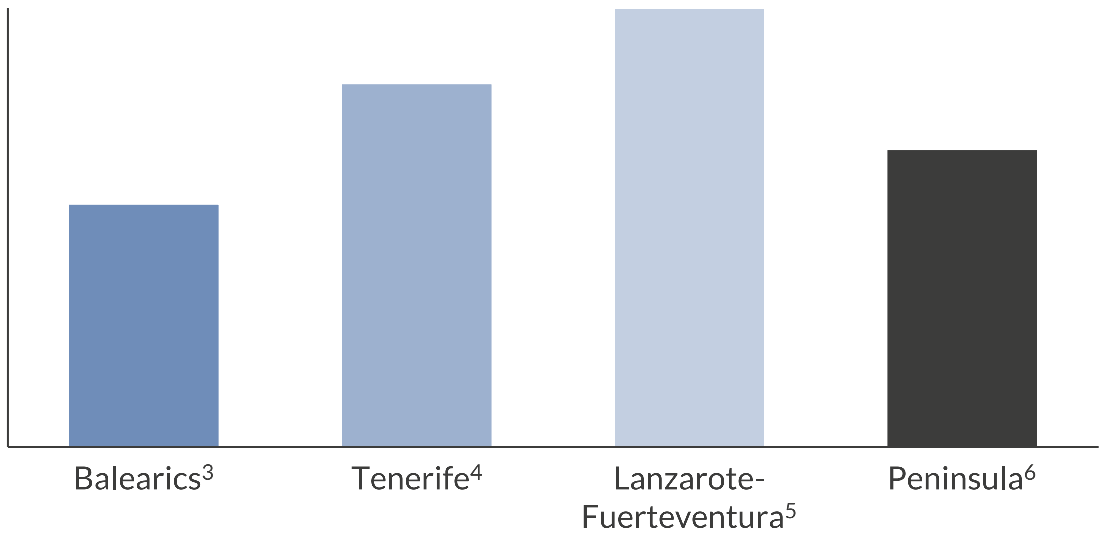
For projects with operations commencing in 2025, highest returns come from Canary islands where load factors reach up to 46%

Wind project (COD[1] 2025) IRR by location[2]

%

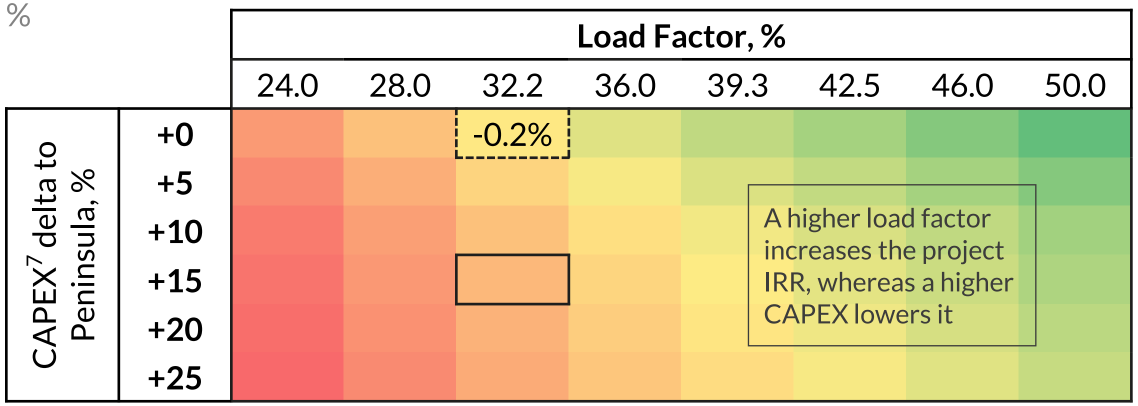


- Projects located in Lanzarote-Fuerteventura and Tenerife are more profitable than in the peninsula and the Balearics due to the higher wind resource (46.0%, 39.3%, and 32.2% LF respectively).
- Increased Capex and a load factor similar to the peninsular average causes the IRR for the Balearics to be the lowest of the four regions.

Similar capture prices in the NPTs with the peninsula result in higher CAPEX and load factor sensitivity in IRR calculation

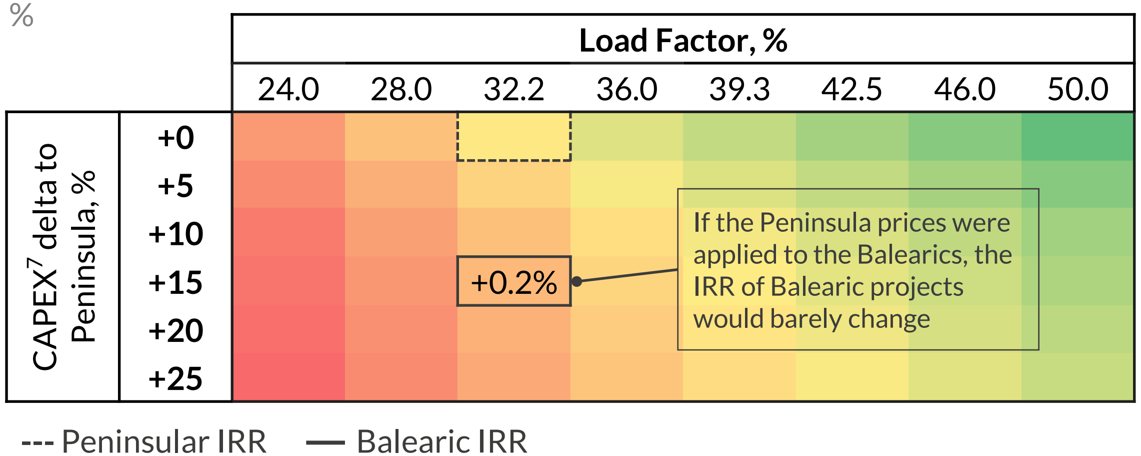
Project IRRs with Balearic wind capture prices

