

Bio Coal Market Perspectives in Europe



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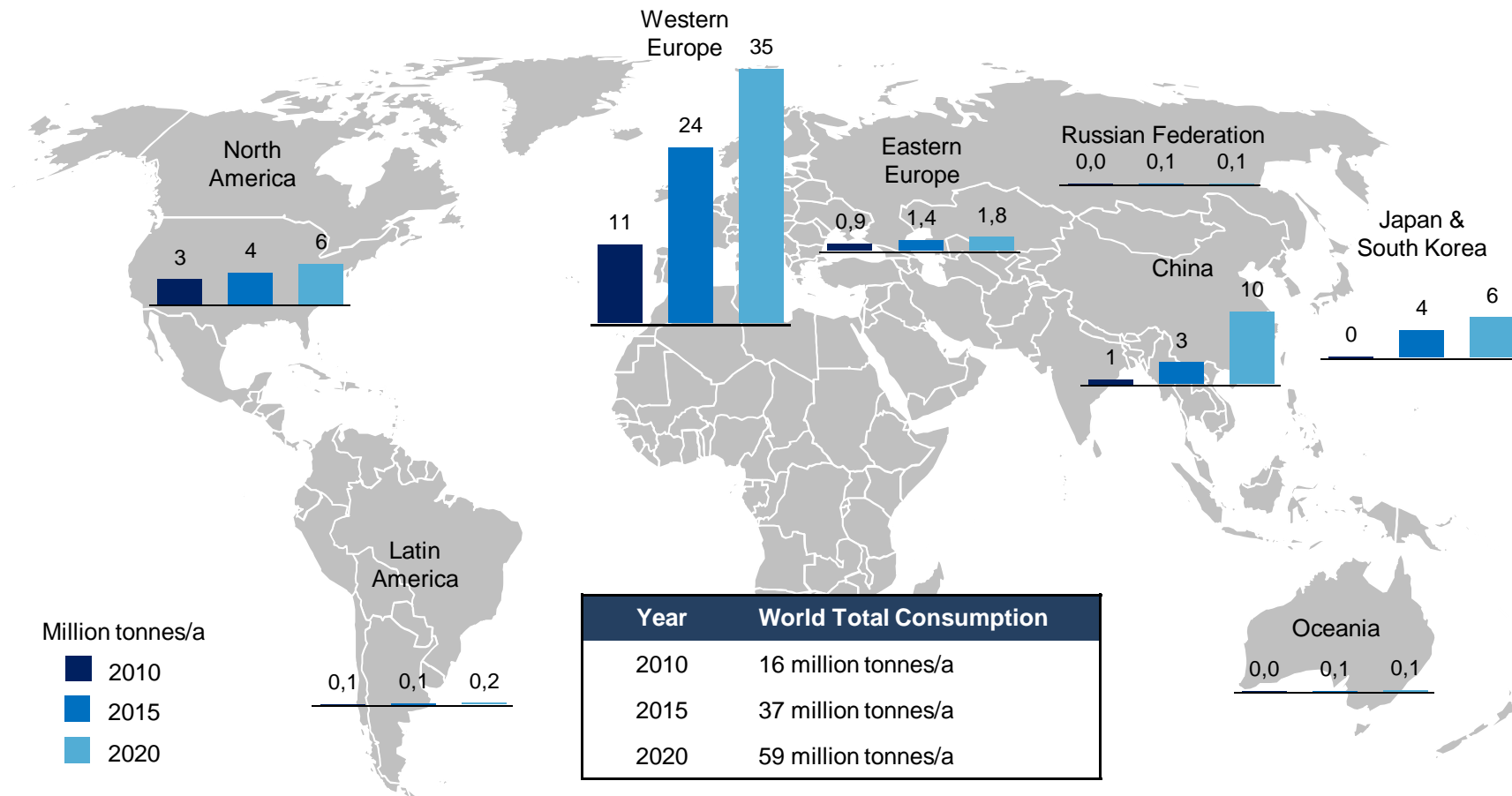
Albania | Argentina | Australia | Austria | Brazil | Bulgaria | Canada | Chile | Colombia | Czech Republic | Estonia | Finland | France | Germany | Hungary | India | Indonesia | Iran | Italy | Latvia | Lithuania | Malaysia | Mexico | New Zealand | Norway | Oman | Peru | Philippines | Poland | Republic of Korea | Romania | Russia | Saudi Arabia | Singapore | Slovakia | South Africa | Spain | Sweden | Switzerland | Thailand | Tunisia | United Arab Emirates | United Kingdom | United States of America | Venezuela | Vietnam | Zambia

