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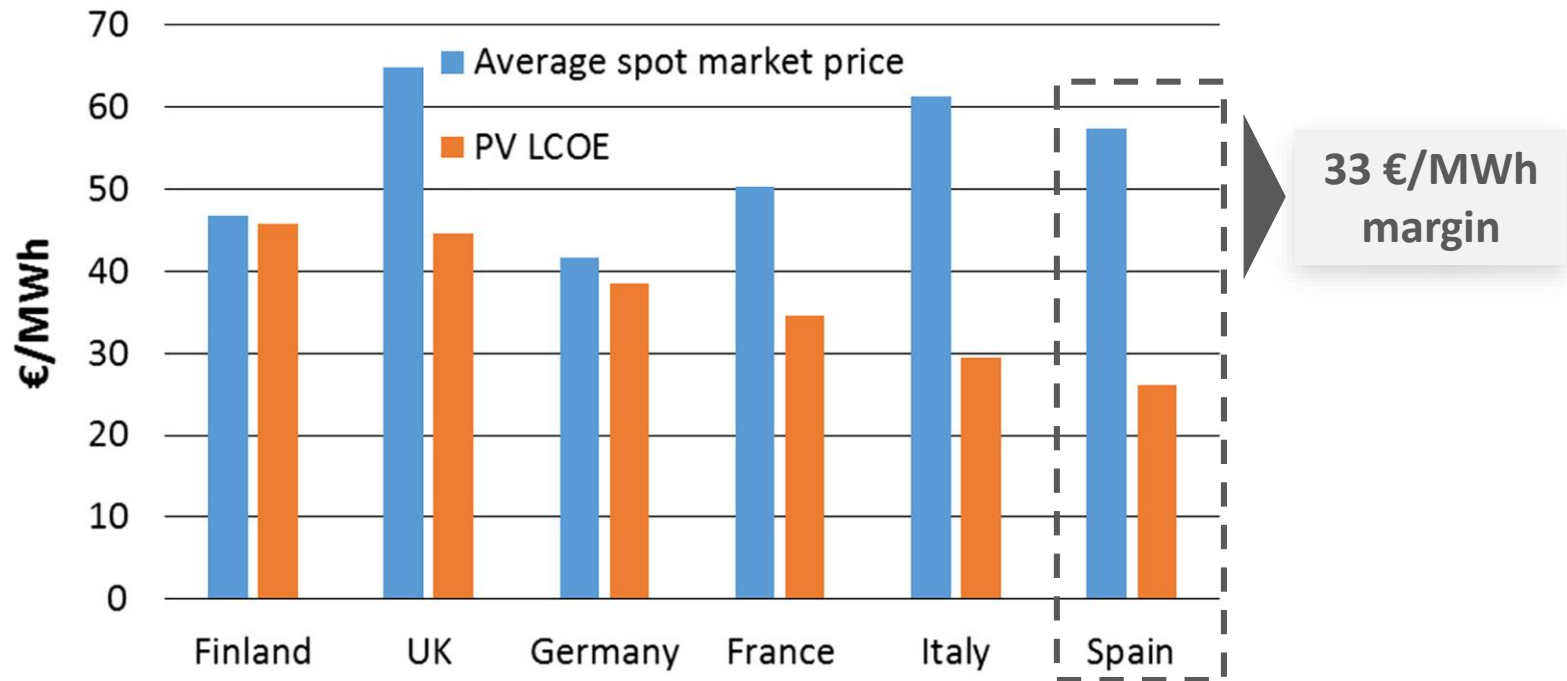
# Electricity markets and RES profitability

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**IEA PVPS Task 1 Event: Trends in PV Development:  
Self-consumption and Innovative Distributed Applications**

