

9 WOOD ENERGY

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HIGHLIGHTS

- Recent data for the EU28 show that primary energy production from “solid biofuels (excluding charcoal)” decreased by 3% in 2014 compared with 2013, to 3,591 PJ. Solid biofuels accounted for 43.8% of primary energy production from renewable sources.
- Demand for wood energy feedstock is increasing in the CIS as wood energy consumption (including pellets, briquettes and chips) continues to grow in the CIS and neighbouring countries. Wood pellet production in the Russian Federation was 973,000 tonnes in 2015, the highest since 2009.
- Wood energy consumption in North America was estimated at 2,725 PJ in 2015. Consumption increased in Canada by about 8% in 2015, due partly to the harsh winter there. On the other hand, wood energy consumption declined by 7.6% in the US, led by a 22% contraction in residential wood energy consumption, likely a result of lower fossil fuel prices.
- In Europe and North America, industrial and residential (premium) pellet prices declined year-on-year in 2015, driven partly by oversupply and partly by lower demand linked to mild winter temperatures. There is uncertainty in the market because installed wood pellet manufacturing capacity is growing but the extent of additional demand is unknown. Potential changes to eligibility rules and financial incentives for renewable energy are another source of uncertainty.
- North America exported 6.2 million tonnes of wood pellets in 2015, about 5.8 million tonnes of which went to the EU28; the UK is the EU28’s largest importer of industrial wood pellets. The devaluation of local currencies in CIS countries supported an increase in export sales there by wood-processing companies, including of wood energy products.
- The production of all woodfuels except charcoal increased in the western Balkans in 2015, reaching a value of 214.2 PJ. Firewood production in the subregion was 19.9 million m³, a record high, and wood pellet production was 909,600 tonnes. An analysis of the woodfuel trade flows of western Balkan countries in 2015 showed that about 81% of woodfuel was exported beyond the subregion, mostly to Italy.
- The extent to which the adoption of the Paris Agreement will support an expansion of wood energy markets depends on many external factors, including the frameworks adopted for carbon accounting.
- Small-scale, highly efficient power-and-heat-generation units using woodfuels present opportunities for development, and some seem close to commercial feasibility.



9.1 INTRODUCTION

The availability of information on wood energy²⁰ continues to improve, particularly for commoditized woodfuels. Wood energy consumption and production vary in the UNECE region because demand is strongly affected by weather and the prices of competing energy sources. There has been an increase in wood energy in the power-and-heat sector in the EU28 and North American subregions in the last ten years, with prospects for a similar trend in the CIS. The implementation of renewable energy targets and financial incentive programmes, and improvements in energy conversion efficiency, has helped drive this trend. Across the UNECE region, other factors influencing wood energy markets include requirements to address bioenergy sustainability and the role of wood energy in reducing greenhouse gas (GHG) emissions. Programmes developed to ensure standardized wood pellet quality and sustainability exemplify proactive multistakeholder efforts to deal with these potential concerns. Government action requiring the certification/verification of wood-fibre sources, the establishment of GHG accounting frameworks, and updated renewable energy targets can significantly influence commoditized wood energy markets.