CONTENT

- 1. Global pellet consumption**
- 2. Pellet consumption per market segment**
- 3. Wood Pellet Trade Flows**
- 4. Introduction to co-firing**
- 5. Bio coal co-firing potential in Europe**
- 6. European incentives for co-firing**
- 7. Bio coal supply constrains / demand growth**
- 8. Summary and Conclusions**

1. GLOBAL PELLET CONSUMPTION – 2015 AND 2020 OUTLOOK

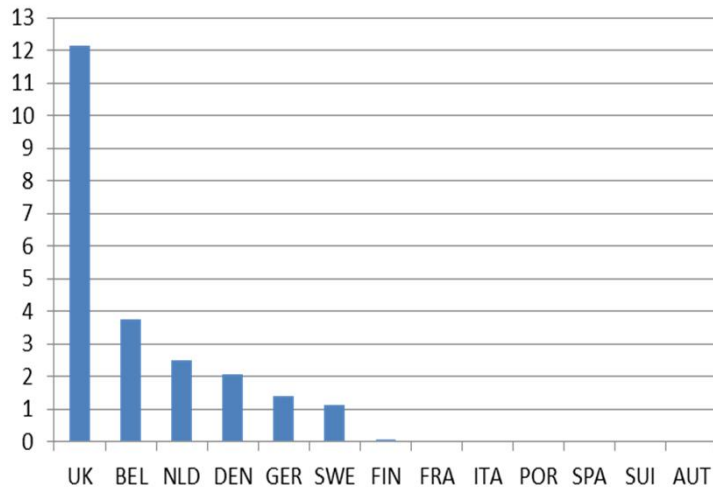
Western Europe will continue to be the largest pellet consumer in the next decade. North America will see growth mainly in the residential pellet sector. The Asian countries have seen emerging use of pellets recently and this will continue.



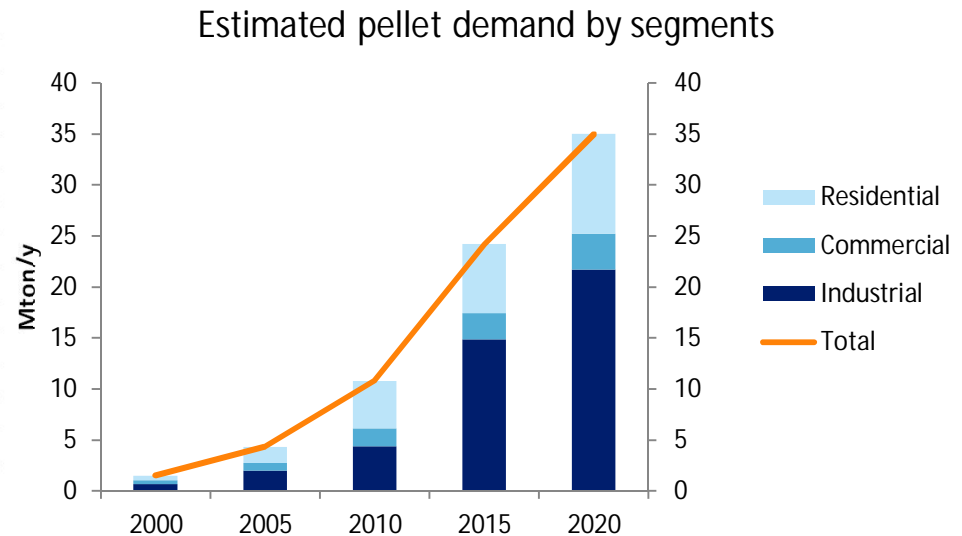
2. PELLET CONSUMPTION PER MARKET SEGMENT IN EUROPE