**Session 2 – Innovative Distributed Applications for PV,  
Smart Buildings and Electric Mobility**

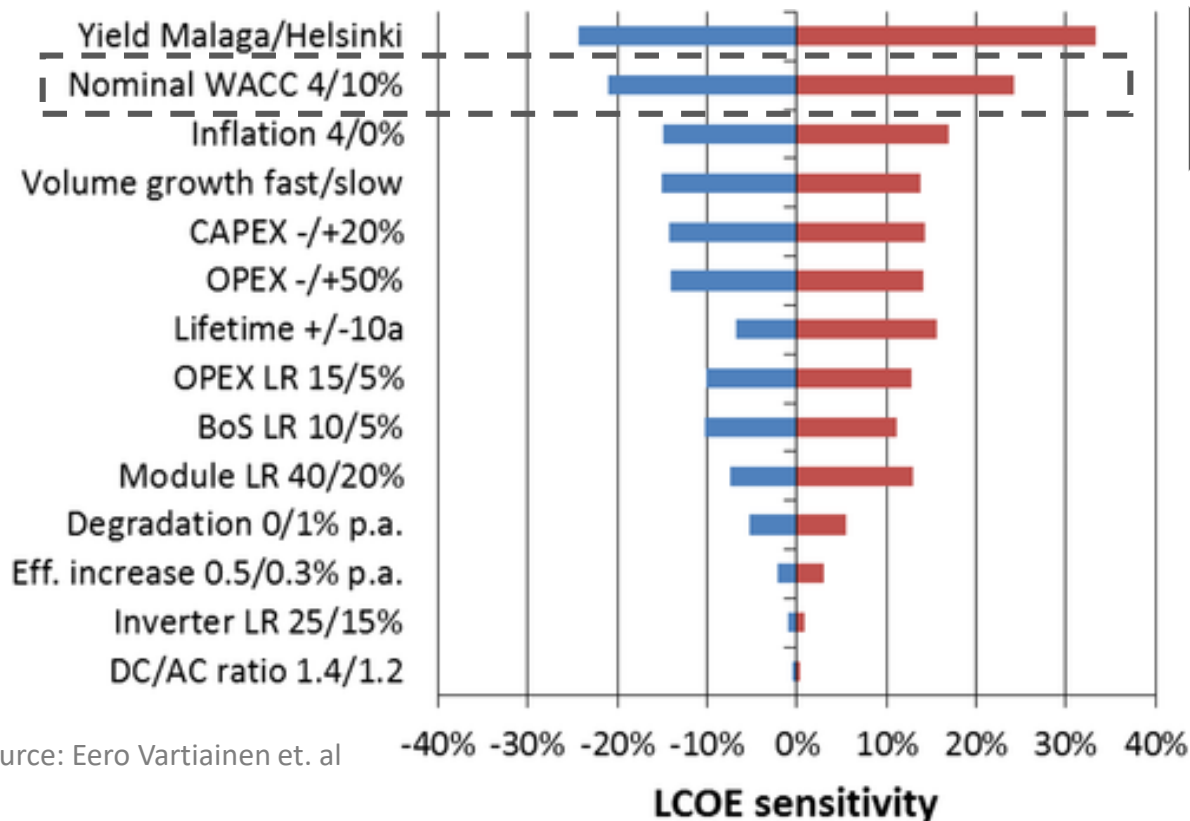
# PV is below spot market prices



Source: Eero Vartiainen et. al

**If costs are below market prices, rational agents would invest massively. As this is not the case, there must be barriers that prevent RES investment**

# Main barrier is cost of capital



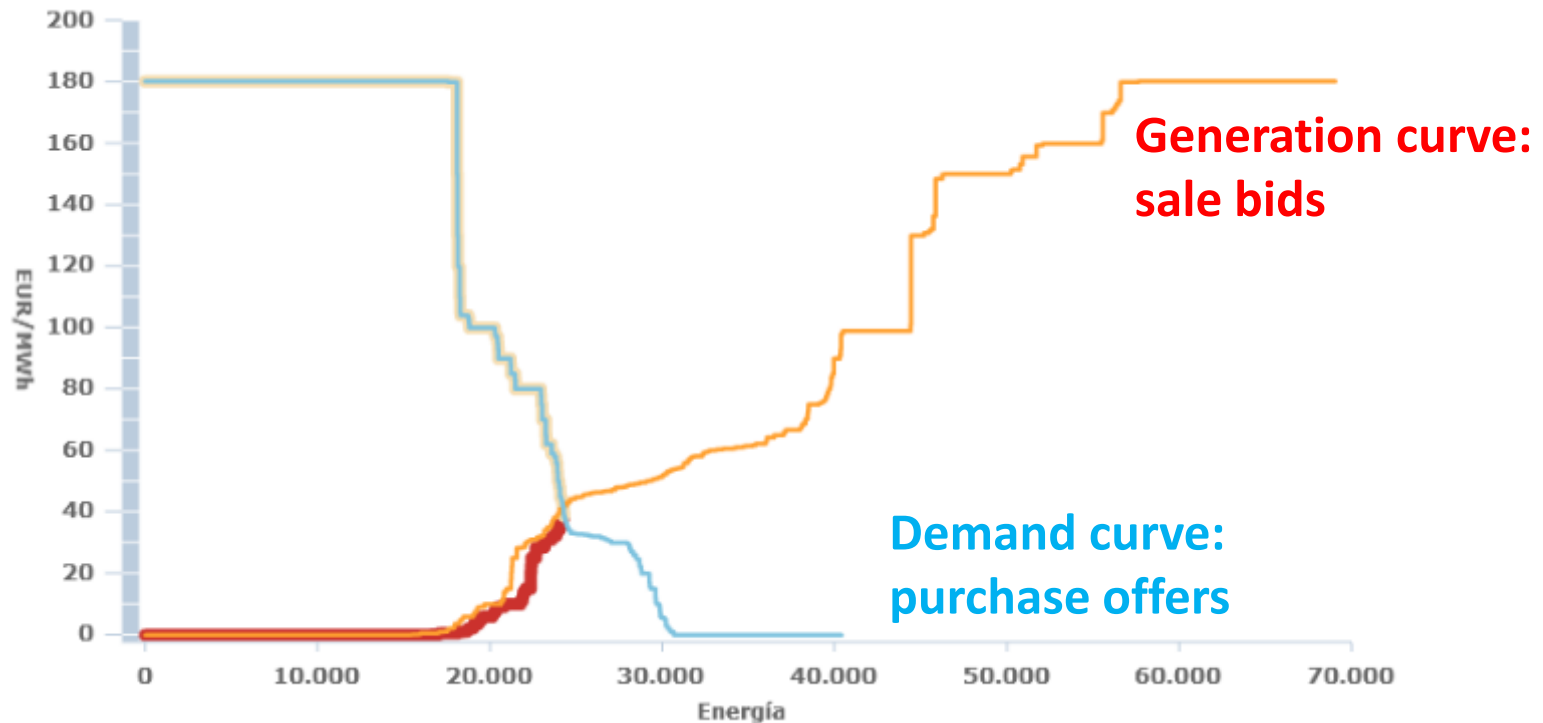
Increasing nominal WACC from 2% to 10% doubles LCOE

Source: Eero Vartiainen et. al

In order to achieve the energy transition, generation remuneration should ease the financing of renewable plants