%



Project IRRs with peninsular wind capture prices

%



1) Commercial Operations Date. 2) Given the resource variation across islands, IRRs may vary significantly in different locations within the same island. 3) Balearics load factor: 32.2%. 4) Tenerife load factor: 39.3%. 5) Lanzarote-Fuerteventura load factor: 46.0%. 6) Representative IRR based on the average load factor of wind zones modeled by Aurora: 32.0%. 7) Projections do not consider inflation. 15% increase is not applied to grid connection costs..

Sources: Aurora Energy Research

The current regulation incentivises investment in Solar PV, however, it does not address certain aspects that are also key to decarbonisation

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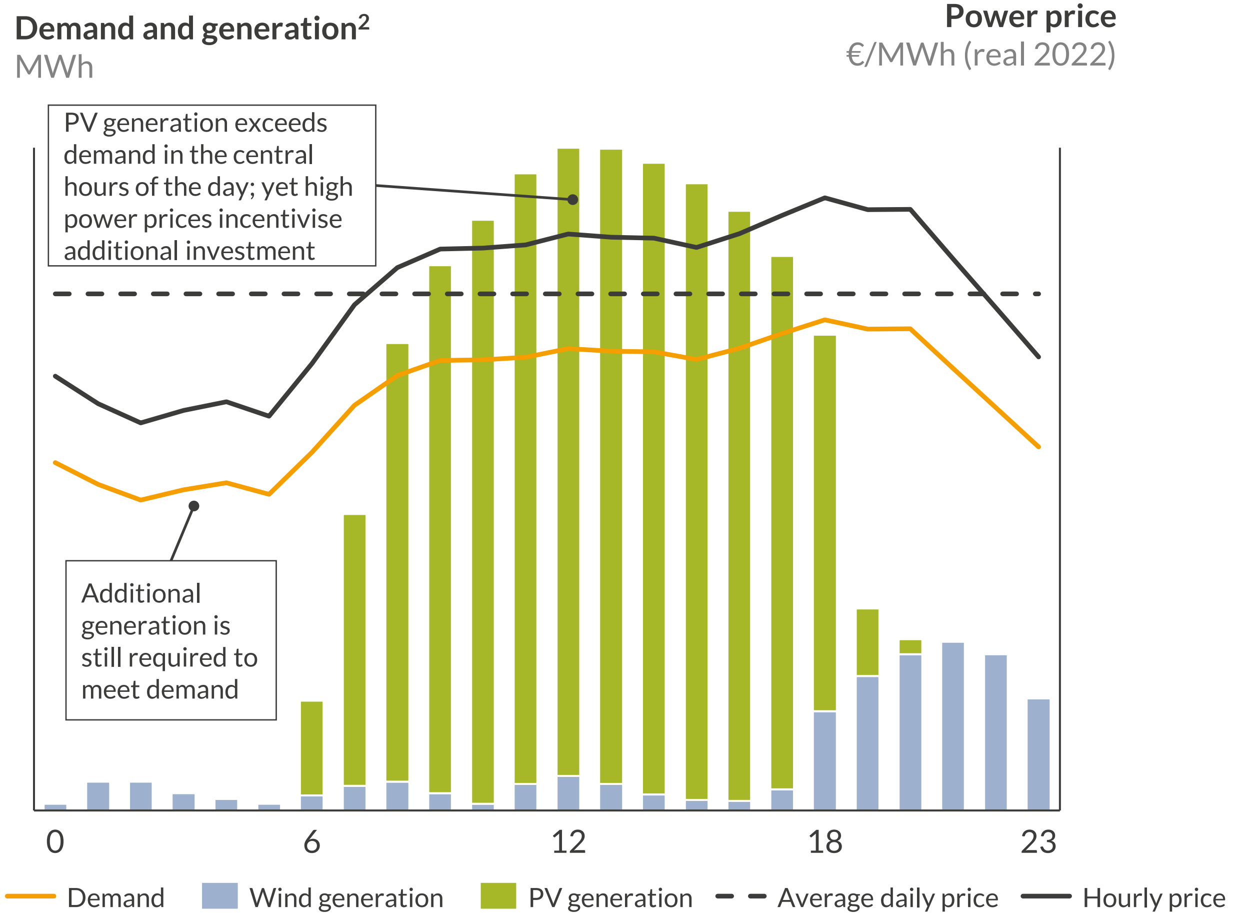
1 Price signals are adequate to attract RES[1] investment, however, they do not properly capture the system needs

Example day in the Balearic Islands, July 2030.