Premium pellets for residential and commercial use in heat generation have the largest share in the current demand for wood pellets. With limited further availability of bark free sawmill residues, future capacity increases have to focus more on roundwood, harvesting residues and dedicated energy crops as raw material.

Industrial pellet consumption estimate by countries in W-Europe in 2020, Mt/a (Source: Pöyry)



Wood pellet consumption by market segment in Europe, 2010 and predicted development until 2020

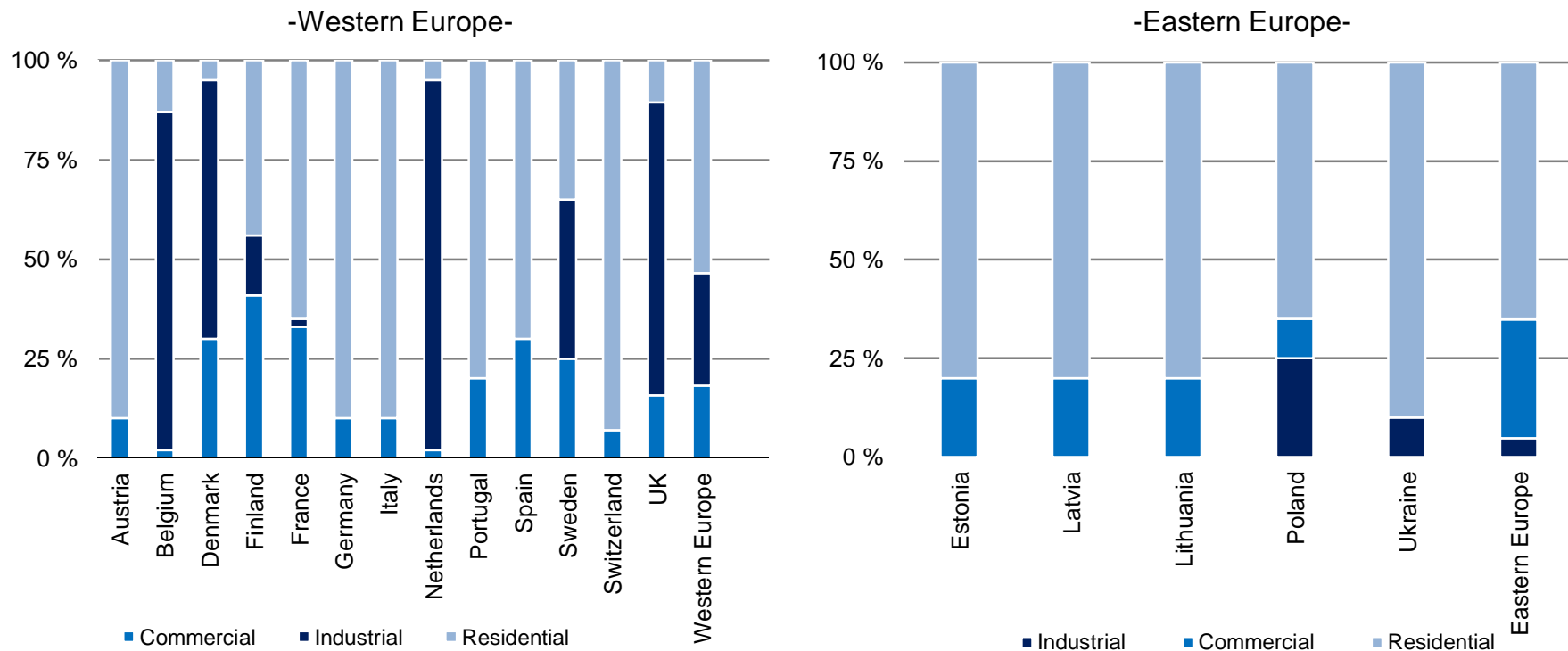


- Pellet consumption in Western Europe expected to triple in the next 10 years
