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INSIGHT

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ENERGY PACT BELGIUM: COST ANALYSIS OF THE ENVISAGED AMBITIONS

A STUDY ON THE PUBLIC COST THAT THE PROPOSED MEASURES IN THE ENERGY PACT WILL IMPLY

Energiepact
Pacte Energétique

Introduction

The energy pact is an interregional collaboration of the four Belgian ministers of energy that sets long term energy policy goals for 2030 and 2050 and proposes concrete measures to transit towards a more sustainable energy supply. The ambition of the pact is to set guidelines to guarantee safe, secure and sustainable energy supply at an affordable price. The pact was negotiated and concluded by the four Belgian ministers of energy but is not yet enforced by all four regional and Federal Governments as it has failed to reach a large consensus regarding the nuclear phase out.

Sia Partners wants to add to the political debate by providing a reliable cost estimation based on statistical optimization models and analytics technologies. No matter which energy policy is decided on political level, the decision should be based on facts. Hence, Sia Partners analyzed the proposed measures in the Energy Pact and identified all quantifiable propositions and targets in terms of cost for society. The following analysis of the Energy Pact is based on the version of the pact relayed by the press in December 2017.

Proposed measures in the Energy pact and aimed timeframe

The ultimate aim of the Belgian Energy Pact is to reach a low-carbon society by 2050. The pact aspires to achieve an optimum in terms of economic, environmental and societal efficiency while controlling the cost for the final user. In the energy pact, Sia Partners identified three main fields for which goals are set; energy production and consumption, energy efficiency and mobility.

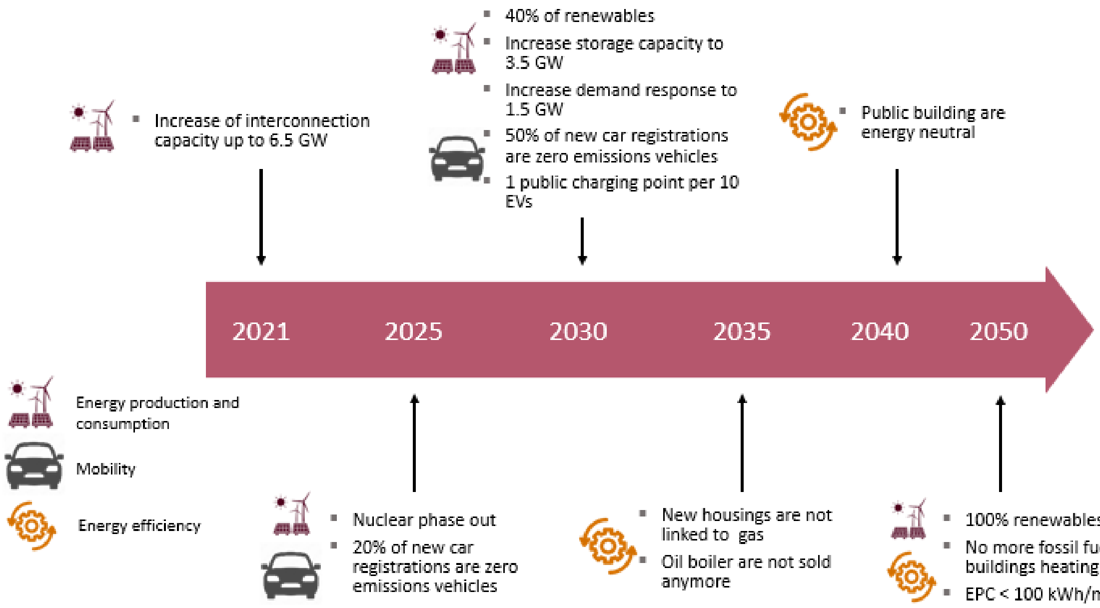

FIGURE 1: OVERVIEW OF THE MEASURES OF THE ENERGY PACT AND THEIR RESPECTIVE IMPLEMENTATION DATE

Cost analysis of the objectives of the Energy Pact

Among the different objectives and measures described in the energy pact, many are vaguely described and not sufficiently defined to estimate their costs. Hence, only the concrete, quantifiable objectives and measures are included in the cost analysis. The scope of the cost estimation is set at the measures and goals until 2030 as there are too many variables and parameters that cannot be anticipated beyond that timeframe.