2 The current regulation has additional limitations relating to ensuring security of supply and investment in flexible technologies

Ancillary services

- Due to their lack of interconnections and the fragility of their electricity network, ancillary services are critical to ensure reliability of supply.
- However, as of now, there is a lack of clarity on how these services will evolve in the future, especially when considering storage participation.

Local considerations

- Islands that are not interconnected have the same price as they are calculated on a territory level (i.e Balearic and Canary Islands).
- This is especially relevant for the small islands that are not interconnected, as a large change in the demand pattern of a small island will not have an impact in the aggregated demand and therefore, in the overall price paid by all systems.
- Island specific security of supply requirements must be considered as price signals to consumers to reduce demand are more important in tighter systems.

Deep dive in following slide

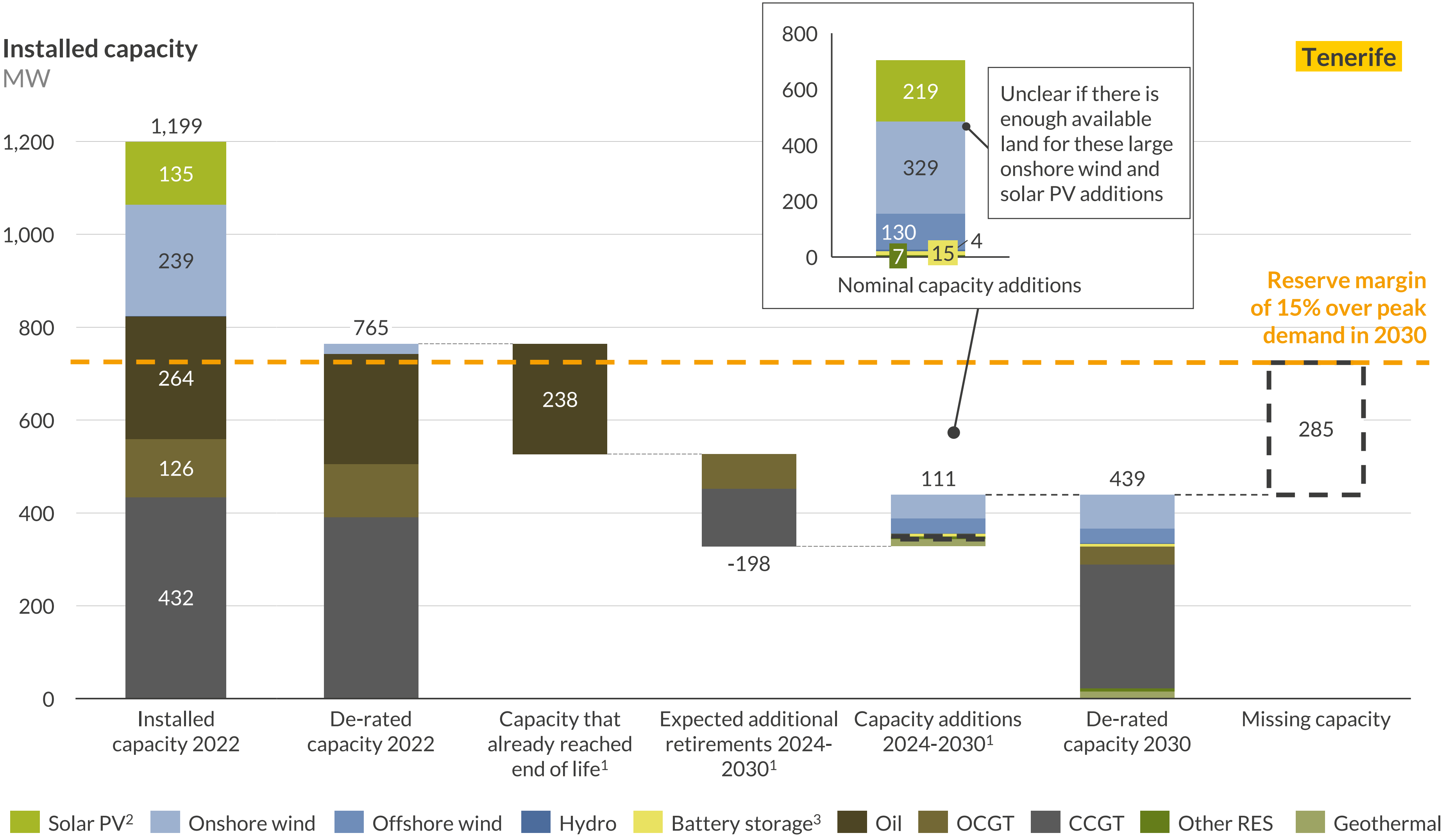
Regulatory uncertainty

- It is difficult to create long-term forecasts as the regulation could be modified in the future.
- Despite the higher profitability, uncertainty around the future evolution of the regulation could hinder investment in the islands.