- UK is expected to become the biggest industrial pellet consuming country in W-Europe in 2020
- The market outlook is sensitive to changes in policies

2. PELLET CONSUMPTION PER MARKET SEGMENT IN EUROPE

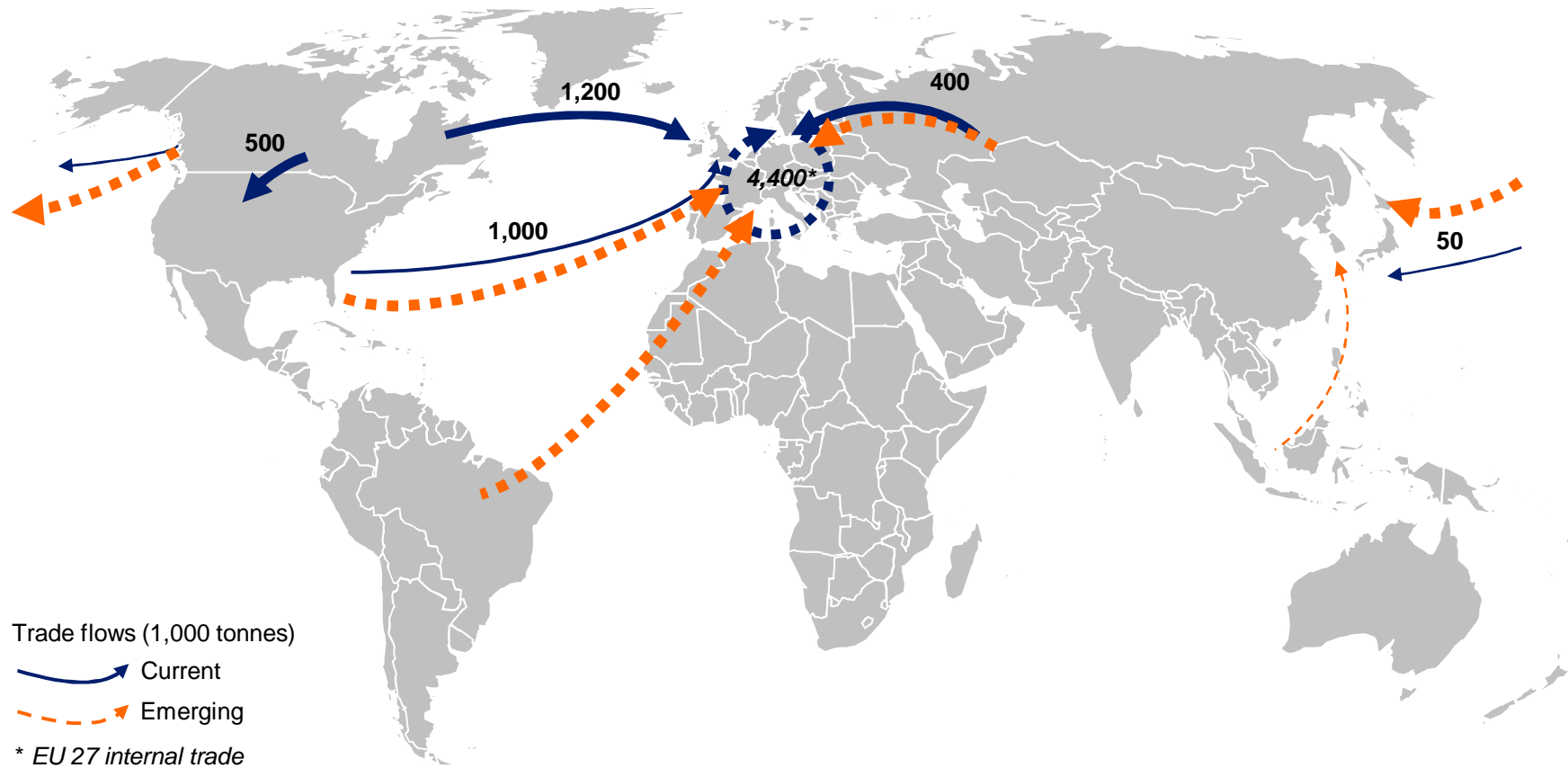
Wood pellet markets have developed according to national incentive mechanisms. Industrial pellet use is strong in countries with a high importance of biomass-based electricity generation or district heating, e.g. Denmark, the Netherlands, Belgium, Sweden and the UK. Other maturing markets almost exclusively cover premium pellet qualities that are suitable for residential heating applications.