# Spot is not investment friendly

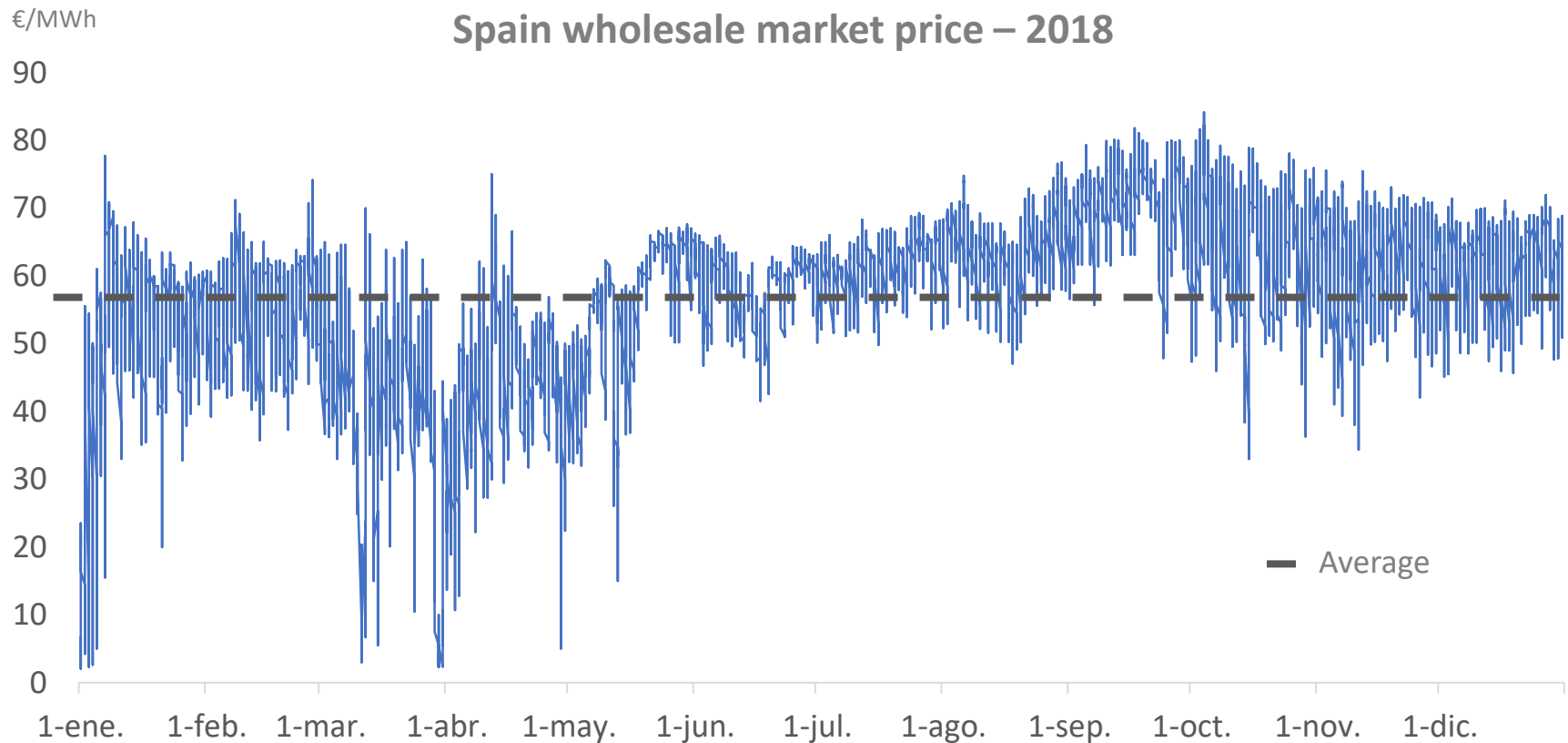
Spain wholesale market price – One hour the 4th September 2019



Source: OMIE

Price in spot markets is set through a pay-as-clear auction of generation and demand for every hour of the year, that results in 8,760 prices

# Spot is not investment friendly

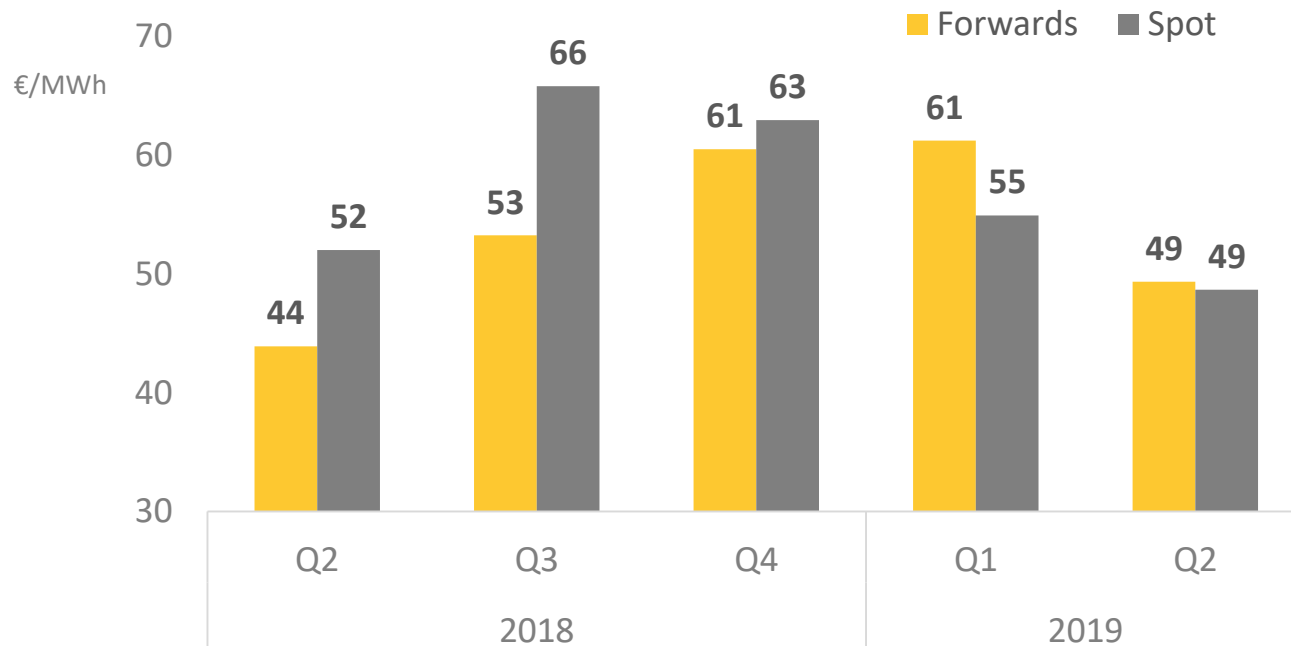


Source: Esios

**Price in spot markets is set as a pay-as-clear auction of generation and demand for every hour of the year, that results in 8,760 prices**

