Hydrogen Potential of JSW

Daniel Ozon

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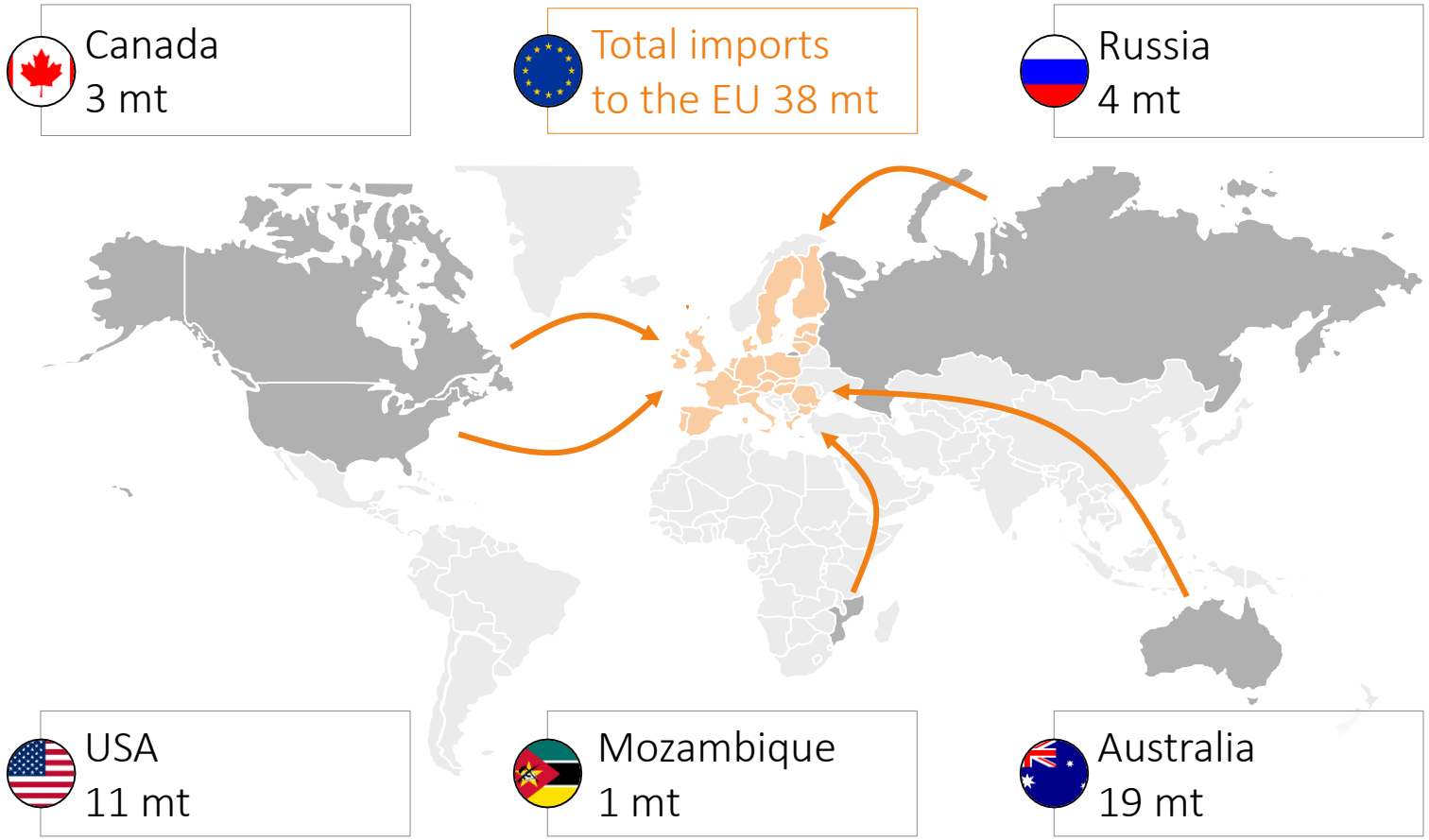
EU demand for coking coal

- JSW is the largest producer of high quality coking coal and a major merchant coke producer in the European Union
- The level of coking coal imports into the EU points to the significant potential for growing the JSW Group's coking coal sales
- The JSW Group consists of 4 mines (including 7 sections) and 4 coking plants
- The resource base supports a long life of mine