Wood pellets consumption by end-use volumes and country, 2010



3. WORLD PELLET TRADE FLOWS IN 2011

Western Europe has recently been the largest off-take market for wood pellets, with total imports adding up to over 2.5 million tonnes in 2011. Going forward it is expected that increasing volumes will be exported from the US and Brazil to meet European demand.



4. INTRODUCTION TO CO-FIRING

Co-firing is the mixing of biomass together with coal in coal-fired energy plants. It frequently represents a low cost pathway towards achieving renewable energy targets.

- Pellets are an attractive fuel for use in co-firing
- The co-firing rate of bio coal with coal can reach 50 – 70 %
- Changes in market drivers could influence bio coal demand in Europe:
 - the price of bio coal delivered to plant,
 - the natural gas and coal price,
 - the value of carbon credits/certificates
 - incentives/taxes.
 - European economic situation
 - Electricity demand
 - Biomass sustainability criteria
 - Commercialization status of black pellet production technologies
- The current investment trend in Europe is towards dedicated biomass plants, but many EU countries will remain highly dependent on coal power.

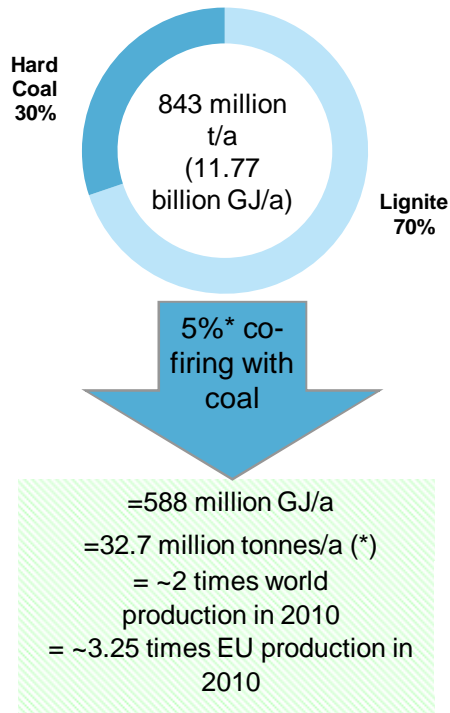
Due to a significantly higher energy price of pellets compared to coal, country level subsidy schemes for pellet co-firing are seen as the single most important driver for pellet co-firing.