1) Renewable Energy Sources. 2) Assumptions on RES capacity installed: The solar PV capacity must be able to cover 70% of the total yearly power demand. The solar PV/wind capacity ratio is equal to 4.8

Sources: Aurora Energy Research

Considering a 15% reserve margin, the current decarbonisation plan for Tenerife would lead to a missing capacity of almost 300 MW



- We assume the Alternative 2 values[4] of the government plan (PTECan).
- In 2030, 61% of the demand is expected to be covered with RES[5].
- In terms of capacity, an additional 285 MW (de-rated capacity) are required by 2030. This would be equivalent to the addition of 746 MW of 2h batteries.
- This represents an additional investment of 459mn €[6] and would represent an additional 21% of investment with respect to the values displayed in the PTECan.
- A more optimal capacity mix would be needed. This could include flexible technologies (demand side response and offshore wind for example).

1) Values shown are derated capacities. 2) Includes 11 MW of floating PV, as per PTECan. 3) The PTECan only provides the MWh value of 29 MWh additions. We have assumed this corresponds to 2-hour battery capacity. 4) Alternative 2 targets full decarbonisation by 2040 but taking a less aggressive path than the other proposal, Alternative 1. 5) Renewable Energy Sources. 6) Using average forecasted battery costs in 2024-2030.

Sources: Aurora Energy Research, PTECan

Alternatives to the current regulation that ensure security of supply, as well as preserving price and investment signals exist

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Power prices

- To give adequate signals for investors, the price generators receive should reflect the impact of cheaper renewable generation, and not only the demand levels. Alternatives to the current formula could include:
  1. A marginal, merit-order based market with the same clearing price for generation and demand, as in the Peninsula.
  2. A formula[1] that aims to increase prices proportionally to demand not covered by renewables:

$$\text{Hourly NPT price} = \text{Weighted average daily peninsula price} * \frac{(\text{Hourly demand} - \text{Hourly renewable generation} * \text{k}^1) \text{ in the NPT}}{(\text{Average daily demand} - \text{Average renewable generation} * \text{k}^1) \text{ in the NPT}}$$

  3. As proposals 1 and 2 lead to price cannibalisation with increasing renewables, another alternative to provide more certainty to developers is to promote competitive renewable PPA auctions specifically for the islands.

Security of supply

- Incentivise investment in storage and flexibility by enabling additional revenue streams for these technologies. Examples of such streams would be capacity markets and other ancillary services.
- Build additional interconnections between electric systems.
- Ensure that price signals given are coherent with the supply requirements of that isolated system.
- Support strategies to lower the demand, especially during peak hours, such as the implementation of DSR[2].

Regulatory framework

- Any measures that are implemented should be closely monitored to ensure the right market signals are provided:
  - Incentivise demand reduction during peak hours
  - Incentivise investment in technologies required for decarbonisation
- Identify technologies (such as storage and DSR[2]) that are key to decarbonisation and providing security of supply, and ensure a clear, transparent regulation to evaluate the business case.
- Finally, regulatory certainty should be given to investors (what changes are expected to be implemented, when, and if they will be retroactive).

1) *K* is a parameter between 0 and 1 that would be used to modulate the effect of renewable generation in the price. The lower the value, the closer the prices would be to the current formula and the lower the cannibalisation effects would be. 2) Demand Side Response.

Sources: Aurora Energy Research

Agenda

Key takeaways

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1. In contrast to the peninsula, the island systems are heavily dependent on thermal generation. This leads to the cost of generating electricity being higher than in the peninsula. However, by law, consumers in different regions must pay the same price for electricity, creating additional costs that are funded via the State Budget (50%) and the electricity system (50%).

2. A specific regulatory framework is applicable to the Balearic and Canary Islands; generators receive compensation based on the average peninsula wholesale market price, adjusted by demand on an hourly basis. This adjustment factor is cannibalised over time as demand decreases in line with the increase in Solar BTM generation. However, the cannibalisation effect is less aggressive than that observed in the peninsula.

3. Material costs can be higher for projects located in the islands, however, several factors must be considered, such as the project size, the type of developer, technology and contract structure. Resource in the Canary Islands is much higher for both wind and solar PV technologies, whilst in the Balearics, the solar resource is higher than the peninsula.

4. Despite additional material costs, higher resources and prices lead to higher IRRs for projects located in the islands compared to the peninsula, with the exception of wind projects located in the Balearic Islands. This difference is higher for solar projects, as cannibalisation in the peninsula is expected to be higher for this technology compared to wind.

5. The current regulation has several limitations including a lack of relevant price signals and incentives for installing flexible technologies and reducing demand during peak hours. This could lead to regulatory uncertainty as the incentives for further investment in renewables becomes unsustainable without the current price formation formula. Any measures implemented will need to consider security of supply and decarbonisation targets, whilst minimising the cost to the consumer and taxpayer.