Sia Partners focused on three major measures:

- The cost of the proposed electricity mix according to the nuclear phase out and the renewable production capacity objectives
- The cost of improving the energy efficiency in the residential heating sector
- The cost of providing one public charging point (EVSE) for every 10 EVs in Belgium

Energy production and consumption – Nuclear phase out and 40% of electricity generation from renewable energy sources

Methodology

Sia Partners developed a cost-optimal optimization model to estimate the optimal Electricity Mix that minimizes the investment and operational costs while meeting the Energy Pact objectives[1]. The renewable production capacity objectives of 8 GW for solar PV, 4.2 GW for on-shore wind and 4 GW for off-shore wind as defined in the Pact are used as lower bounds in the model. A minimum production of 40% renewable energy is included as a constraint. Data on biomass capacity investment & operational costs are also added to the model as production means to support that minimum production target, in the most cost-efficient way.

To determine the cost of the proposed electricity mix, three contributions are considered:

- The cost of a Capacity Remuneration Mechanism (CRM) based on the capacity payments schemes that remunerate the generators for the flexible capacity they provide. The consumer pays the price in exchange for security of supply.
- The cost of support for intermittent renewable technologies. The required support is the amount required to guarantee a profitability of 7%.
- The impact on the commodity price determined as the difference between the mean electricity price in 2017 and the price computed by the model.

The following assumptions were considered:

- Demand in 2030 is similar to the one in 2010, i.e. about 90 TWh, which is in line with the base case scenario of Elia, the Belgian TSO.
- The increase in industrial storage capacity comes from an increased pumped storage capacity. The maximum amount of electricity that can be stored is 8.2GWh. This increase in pumped electricity storage is in line with expectations of Elia.
- The electricity price is assumed to be equal to the marginal cost of the last running unit in the merit order (the most expensive). A conservative maximal import capacity, estimated at 4000 MW for 2030, is considered as upper boundary condition. 4000 MW represents Elia's current investment effort to bring the current interconnection capacity to 6500 MW around 2020, with an availability handled as a probabilistic variable with an expected value of 66%.

Optimal capacity in 2030

Based on the key objectives and assumptions, the following optimal electricity mix is obtained. The latter represents a total investment cost of 18.6 billion € up to 2030. Moreover, an operating cost of 2.7 billion € a year is required. The proposed electricity mix relies on import and CCGT as a baseload. The important intermittent renewable capacity induces large peaks in the production. Therefore, high flexibility is required from the baseload.

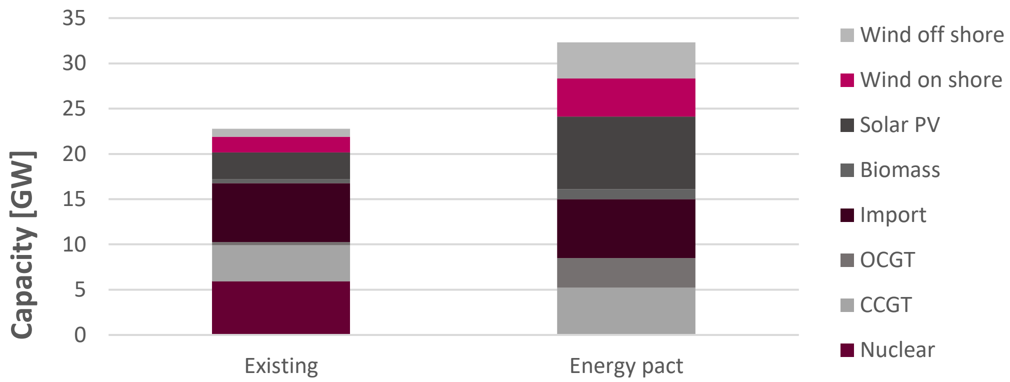

FIGURE 2: CURRENT CAPACITIES NOW AND IN 2030 FOLLOWING THE OPTIMAL ELECTRICITY MIX

The 5 GW of gas capacity that are foreseen in the Energy pact won't be sufficient to meet the demand. The model computes that at least 8.5 GW of flexible gas generation capacity will be needed. Alternatively, flexible peak capacity could be obtained by replacing the gas capacity by biomass (flexible), however this would result in an even higher CAPEX and OPEX as biomass production relies largely on support from the government. The current study considers 1100 MW of Biomass as a constraint based on the Energy Pact.