# What about forwards?

## Spain forwards prices for quarters in 2018 and 19

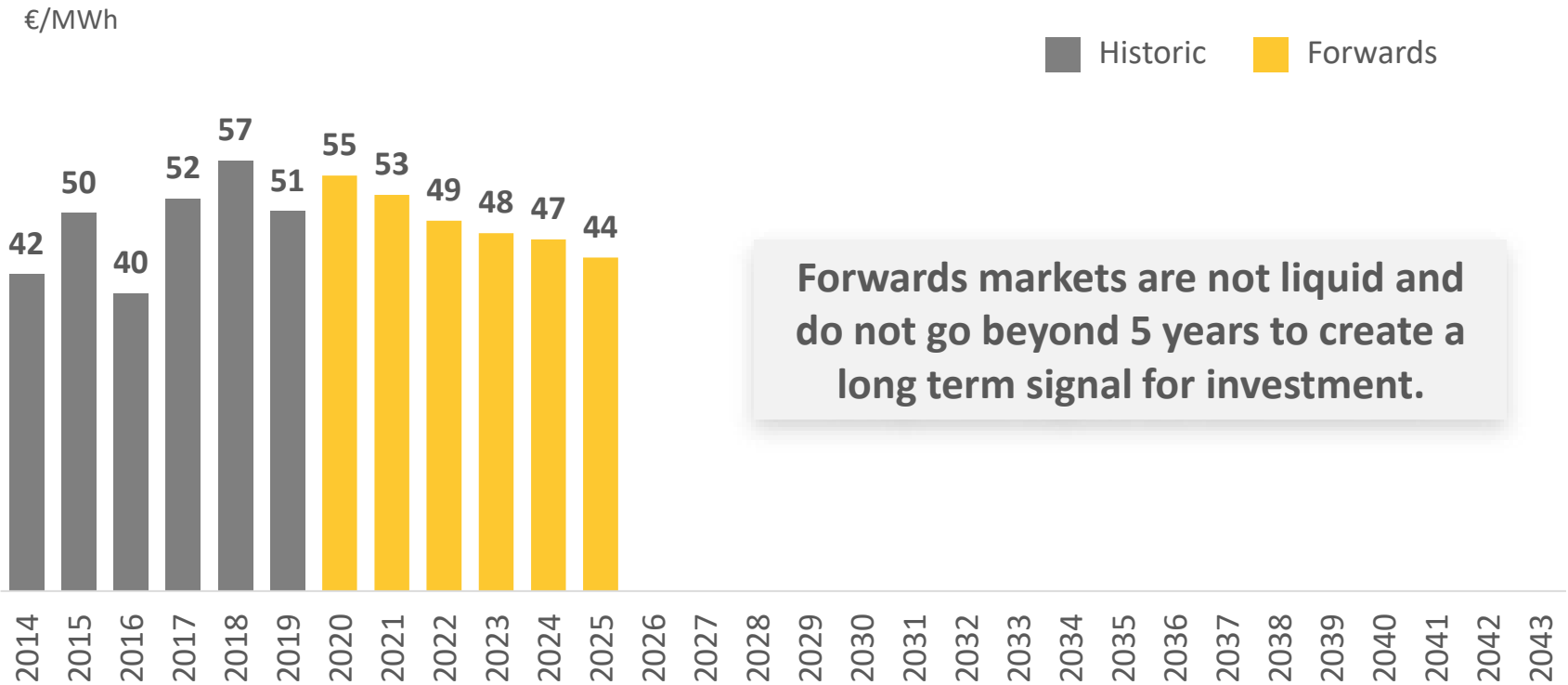


Source: OMIP and OMIE

**Forwards struggle to be a proxy for the spot market even in short-term products and close quotations**

# And in the long run?

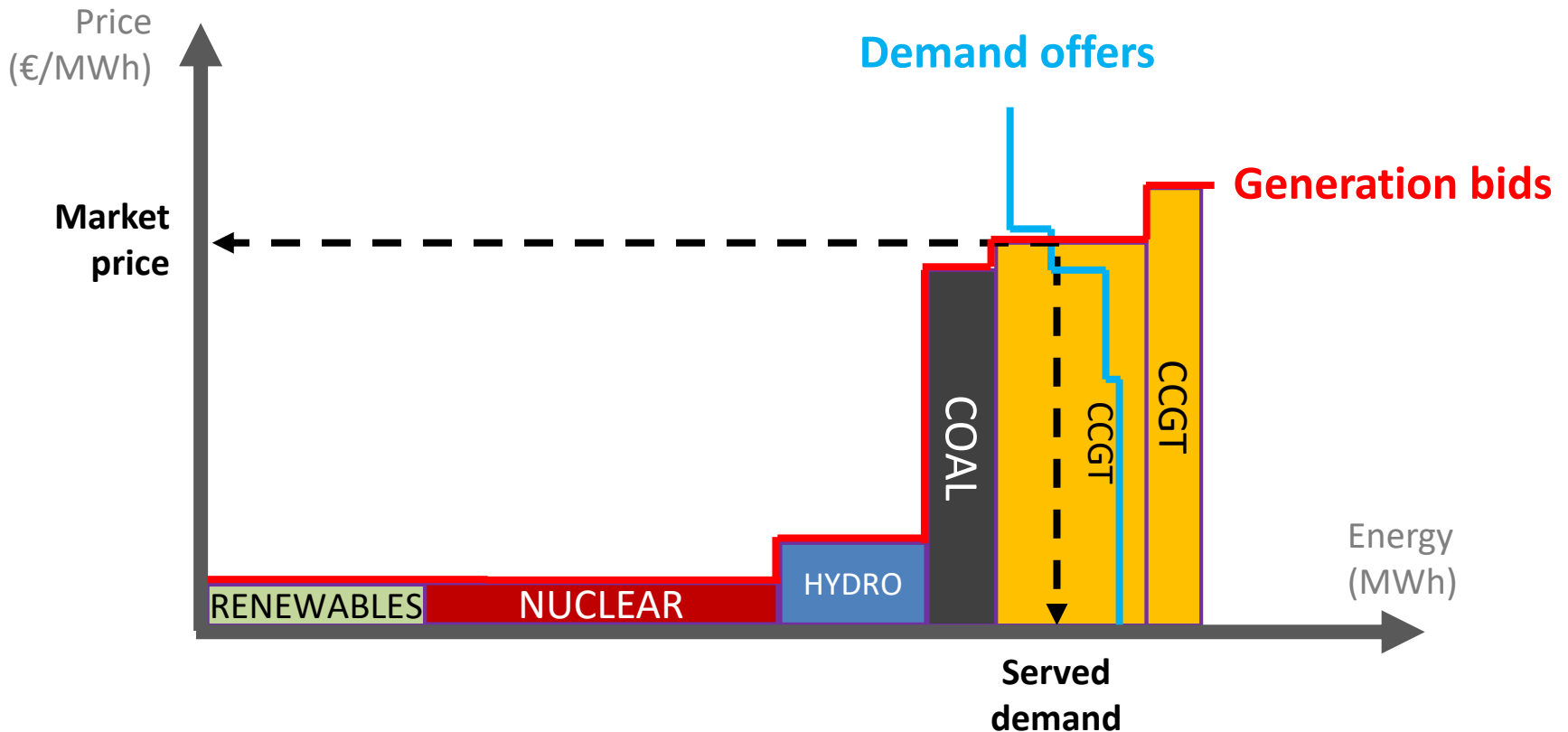
## Spain wholesale market yearly average price 2014-2019