Sources: Aurora Energy Research

Understand the risks and stay ahead of the impact of grid curtailment with the Spanish Grid Curtailment Add-On

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Spanish Grid Curtailment Add-On

Report

Biannual Reports

- Overview of the market framework for Technical Restrictions and policy developments
- Historical assessment of grid curtailment in Spain, focused on renewable assets

Historical Data

Historical data dashboard

- All historical curtailment data in Spain, per province and per programming units available as dashboards on our EOS platform. Updated daily.

Data

Biannual Data Reports

- Central scenario forecast, until 2030, including:
  - Demand per province
  - Capacity stack per province
- For the 9 most impacted provinces, data on:
  - Grid curtailment [%] per province
  - Grid curtailment [GWh] per province
  - Weighted average price of curtailment [€/MWh]
- Sensitivities
  - Based on the biggest risks in the market, some sensitivities are developed (No nuclear phase-out, Low Hydrogen, Battery impact)

Upcoming Grid Modelling

Grid Modelling integration

- Developing a Spanish grid model to forecast upcoming grid congestions in the system to 2030
- Integrating the upcoming network evolution from the latest National Network Development plan

Discuss how our product can help your business **with Enilio Alvarez,**

Senior Commercial Associate:

enilio.alvarez@auroraer.com

Source: Aurora Energy Research

Agenda

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The System Operator is responsible for deciding the energy dispatch on a cost reduction basis

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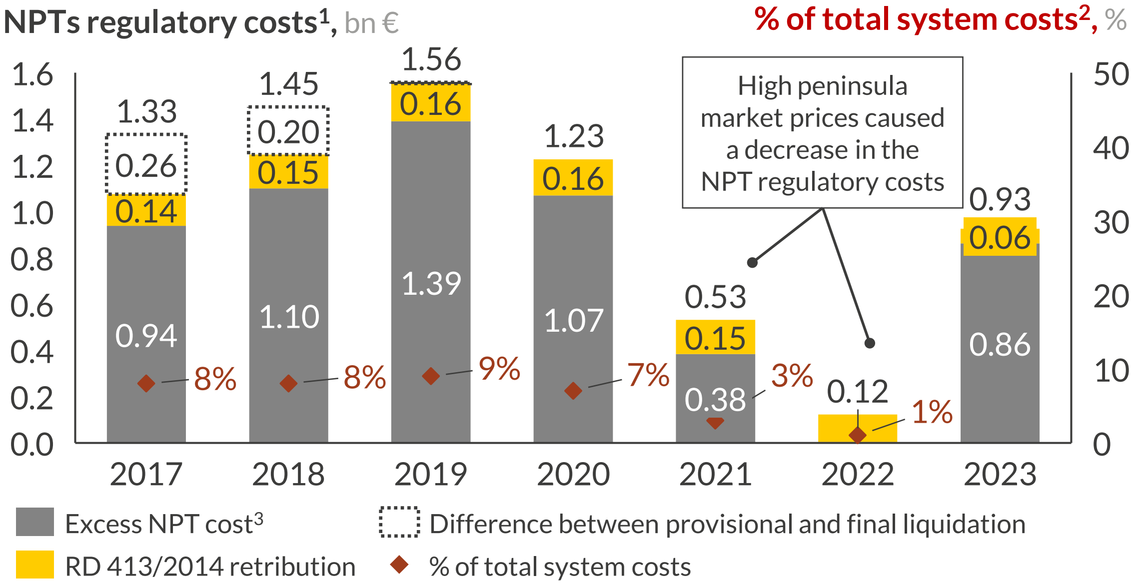
A specific regulatory framework in the island systems is required due to the additional cost of producing electricity compared to the Spanish mainland

- In Spain, all consumers must pay the same price, independent of location.
- However, the cost of generating electricity in NPTs is higher than the peninsula, due to their dependence on thermal generation.
- Therefore, the price that the demand pays when buying electricity in the Wholesale Market, is calculated such that it is not more expensive than buying electricity in the peninsula.
- The difference between the price that generators receive, and the price that the demand pays for this energy is denominated excess NPT costs.

NPTs regulatory costs[1], bn €



The System Operator decides which plants will supply the forecasted demand using an economic criteria, i.e minimising the cost for the system

Power plants located in any NPT will receive the following remuneration:

Wholesale Market Price in the applicable system[4]

+

Specific retribution regime dependent on the type of technology

A **Category A technologies receive the additional retribution regime detailed in RD 738/2015[5]**

Category A technologies include:

- Run-of-river
- Thermal generation[6]

B **Category B technologies can benefit from an additional subsidy according to RD 413/2014, or subsidies relating to RRE[7] and REER[8] auctions**

Category B technologies include:

- Renewables
- Cogeneration plants with an installed capacity < 15 MW

The combination of these components is the price paid to generators located in Non-Peninsular Territories.

1) Final liquidation presented until 2019, following years showcase provisional liquidation. 2) Includes Transport and Distribution costs, Debt Quota, remaining RECORE subsidies under RD 413/2014, NPT excess costs and other costs. 3) Includes excess NPT costs. 4) This is not the same price as the peninsula, more detail on slide 8. 5) Includes two components that compensate fixed and variable costs. 6) Includes coal, biomass, biogas, geothermal, waste-to-energy, and cogeneration plants > 15MW. 7) Régimen Retributivo Especifico: 2016 and 2017 auctions. 8) Régimen Económico de Energías Renovables: contract for difference auctions held since 2020.