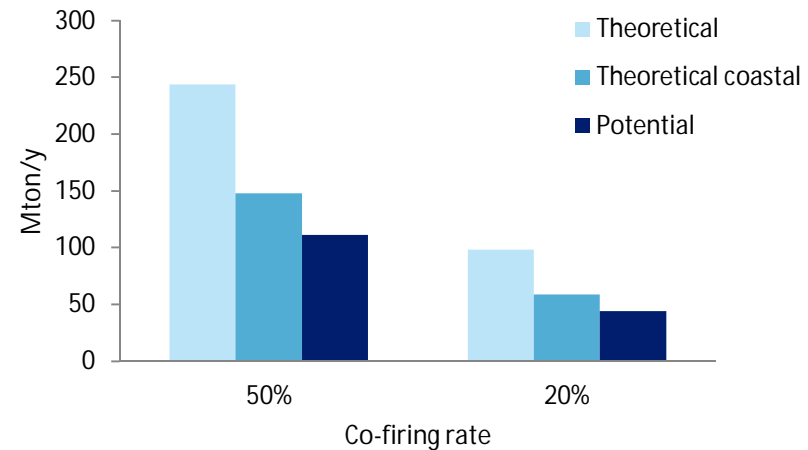
5. BIO COAL CO-FIRING POTENTIAL IN EXISTING OPERATING PULVERISED COAL PLANTS IN EUROPE

The demand for wood pellets from the European coal consuming energy plants has grown steadily as co-firing is viewed as a suitable means to reach CO₂ targets.

-European coal consumption by coal type, 2010-



**Potential Bio Coal demand in Europe



Constraints (Theoretical): Plants in operation, Latest large coal plants are not included, No stoker boilers

Constraints (Ther. Coast.): No inland countries

Constraints (Potential): 25 % of the plants do not find the Bio Coal combustion feasible

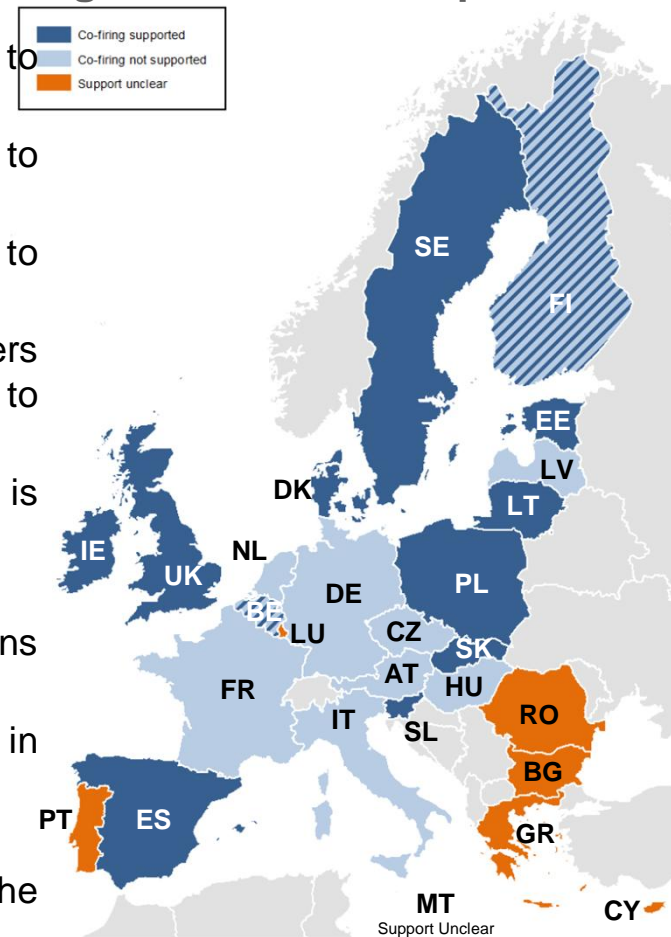
* Depending on the combustion parameters, the degree of biomass in direct co-firing would be between 5 % and 10 %, with Bio Coal the share could be as high as 50 - 70 %.

** Based to UDI 2009 data base and the use of Bio Coal having a heating value of 20,9 GJ/t (5,8 MWh/t), 5 500 h/y operation time and 40 % plant efficiency

6. CO-FIRING OF BIOMASS WITH COAL IN EUROPE - OVERVIEW

Co-firing support across the EU27 differs. Although a larger number of countries offer incentives, they account for less than 50% of European coal consumption. Policy changes regarding co-firing can have a large effect on future pellet demand.