Coking coal imports to the EU in 2017



Coking coal on the list of critical raw materials

List of the EU's Critical Raw Materials – coking coal is one of the 27 raw materials entered on the list of critical raw materials

Specific abbreviations for the materials covered

Agr	Aggregates	Mn	Manganese
Al	Aluminium	Mo	Molybdenum
Sb	Antimony	NC	Natural cork
Brt	Baryte	Gr	Natural graphite
Bx	Bauxite	Nr	Natural Rubber
Bn	Bentonite	Nt	Natural Teak wood
Be	Beryllium	Nd	Neodymium
Bi	Bismuth	Ni	Nickel
Bo	Borate	Nb	Niobium
Ce	Cerium	Pd	Palladium
Cr	Chromium	Pe	Perlite
Co	Cobalt	P	Phosphorus
Cc	Coking coal	Phs	Phosphate rock
Cu	Copper	Pl	Platinum
Di	Diatomite	Po	Potash
Dy	Dysprosium	Pr	Praseodymium
Er	Erbium	Re	Rhenium
Eu	Europium	Rh	Rhodium

Our strategy to become Green

Environmental Initiatives

JSW cares for the natural environment and strives to be environmentally transparent, therefore JSW is currently implementing the CARBON FOOTPRINT Program

Energy efficiency

JSW is taking actions suggested by the enterprise energy audit in order to improve the energy efficiency of the consumed energy sources and energy offtakers.
Energy efficiency certificates, called "white certificates", are a market mechanism forcing companies to take measures to improve their energy efficiency. These certificates are awarded to companies that have successfully implemented energy-saving measures.

Circular economy

JSW is taking measures to improve the management of mine waste. We are currently working on reducing the amount of stone waste (post-mining waste) in our mining processes and using them as much as possible in underground mine operations and on the surface. The resulting stone is used for the production of aggregates.
We also make efforts to ensure the reuse of water by safely treating and disposing of saline groundwater in JSW mines.

Electric vehicles

JSW has started to replace the traditional gasoline-powered vehicles with modern, environment-friendly and economical electric vehicles. The project included construction of a free-use public charging station.

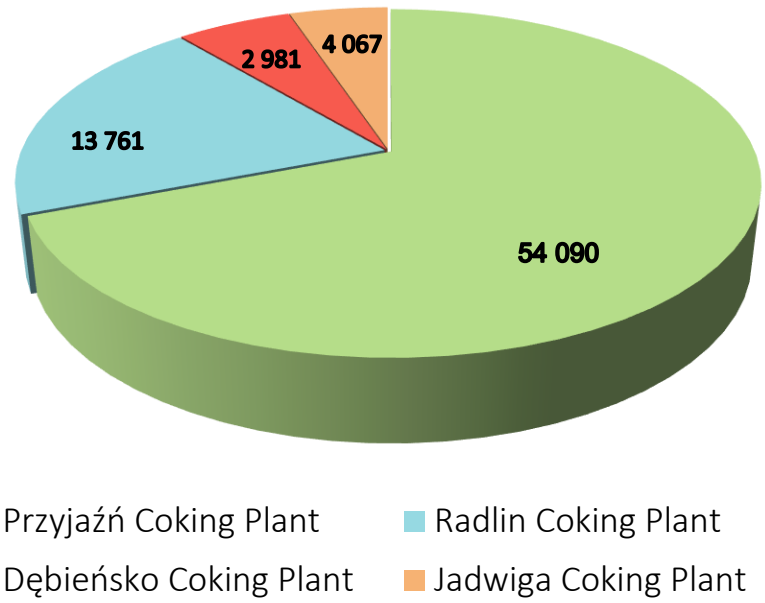
Hydrogen – fuel of the future

Coke-oven gas, a by-product of the coking process, contains about 55% of hydrogen. JSW Innowacje, a subsidiary serving as R&D base for the Group, is currently working on implementation of the hydrogen separation technology. Separation of hydrogen from coke-gas oven would be an important step towards clean air, while coking coal could be considered a clean energy source. Transition towards hydrogen fueled public transport would significantly improve air quality on the local level.