Source: OMIE and OMIP

Electricity sector has a missing market problem

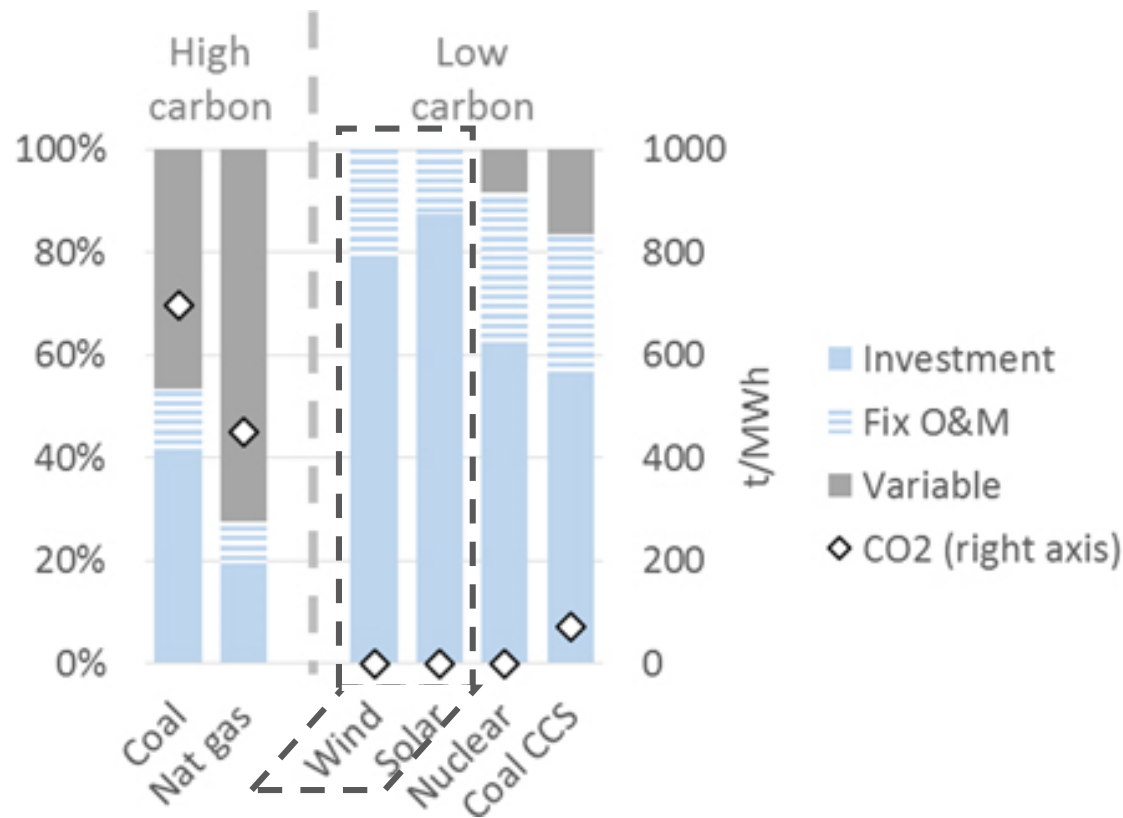
# Marginal market is **not for RES**



Marginal markets were designed to dispatch thermal technologies (mostly OPEX) and are not suited to remunerate RES (mostly CAPEX)



# Marginal market is **not for RES**



Source: Lion Hirth and Jan Christoph Steckel

**Marginal markets were designed to dispatch thermal technologies (mostly OPEX) and are not suited to remunerate RES (mostly CAPEX)**

# Marginal market = windfall profits



Is the resulting price of the wholesale market an efficient price?