Impact on the electricity bill

To determine the cost of the electricity mix, three contributions have to be taken into account:

- The CRM
- The support to renewable
- The impact of the electricity mix on the commodity price.

The remuneration per MW of the **CRM** is calculated in such a way that flexible power plants are no longer facing deficits. A total amount of 430 million €/year are necessary from which 162 million € are required for supporting gas power plants.

The CRM cost for supporting only gas fired power plants induces an increase of the electricity bill of **+1.78 €/MWh**.

As constrained by the Energy Pact, 268 million € would be needed for supporting biomass power plants. Notably, in a reference scenario, without constraints formulated in the Energy Pact, only one third of biomass capacity, 420 MW, would be needed in 2030.

The total CRM cost induces an increase of the electricity bill of **+4.74 €/MWh**.

The **support to intermittent renewable technologies** is designed in a way that a profitability of 7% is guaranteed, in order to ensure adequate investments. Considering this, the total amount to be supported is 1.12 billion €/year. This amount is mainly due to the support required by the large solar PV capacity (500 million €) and by the off-shore wind turbines (440 million €). It is considered that, in the end, the supported amount will be borne by the final customer. This represents an increase of **+12.42 €/MWh**.

To determine the impact of the electricity mix on the **commodity price**, the average commodity price obtained with the model, a bit less than 40 €/MWh, is compared to the average electricity price of 2017, 42.29 €/MWh.

The lower commodity price is due to the large production of renewables that tends to decrease the electricity price. It is considered that the electricity supplier will not have an additional margin and that distribution and transport prices and taxes remains as they are today. For this scenario, the impact on the commodity price induces a decrease of **-2.56 €/MWh.**

Overall, the electricity mix obtained with the **Energy Pact objectives** results in an increase of the electricity bill of **+14.6 €/MWh**.

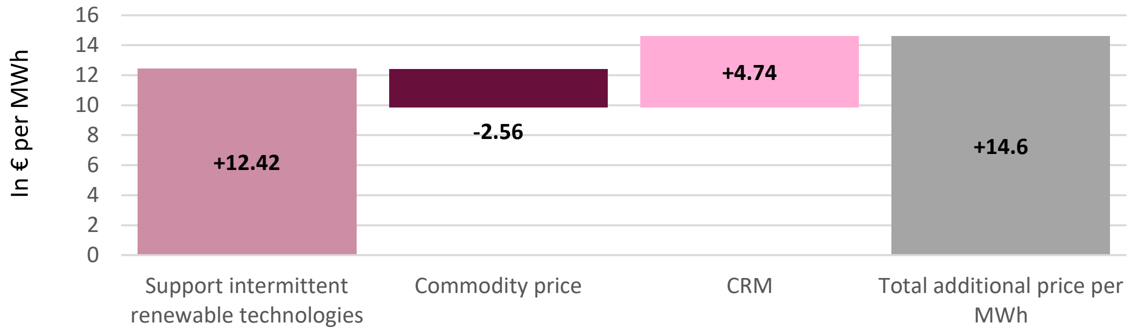

FIGURE 3: IMPACT ON THE ELECTRICITY BILL OF THE THREE CONTRIBUTIONS

Energy Efficiency

Methodology

Sia Partners focusses on estimating the cost of reaching the 2030 targets that are set by the European Energy Efficiency Directive on 30 November 2016. Specifically, this directive sets a new 30% energy efficiency target by 2030 compared to the 2007 levels.

