

World forest and agricultural crop residue resources for cofiring

Compared with the wealth of fossil fuel resources and reserves data available worldwide, there is a dearth of equivalent data for biomass. Yet, biomass accounts for 10% of global primary energy supply (56 EJ of in 2012). Surprisingly, biomass represents three times all other renewable energy production, combined. The role of biomass in the world's economy is as a heating and cooking fuel in agrarian communities, but it is becoming an extremely important power station fuel in a long-term strategy to reduce greenhouse gas emissions from coal-fired power stations.

Amongst the plethora of different biomasses, wood pellets have emerged as one of the most successful and fast growing internationally-traded commodities. Wood (and straw) pellets offer a more energy dense and transportable alternative to the traditional wood chip, a product most commonly associated with the paper and pulp industry. The cofiring fuel market is becoming increasingly sophisticated, with processed wood pellet fuels being sourced in North America that are carefully matched with power plants in Europe. International trade is now common, especially as the heating values and moisture contents of pellets are not too dissimilar to some high moisture coals from Indonesia. In 2013, the biomass pellet market reached 25 Mt/y and continues to grow rapidly, with much of the demand coming from Europe. Opportunities to expand this further to supply the world's coal-fired fleet to help reduce CO₂ emissions are abundant. However, extending cofiring at even low rates (5–10%) in the world's coal-fired fleet will increase demand for wood pellets significantly. Meeting this demand will offer opportunities and challenges for the entire biomass supply chain, not least for global forest resources.

This report reviews the current understanding of world biomass resources using published reports and forestry data from the UN Forestry and Agricultural Organization (FAO). From these data, the author attempts to identify global and regional resource figures for wood in the form of residues and waste by-products that arise from the forestry industry and discusses the broad issues that affect forest resources worldwide.

The sustainability of forest and agricultural industries should be borne in mind and should be at the forefront of all biomass for energy projects. Consequently, this report takes a highly cautious approach, and does not include crops that are dedicated for energy use, or assume that a whole plant is used for pellet manufacture unless it is felled for thinning and fire protection. Only material that would otherwise be discarded or used as landfill is considered; some of this material is already utilised in heating boilers. The report is structured as follows:

- Chapter 1 outlines the study scope and structure.
- Chapter 2 examines the current coal-fired power fleet worldwide and current role of biomass as both a primary and a secondary fuel in power generation, but specifically in coal-fired power stations worldwide. The focus is mainly on capacity that is designed for solid biomasses and wastes.
- Chapter 3 provides examples of existing published reports of biomass resources, and shows the wide breadth of biomass potential in the world's agricultural and forest activities. This section then introduces national and international data that already exist to help determine resource figures for biomass.

IEA Clean Coal Centre is a collaborative project of member countries of the International Energy Agency (IEA) to provide information about and analysis of coal technology, supply and use. IEA Clean Coal Centre has contracting parties and sponsors from: Australia, Austria, China, the European Commission, Germany, India, Italy, Japan, New Zealand, Poland, Russia, South Africa, Thailand, the UK and the USA.

Each issue of **Profiles** is based on a detailed study undertaken by IEA Clean Coal Centre, the full report of which is available separately. This particular issue of **Profiles** is based on the report:

World forest and agricultural crop residue resources for cofiring

CCC/249, ISBN 978-92-9029-571-6, 66 pp, April 2015

This report is free to organisations in member countries, £100 to organisations in non-member countries for six months after publication, and free thereafter.

- Chapter 4 determines the potential waste resource in the world’s forests that could supply waste wood to manufacture wood pellets for cofiring. Only forest land that is legally allocated for industrial scale felling is included.
- Chapters 5 and 6 then use a simple methodology to adapt world forestry and agriculture data to determine a resource figure available to produce fuel pellets. Constraints on land use are also discussed.
- Chapter 7 concludes the report comparing the potential for cofiring in the world’s coal fleet against the reported and calculated resources.

Ten largest forested countries by carbon stock in Mt (FAO, 2010)					
	1990	2000	2005	2010	% change 1990-2010
Brazil	68119	65304	63679	62607	-8
Russian Federation	32504	32157	32210	32500	0
Democratic Republic of Congo	20433	20036	19838	19639	-4
USA	16951	17998	18631	19308	14
Canada	14284	14317	14021	13908	-3
Indonesia	16335	15182	14299	13017	-20
Peru	8831	8713	8654	8560	-3
Colombia	7032	6918	6862	6805	-3
Australia	6724	6702	6641	6641*	-1
China	4414	5295	5802	6203	41
World forest carbon stock	285330	281669	280500	270265	-5
* estimate					