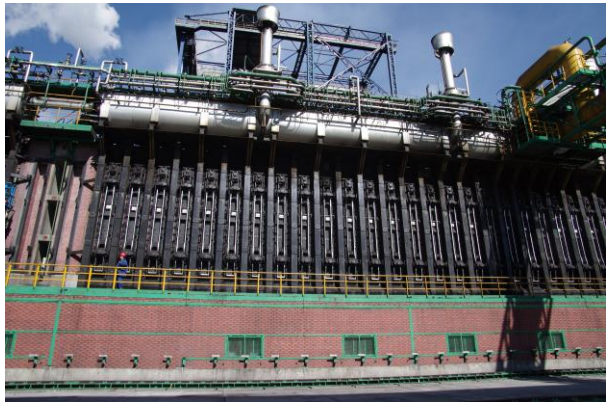
JSW S.A. and JSW Innowacje S.A. are planning to build the installation for hydrogen separation from coke-oven gas in one of JSW Group coking plants in tested PSA (Pressure Swing Adsorption) technology. Obtained HYDROGEN 5.0 with high level of purity (99,999%) will secure needs of Silesia for implementation and development of zero-emission urban transport based on fuel cell technology.

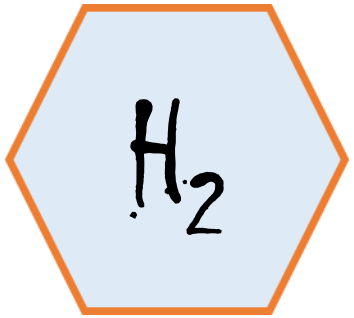
The total amount of hydrogen in all JSW coking plants is almost 75 000 Mg annually, while coking plant „Przyjaźń” alone can produce up to 8 000 Mg of clean hydrogen. The fuel obtained from coke-oven gas will secure the annual demand for fuel for about 700 buses.

Total amount of Hydrogen in JSW Coking Plants 74 899 [Mg/year]