In the analysis, 7 major residential heating energy efficient measures are identified, along with their current respective premium for each region. For each measure a maximum penetration rate was determined according to the current penetration and the specific features of that measure for each respective region. Based on the maximum penetration rate and the current state of the housing market, the market potential was calculated, i.e. the total amount of houses where energy efficient measures can be carried out. The total public costs, energy and CO2 savings were calculated based on the respective market potential and current premiums for each measure.

Results

By implementing all potential measures identified, a total amount **of 27.5 TWh (primary energy) could be saved every year**, resulting in **a CO2 reduction of 7.5 million ton/year**. These savings come at a **cost of 3.5 billion €,** spread out over 13 years (270€ million/year). This is an increase of 60% a year compared to the subsidies that were granted to households in 2015 (168€ million).

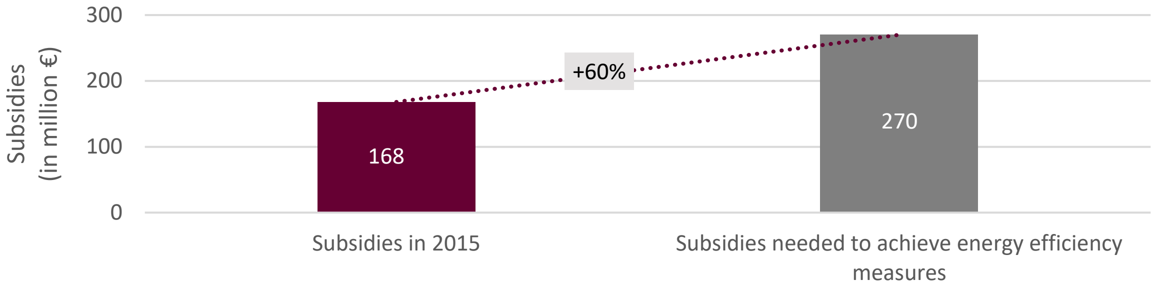

FIGURE 4: AMOUNT OF PUBLIC SUBSIDIES FOR RESIDENTIAL ENERGY EFFICIENCY IMPROVEMENTS

The estimated cost is based on the current technologies and subsidies. Maturing technology and increasing energy prices may trigger a process of decreasing subsidies as the incentives to carry out energy efficient measures increase. Therefore, the public costs won't be as high as estimated and the estimated public cost can be considered as an upper-bound.

Electric vehicles (EV)

Methodology

Two different models were used to estimate the size of the EV fleet by 2030. The first prediction was based an exponential model. A second prediction model of the EV fleet takes into account that 20% of new registered cars have to be zero emission vehicles by 2025, gradually increasing up to 50% by 2030.