Technologies with high variable costs participate less in the market and require capacity payments to cover their fixed costs

**Underretributions**



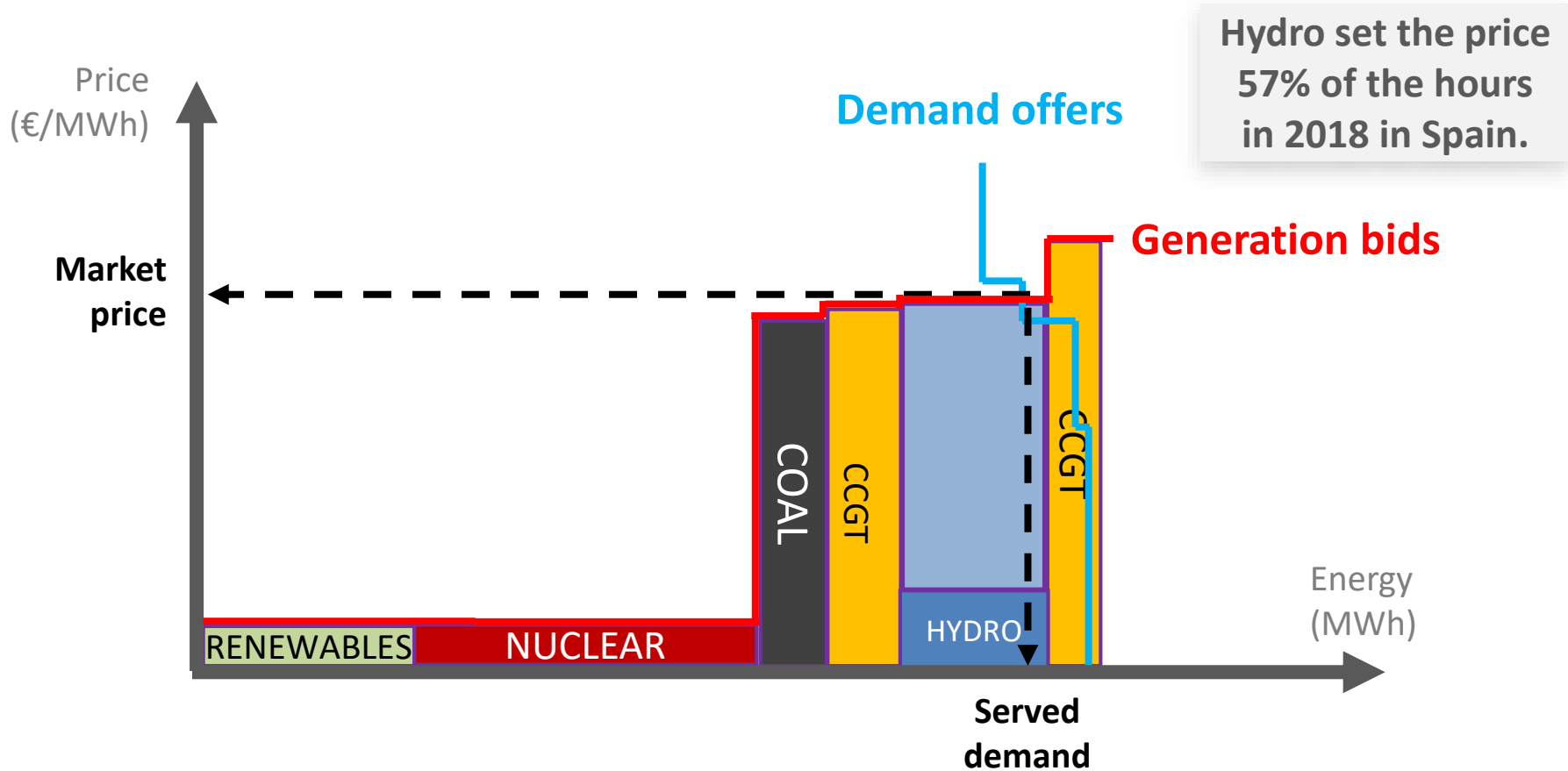
**Overretributions**



Inframarginal technologies are overcompensated by the market. Worse if hydro can bid at its opportunity cost (thermal techn.)

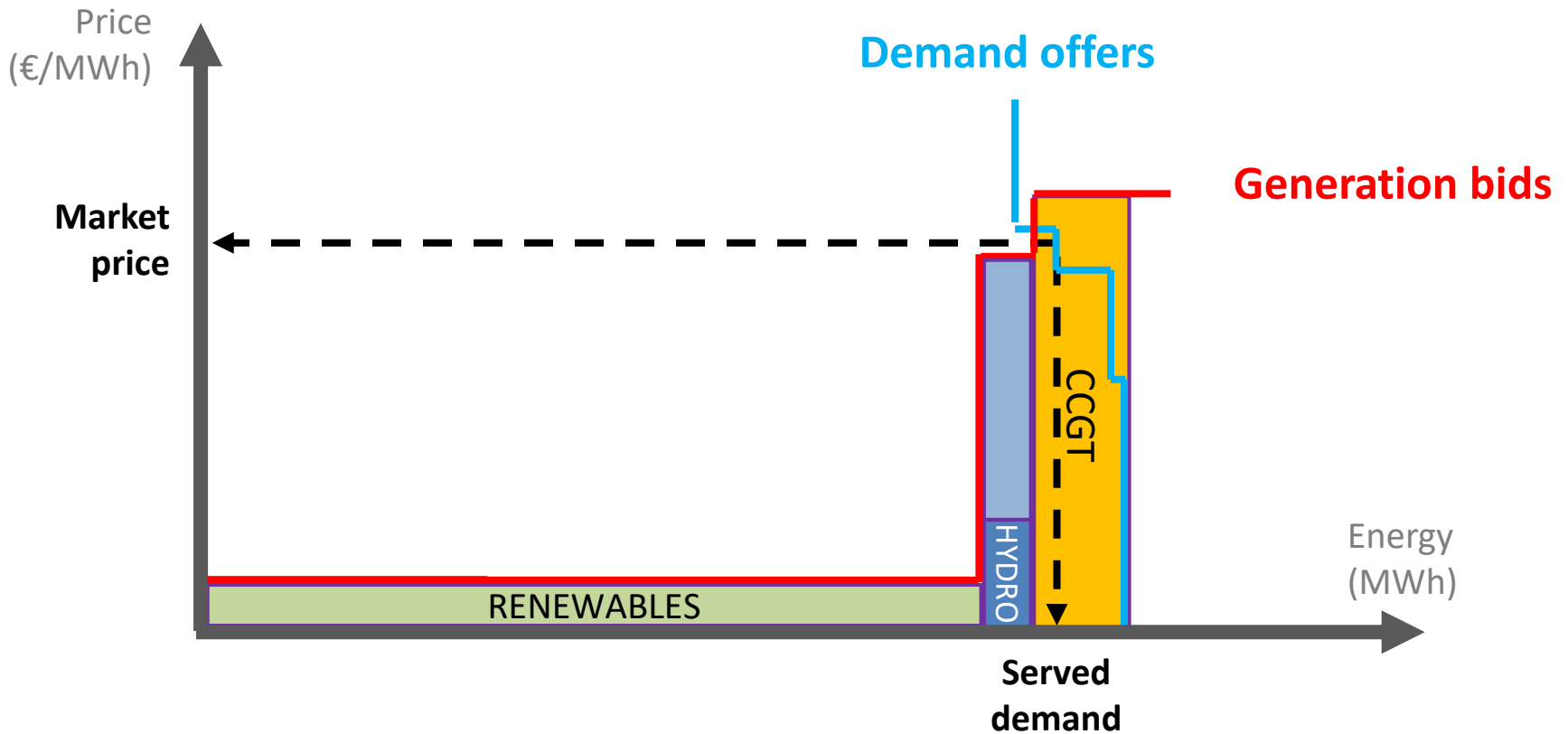
With this system, profitability depends on the position of each technology with regard to the marginal costs of the technologies that set the price