Sources: Aurora Energy Research, MITECO, Boletín Oficial del Estado, CNMC

The Canary Islands are made up of six different electric systems. Our analysis will be focused on Tenerife and Fuerteventura-Lanzarote

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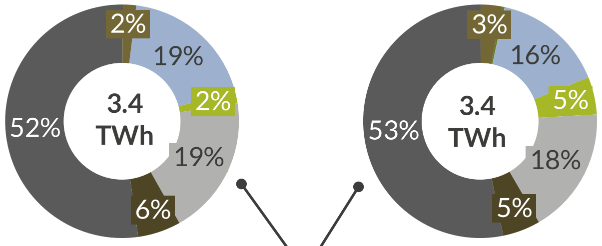
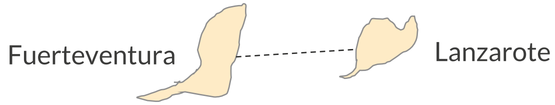
1 Island systems that have large populations[1], and additional industry on top of tourism

Generation mix (2021), % of total TWh

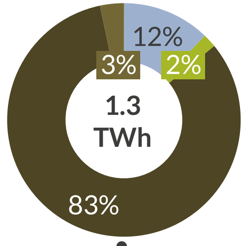


Dominated by thermal technology and a relatively high RES[2] contribution.

2 Medium-size islands, with a population over 100k; demand mainly comes from tourism



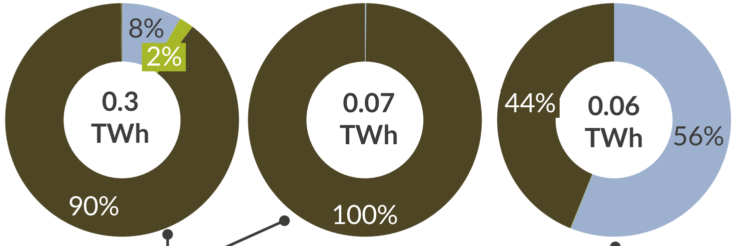
Generation mix (2021), % of total TWh



Mainly oil engines, with some RES and residual OCGT[3] generation.

3 Small islands, with a populations below one hundred thousand inhabitants

Generation mix (2021), % of total TWh

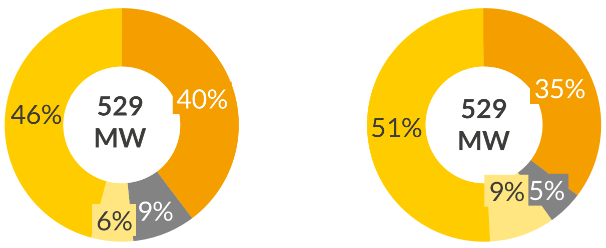


Almost all generation is provided by oil

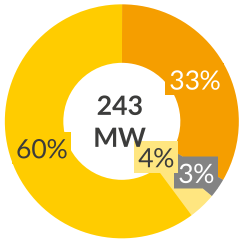
Split between hydrowind[6] and oil

OCGT[3] | CCGT[4] | Oil | Steam turbine | Solar PV | Wind | Other RES[5] | **XX TWh:** Total demand

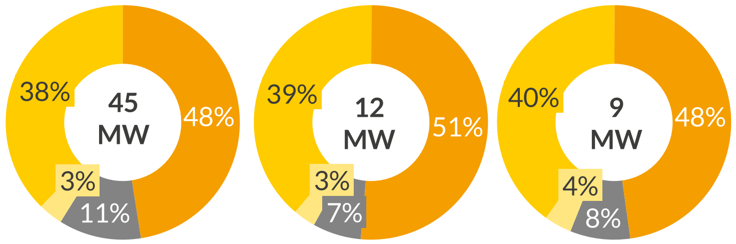
Demand breakdown (2021), % of total TWh



Demand breakdown (2021), % of total TWh



Demand breakdown (2021), % of total TWh



Residential | Commercial | Industrial | Other | **YY MW:** Peak demand

1) More than 1 million inhabitants. 2) Renewable Energy Sources. 3) Open Cycle Gas Turbine. 4) Combined Cycle Gas Turbine. 5) Includes hydro, biomass, biogas, renewable waste, geothermal, and marine energy. 6) Refers to the Gorona del Hierro plant, which combines wind and pumped storage.