- Financial support for co-firing of bio coal is not seen to play a major role
 - Poland targets wood-based biomass co-firing to be replaced by agricultural feedstock
 - Germany is focusing the support on small- to medium-sized applications
 - In Belgium co-firing is supported in the Flanders area. In Wallonia the biomass co-firing rate has to be at least 70% to be eligible for incentives.
- In Finland support for biomass co-firing in coal plants is currently under discussion
- Recent changes
 - The current policies In UK attracts full conversions of coal plants to biomass
 - In Poland the incentives are being directed in steps to dedicated biomass plants
 - Reduction of incentives in Spain
- Big utility companies holds the balance of power in the bio coal market development



7. BIO COAL SUPPLY CONSTRAINS / DEMAND GROWTH

Bio coal is expected to replace industrial wood pellet in selected co-firing projects, the bio coal market is included to the industrial pellet markets

Bio coal DEMAND drivers

- Political pressure
- Reduction of CO2-emissions
- Approval of product from certain large utility companies exists
- Low investment requirements at the end user
- Lower logistic costs

Bio coal SUPPLY drivers

- Clear view of the large demand potential
- Availability of low cost biomass (NA, SA, Russia, SEA)

Bio coal DEMAND constrains

- Bio coal product(pellet) quality
- Production cost of Bio Coal
- Subsidiary requirements
- Risk of changing political support

Bio coal SUPPLY constrains

- Large scale production and pelletisation technology maturity
- Credibility towards end users
- Take off agreements
- Guarantees / Risks
- Investment decisions/implementation timelines
- Financing for small technology developers
- Product standards for bio coal and further processed bio coal products

7. BIO COAL PRODUCTION AND CONSUMPTION GROWING

Bio coal production is coming. The growth expectations are dictated by the supply constrains

- Currently white pellets are dominating pellet market, but bio coal pellets are already available on commercial terms for large scale testing purposes. Already there are developers whose product has been tested and accepted by energy utilities / plants.
- Based on project developers project pipeline and technology developers and energy utilities plans/aspirations the black pellet production estimated to reach 0,6 Mt in 2015 and increase to 7,5 Mt/a by 2020.

Year 2015 production estimate is based on:

- Project developers project pipeline in N-America and Russia

Year 2015 - 2020 estimate is also based on:

- Technology developers' and energy utilities' investment / strategic plans in N-A and Russia
- Pöyry's detailed know-how on the steam explosion and torrefaction technologies and their commercial status
- Pöyry's own industrial sector traditional pellet consumption scenarios
- All black pellets are expected to be co-fired with coal (industrial sector)

Bio coal pellet production estimate by geographical area, Mt/a

	2010	2015	2020
Western Europe	0	0	0,2
North/South America	0	0,5	4,2
Russia	0	0,1	3,1
Total	0	0,6	7,5

Bio coal pellet consumption estimate by geographical area, Mt/a

	2010	2015	2020
Western Europe	0	0,54	5,00
North/South America	0	0,03	0,50
JPN, S-KOR	0	0,03	1,50
Other	0	0,00	0,50
Total	0	0,6	7,5

8. SUMMARY AND CONCLUSIONS

Supply, Demand & Prices

- Demand in Europe will continue to grow and drive growth in production capacity on a global scale.
- As European demand is driven by legislation, paying capability for bio coal will be capped by the level of associated incentives.

Future Market Dynamics

- Utility scale players may be **forced** to move upstream into the supply chain in regions such as Canada and the Southeast US to secure feedstock.
- Large resource owners will build (with equity investment) dedicated facilities in South America, and possibly later in West Africa.
- Converting existing white pellet plants to bio coal production

Technology development

- Commercialisation of the bio coal production and densification technology
- The cost of pelletised bio coal

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