# Marginal market = windfall profits



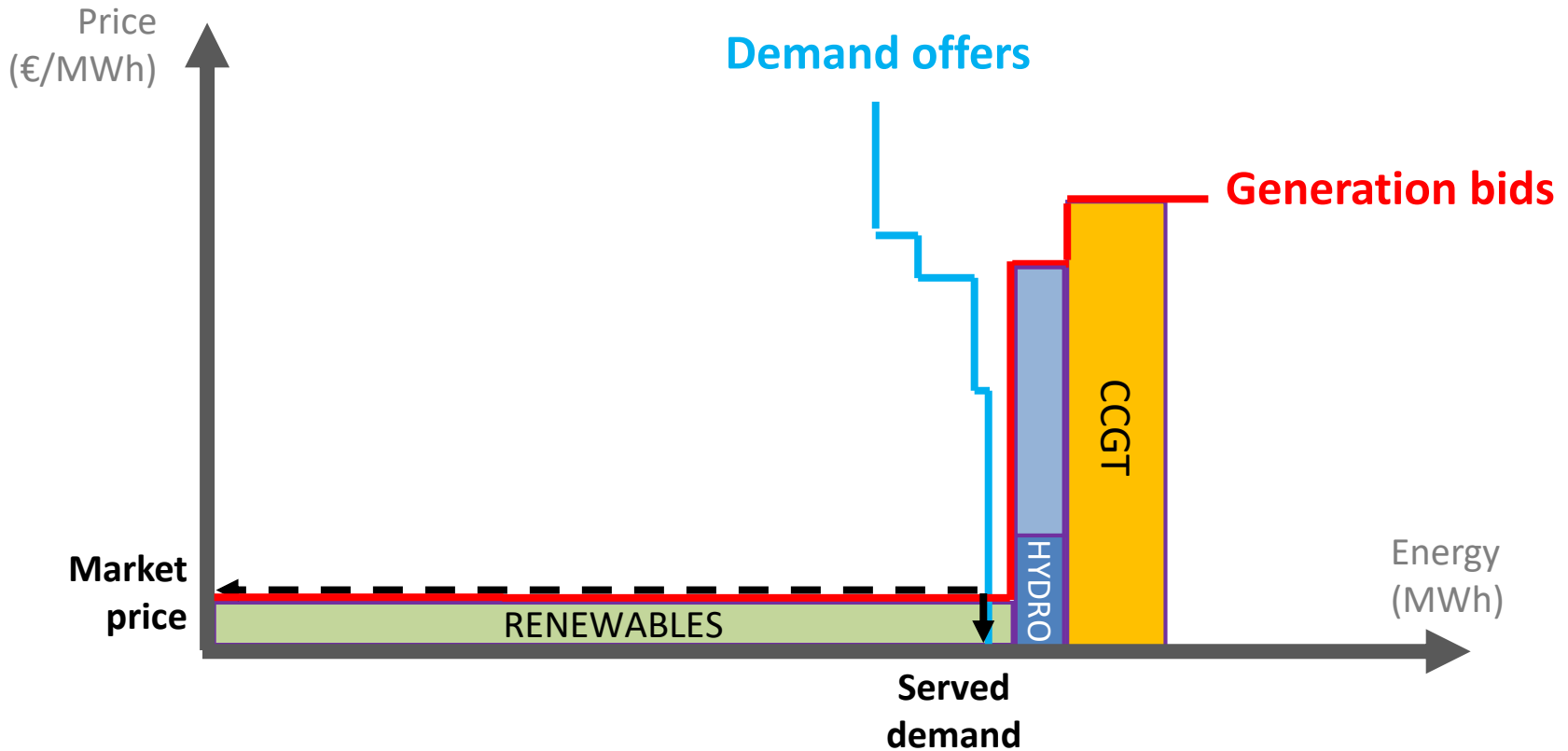
With this system, profitability depends on the position of each technology with regard to the marginal costs of the technologies that set the price

# What will happen with more RES?



Can a market system in which the price is assigned in terms of variable costs be an efficient allocator for technologies that do not have them?