Sources: Aurora Energy Research, Anuario Energético de Canarias

A stronger demand variation can be observed in the island systems, with the Balearics seeing the highest divergence to the peninsula

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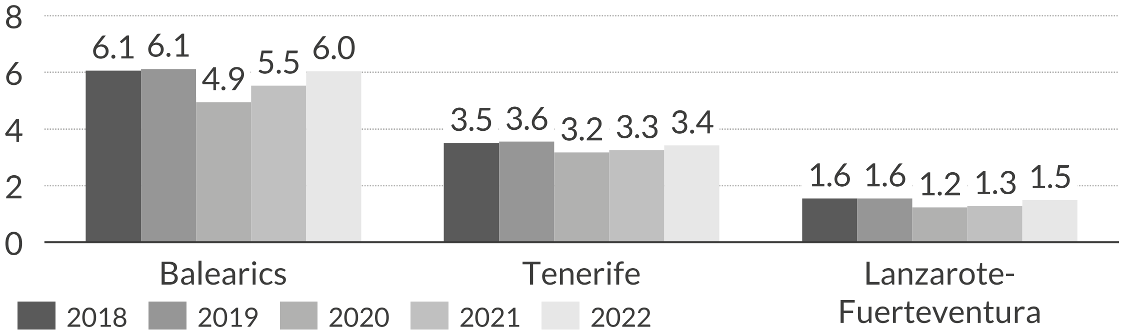
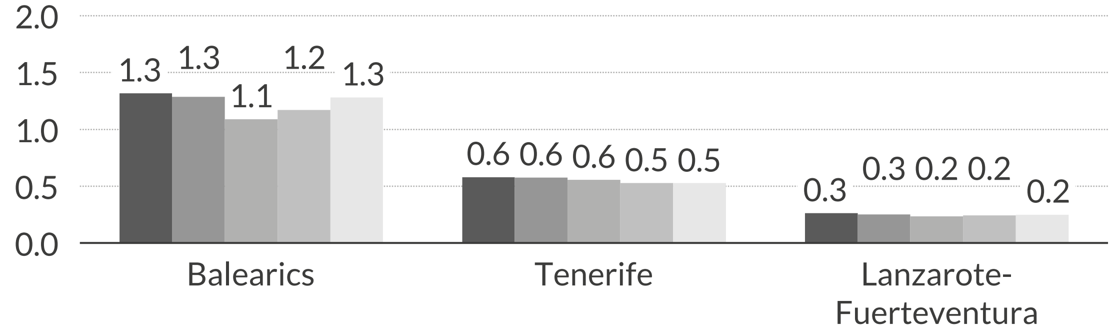
1 Demand recovered in 2022 following the Covid-19 pandemic and energy crisis; the Balearics have the highest demand of the electrical systems

Annual demand, TWh



2 Given their isolation, island systems have a higher security of supply standard although peak demand is low overall

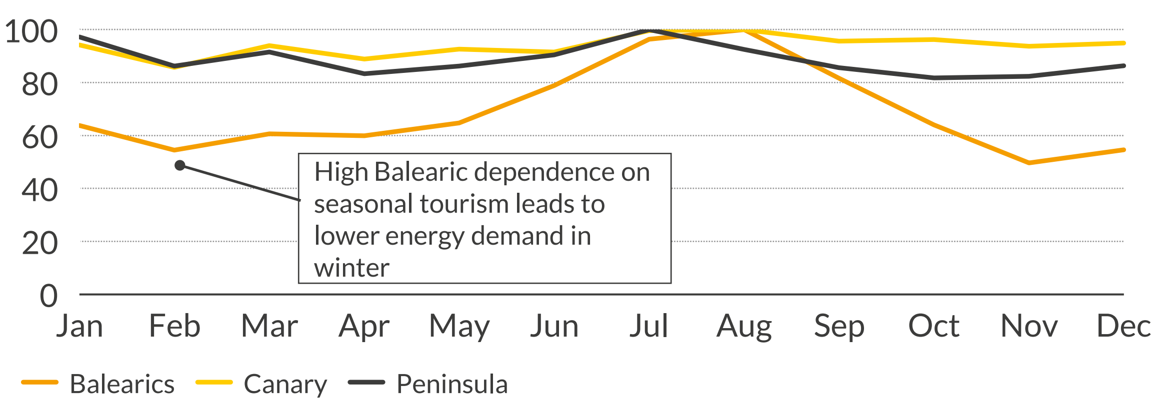
Peak demand, GW



3 Demand in the Balearic Islands is seasonal; while the Canaries have a more constant demand profile over the year, similar to that of the peninsula

Monthly demand over maximum monthly demand in 2022

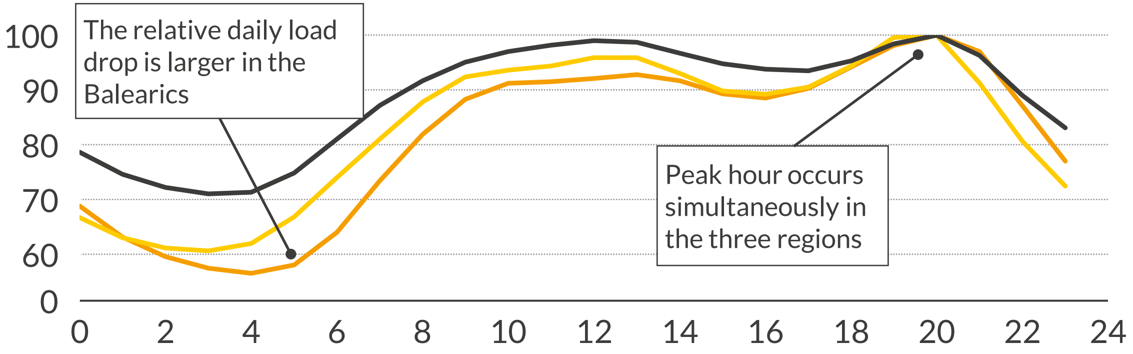
% of peak month[1]



4 Lower industry in the islands, especially in the Balearics, causes a lower nighttime load with respect to the peak load

Average hourly demand over maximum average hourly demand in 2022

% of peak hour[2,3]



1) Compares the total demand in any given month with the highest total monthly demand. 2) Compares the average hourly demand at that time with the highest average hourly demand over the year. 3) The three systems are displayed in UTC+1 time zone, regardless of location and of summer or winter time zone.