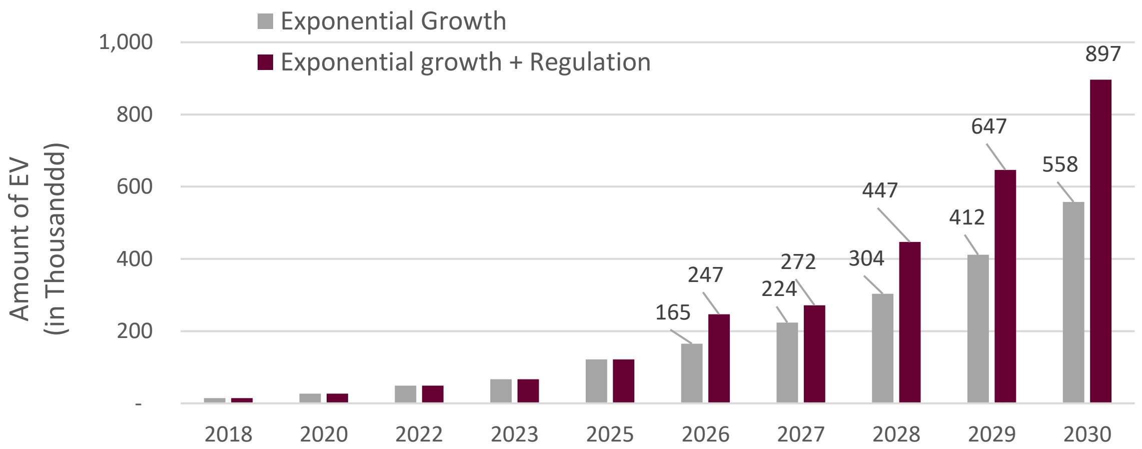

FIGURE 5: PREDICTION OF THE SIZE OF THE ELECTRIC VEHICLE FLEET (IN THOUSANDS) IN BELGIUM

Additionally, the cost of the EVSE roll-out depends highly on the types of chargers installed. Hence, two different assumptions were assessed respectively with a charger mix implemented in Norway (15% slow charger, 85% fast charger) and a mix with slightly lower degree of fast chargers (10% slow chargers, 90% fast chargers). These assumptions were combined with the estimated size of the EV fleet to determine the total cost of each respective combination, resulting in 4 different scenarios.

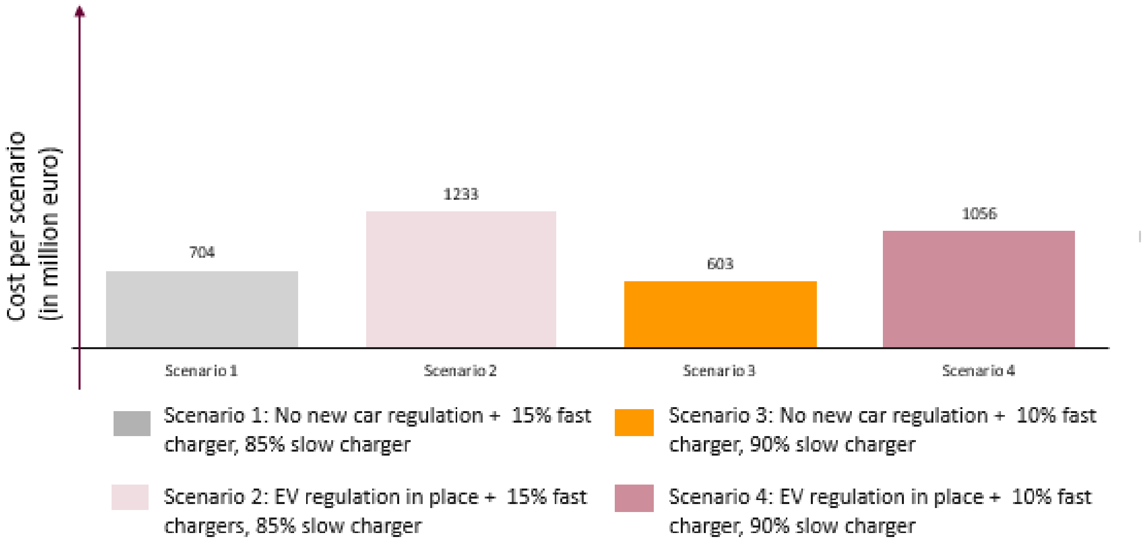

FIGURE 6: BUDGETARY COST OF THE DIFFERENT EVSE SCENARIOS

Depending on the scenario, the **EVSE roll-out of 1 EVSE per 10 EVs** will cost **between 603 million € and 1.23 billion €**. However, it's important to note that cooperation with private companies will decrease the need for public investment in charging points. In the Netherlands, half of the EVSE charging points are already semipublic, meaning that its costs are only partly (or not all) borne by the public institutions.

Conclusion

Sia Partners aims at contributing to the energy debate by providing a reliable cost analysis of the proposed measures. Realized analyses show significant investments will be needed to make the Energy Pact happen. While reaching a consensus about the level of needed investment is important, ensuring investors take action to build the necessary generation units is crucial. The government plays the decisive role in making the trade-off between the additional costs that are linked to more sustainable technologies and the existing energy market model. Whichever decision is taken, the government needs to provide a clear and sustainable regulatory framework for both industry as citizens. In the end, this is the only possible way to ensure security of supply.

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