Source: A. Merkulov, 2016

9.2 EUROPE

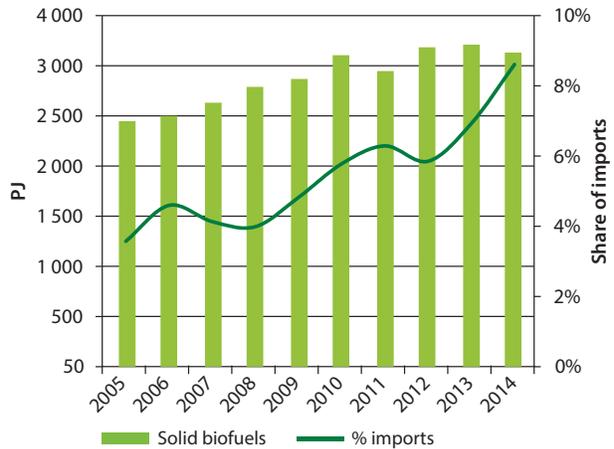
9.2.1 Consumption and production

Recent data show that the primary production of “solid biofuels (excluding charcoal)” in the EU28 decreased by 3% in 2014 compared with 2013, to about 3,591 PJ²¹ (Eurostat, 2016b). Nevertheless, primary energy production from solid biofuels increased by 30% in the EU28 in the ten years from 2005 to 2014 (graph 9.2.1). Solid biofuels accounted for 43.8% of primary energy production from renewable sources in 2014 – they were the main source of renewable energy in the EU28 in that year, followed by hydro (16.5%) and wind (11.1%). Overall, primary energy production from renewables increased by 1.6% in 2014,

the lowest annual increase in 15 years. EU28 imports of solid biofuels have increased three-fold since 2005 (Eurostat, 2016a).

GRAPH 9.2.1

EU28 total primary energy production from solid biofuels, and share of imports, 2005-2014



Note: Excluding charcoal.

Source: Eurostat, 2016c.

An estimated 13.1 million tonnes of wood pellets were produced in the EU28 in 2014, an increase of more than 1 million tonnes compared with 2013 (Eurostat, 2016bc). Germany was the largest producer of pellets in the EU28 in 2014, accounting for 16% of production, followed by Sweden (12%), Latvia (10%) and France (9%). The EU28 contributed about half of global wood pellet production in 2014 (Calderon et al., 2016).

The EU28 accounted for 74% of global wood pellet consumption in 2014, inclusive of uses for electricity, heat and combined-heat-and-power (CHP) generation (Calderon et al., 2016). EU28 consumption of premium pellets²² for residential heating increased to 11.7 million tonnes in 2015, about 7% higher than in 2014 (Calderon et al., 2016). Italy continued to be the largest national market for residential pellets in the EU28, consuming some 3 million tonnes in 2015. Two major factors in Europe that affected demand for wood pellets for heating in 2015 were the mild winter and the continued downward price trend for fossil fuels (Argus Media, 2016b). Sales of wood pellet boilers and stoves declined: sales of boilers were lower in Austria, France and Germany, and stove sales fell by 42,000 units in 2015, year-on-year, to 357,000. Italy is the largest market, accounting for about 90% of European sales, although the French market continues to grow. Prospects are more promising for stoves than for boilers due to their lower capital cost and the opportunity to replace logwood stoves with more efficient and convenient wood pellet stoves (Argus Media, 2016b).

Results for the industrial wood pellet market were mixed in 2015: consumption in Europe increased to an estimated 7.8 million tonnes (Calderon et al., 2016), but the industry also faced lingering uncertainties, with German Pellets, one of the subregion's largest wood pellet manufacturers, filing for

²⁰ Charcoal is excluded except where otherwise indicated.

²¹ One PJ equals about 105,000 m³ of wood or about 50,000 oven dry tonnes of wood fibre (higher heating value).

²² Premium pellets are intended for applications where a low ash content ($\leq 1\%$) is desirable, with moisture content $\leq 8\%$ and fine particles $\leq 0.5\%$. For more details see the Pellet Fuels Institute standards at www.pelletheat.org.



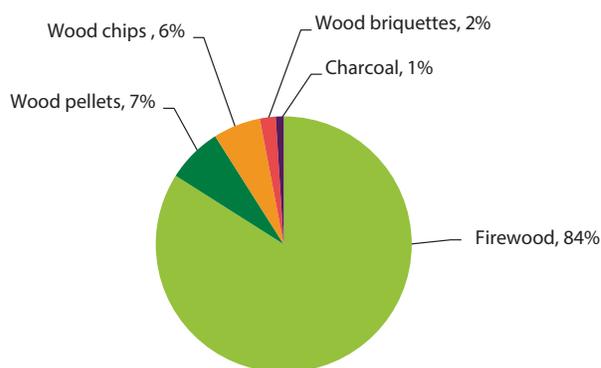
insolvency in February 2016, and its US subsidiary, Louisiana Pellets, also filing for bankruptcy protection. Another subsidiary, Hot's Holzpellets (with plants in Germany and Austria), has been sold, and agreements are in place to sell remaining plants (Argus Media, 2016a,b). Concerns remain, too, about the sustainability of solid biomass fuels.