Sources: Aurora Energy Research, REE, Anuario Energético de Canarias

PERTE schemes managed by IDAE allocate 499mn € to finance sustainable energy strategies for the Balearic and Canary Islands[1]

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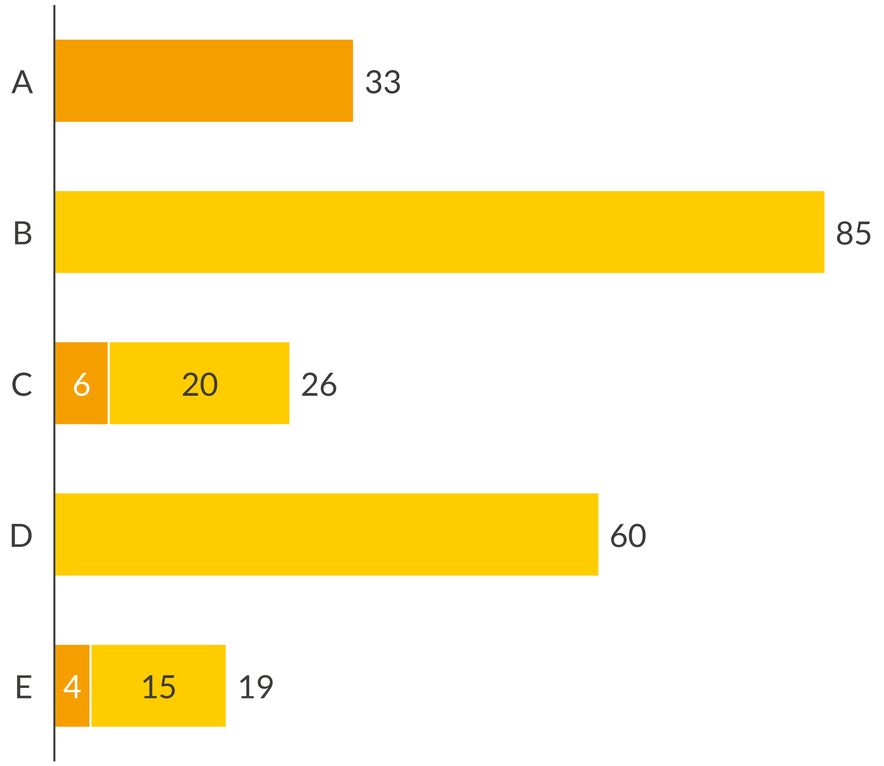
Status of PERTE calls[2]

	Programme call – RES and storage	Status	Next steps
A	Renewable projects in the Balearic Islands	Call closed. Final resolution published on 31 October 2023	Deadline of execution by January 2026
B	Renewable projects in the Canary Islands	Call closed. Final resolution published on 17 November 2023.	Deadline of execution by January 2026
C	Innovative co-located energy projects with electricity generation from renewable sources	Calls closed. Provisional resolution published on 14 November 2023.	Final resolution expected.
D	Geothermal projects in Canary Islands	Calls closed. Urgent processing of calls announced on 10 November 2023.	Preliminary resolution expected
E	Innovative energy stand-alone storage projects	Calls closed. Applications deadline extended to 31 October 2023	Preliminary resolution expected

Estimated call budget

mn €



In addition to specific calls for the islands, additional funds have been allocated to provide additional support for RES and storage projects for Balearic and Canary islands, such as the Aid Lines for Investment in Renewable Energy co financed with FEDER[3] Funds. Out of 316mn €, 212mn € were directed to the islands through EOLCAN, SOLBAL, and SOLCAN programmes[4].

Balearic Islands Canary Islands

1) PRTR approved a total of 700mn € in component C 7.12 "Islands' Sustainable Energy", distributing 233 and 467mn € for Balearic and Canary Islands, respectively. RD 451/2022 allocated 499mn €, 302mn € for the Canary Islands, and 197mn € for the Balearics. 2) Only includes calls where specific funds were allocated for the islands. 3) Fondo Europeo de Desarrollo Regional, FEDER in Spanish. 4) Fund distribution is: 54 mn € for EOLCAN 1 , 80mm € for EOLCAN 2, 20mn € for SOLCAN, 40mn € for SOLBAL 1, and 61mn € for SOLBAL 2.

Sources: Aurora Energy Research, IDAE

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Source: Aurora Energy Research

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