Hydrogen separation from coke-oven gas



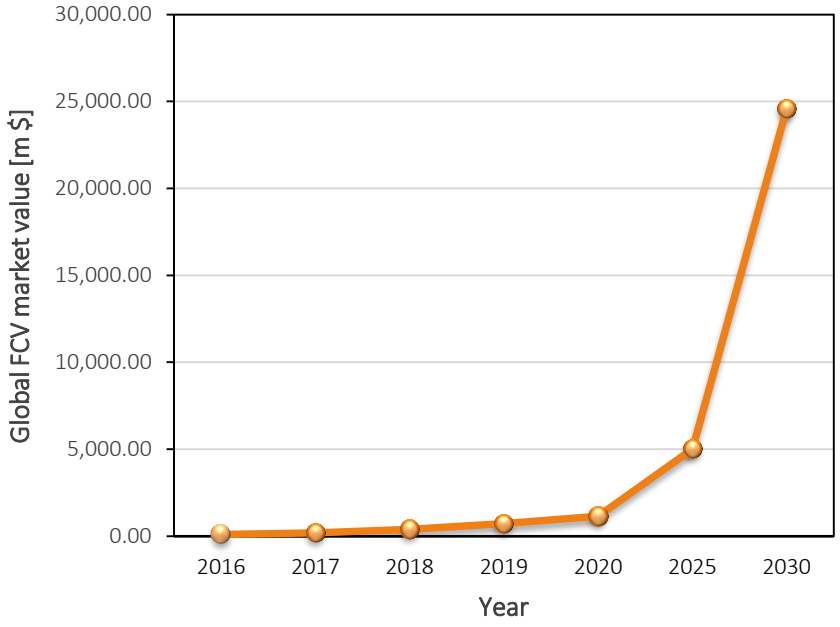


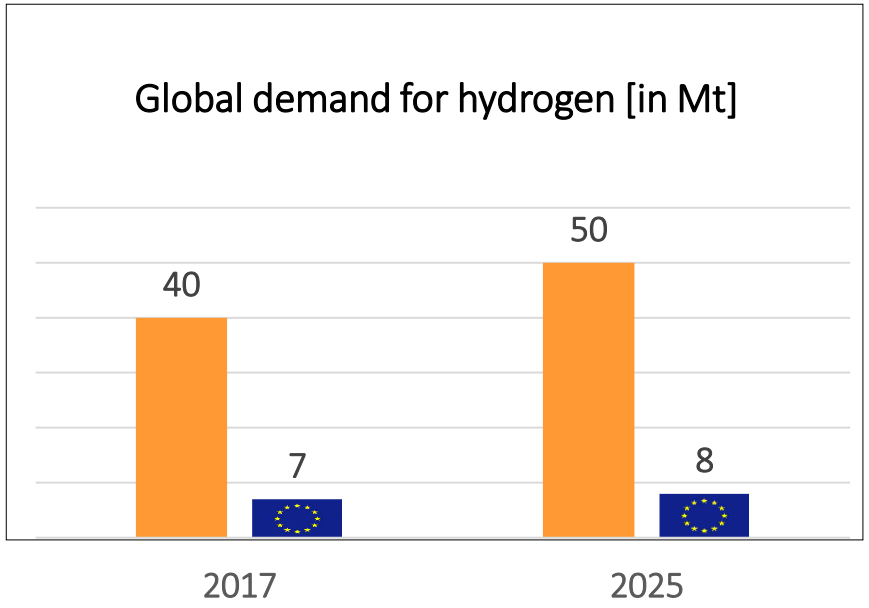
Produced energy value

1 kg H_2 = 4 l gasoline

Hydrogen for e-mobility

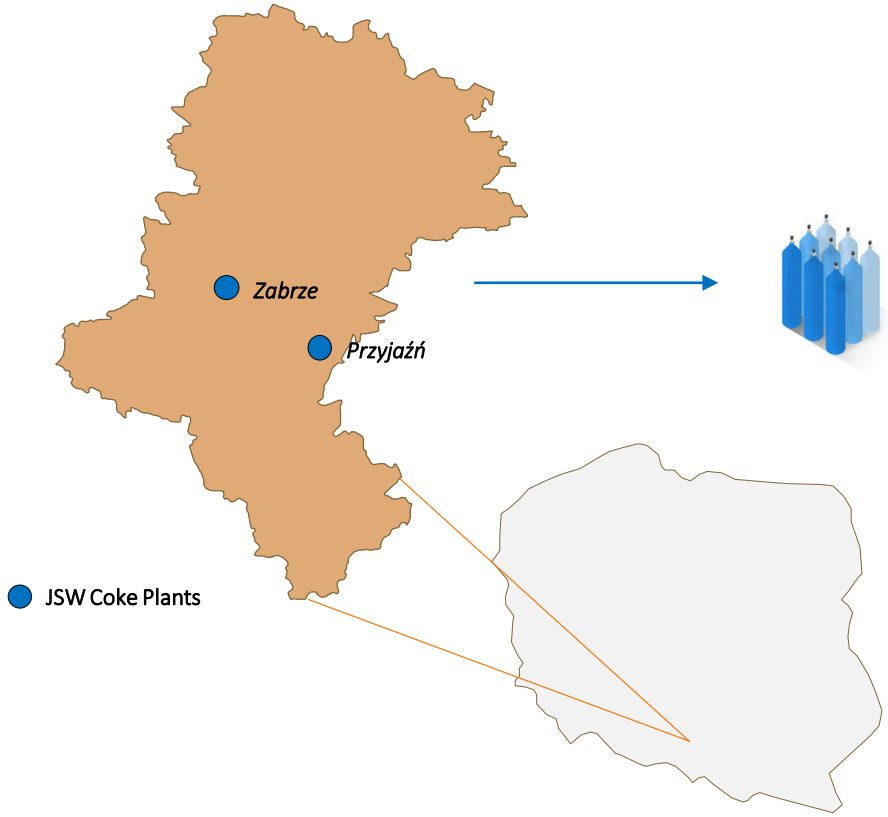
Taking into account efforts made so far to improve the air quality, as well as the efforts to reduce emissions from cars, the initiative of creating a clean urban transport is crutial to achieve the ambitous goals. Transition to a low-emission transport based on fuel cell will not only improve the air quality, but will also help reduce noise.
The demand for clean buses has gone up about 130% in one year and it will be growing steadily in the upcoming years.

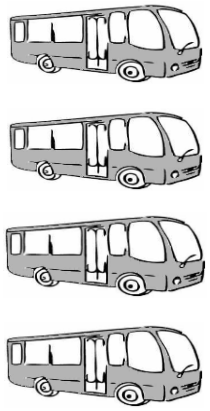




Hydrogen for Silesia

The Metropolis of Upper Silesia is one of the most densely populated areas in Poland with over 2,5M citizens. In the upcoming years, the Metropolis plans a modernisation of the existing bus fleet with 600 new zero-emission vehicles. Whereas JSW could become the main supplier of hydrogen and in this way could contribute to achieve the objectives of the environmental policy in Silesia.





300 km/day

8 kg H_2/100km

24 kg H_2/day

8760 kg/year

Thank you!

Jastrzębska Spółka Węglowa SA