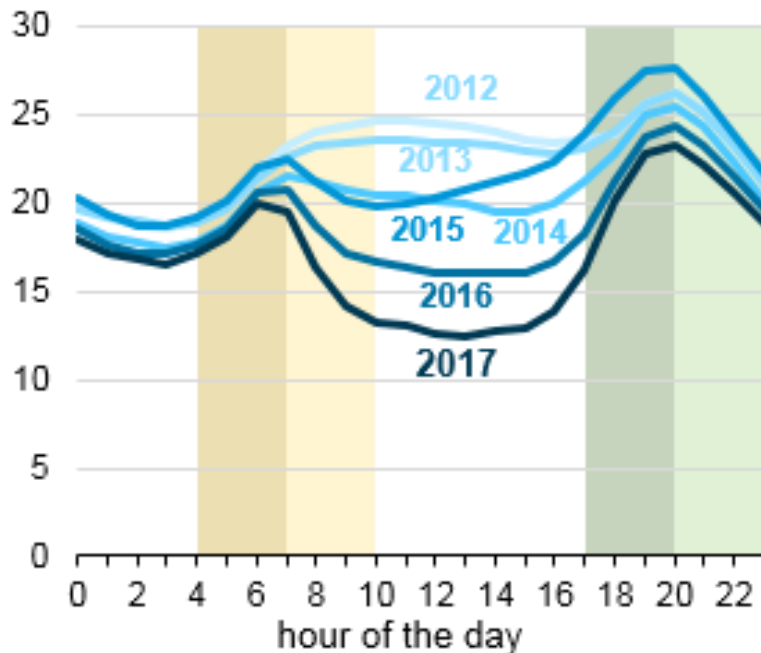
# What will happen with more RES?



Can a market system in which the price is assigned in terms of variable costs be an efficient allocator for technologies that do not have them?

# Zero marginal cost system

**Duck curve -> Cannibalisation**



Source: US EIA

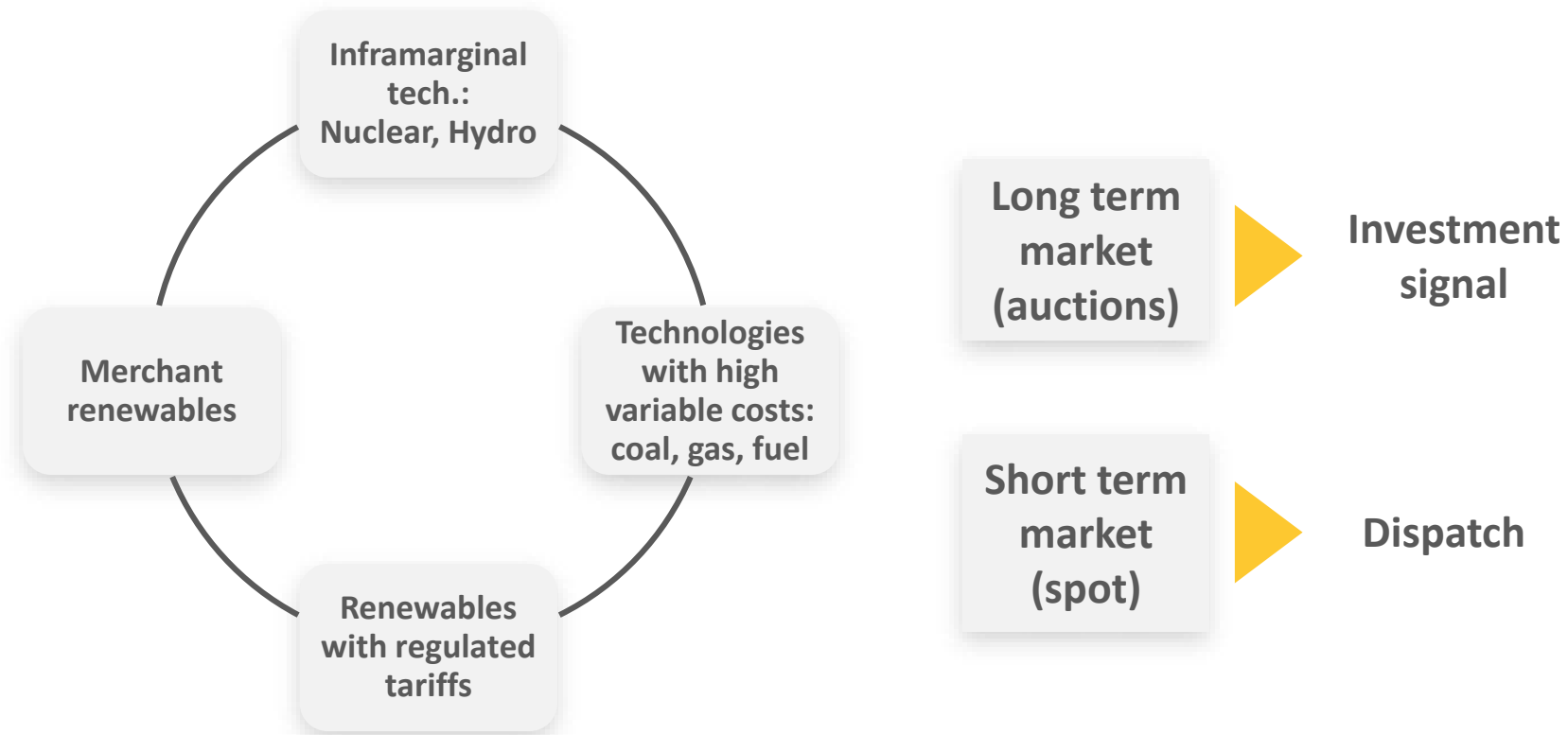
In the near future, many hours will be 100% renewable.

That is a power system with zero marginal cost.

What is the sense of having a marginal market?

**With renewables as the basis of the power system, marginal market is not adequate to remunerate generation nor perform the dispatch**

# We need to **rethink the market**



**A possible idea is that the market splits to ensure that competition is held among similar agents**

**Another option is to create a long-term market through auctions and leave the spot market to cover unbalances**



**Any questions?**