Wood energy consumption reached a record high of 161.1 PJ in the western Balkans in 2015. The consumption of wood pellets increased by about 122,000 tonnes in 2015, year-on-year, with growth most pronounced in Bosnia and Herzegovina, Serbia and Slovenia. The increase in subregional consumption enabled many producers to sell pellets that had been stockpiled in 2014 due to increased competition in the Italian market (the main destination for wood pellets from the western Balkans) from Canadian and US producers (Glavonjić, 2016).

The residential and power-and-heat sectors are the two largest consumers of wood energy in the western Balkans. Households depend heavily on firewood, mainly for heating, with the share of total heating ranging from 53% in Croatia to 92% in The former Yugoslav Republic of Macedonia. There is also a reported trend towards the increased use of wood pellets for residential heating. For example, some 10,000 households in two large towns (Sarajevo and Banja Luka) in Bosnia and Herzegovina disconnected from the district heating system network at the beginning of the 2015-2016 heating season, instead relying on residential boilers using wood pellets. There was a rapid increase in wood chip consumption in district heating systems in Bosnia and Herzegovina – about 45,000 tonnes of wood chips were consumed in 2015 by five district heating systems that had substituted light oil with wood chips. Other towns in Bosnia and Herzegovina announced plans in 2016 to substitute light oil with wood chips in district heating systems, which could increase consumption to over 100,000 tonnes annually. Slovenia is the subregional leader in wood chip consumption in district heating systems. In Serbia, the wood-based panels and juice industries are the largest consumers of wood chips (the juice industry uses wood chips as an alternative to heating oil). Ongoing projects in several heating plants will affect wood chip consumption in district heating systems in Serbia, but not before the heating season of 2017-2018 (Business Annual Report of District Heating in Sarajevo, Banja Luka, Prijedor, Sokkolac and Gradiska, 2015). Bosnia and Herzegovina's first private district heating system has been constructed, with wood pellet consumption in the heating season estimated at 30,000 tonnes. The estimated price of generating 1 MWh of heat delivered to households using wood pellets is about 18% less than the cost of equivalent heat using gas (Business Annual Report of District Heating in Sarajevo, Banja Luka, Prijedor, Sokkolac and Gradiska, 2015).

Woodfuel production in the western Balkans increased in 2015, to 214.2 PJ. Firewood (84% of total wood energy), wood pellets (7%) and wood chips (6%) are the main woodfuels used (graph 9.2.2). Wood energy supplies about 30% of the total energy produced in Bosnia and Herzegovina and Serbia and 16% of the total energy produced in Croatia. The share of wood energy ranges from 4% to 7% in other countries in the subregion (Glavonjić, 2016).

GRAPH 9.2.2
Contribution of woodfuels to wood energy production in the western Balkans, 2015



Source: Glavonjić, 2016.

9.2.2 Prices

Argus Media (2016a) reported that CIF spot prices for industrial wood pellets at Amsterdam, Rotterdam and Antwerp (ARA) declined steadily in 2015 through the first quarter of 2016 (graph 9.2.3). ARA CIF spot prices for industrial pellets declined significantly in 2015, with the largest fall (about 18%, year-on-year) reported in March 2016. This decline in prices can be associated with factors such as flat demand (because buyers had ample supplies of pellets in storage) and an increase in supply from European suppliers and from North American and Russian exporters. The residential (premium) wood pellet market exhibited a slight downward price trend: according to Argus Media (2016a), the price of delivered bulk premium (EN plus certified A1) pellets in northern Italy dropped by 2% in April 2016, to €145 per tonne. On the other hand, delivered bagged pellets showed almost no change, with an average price of €190 per tonne.

GRAPH 9.2.3
Wood pellet prices at Amsterdam, Rotterdam and Antwerp, May 2014-March 2016



Note: Spot CIF prices within 90 days.

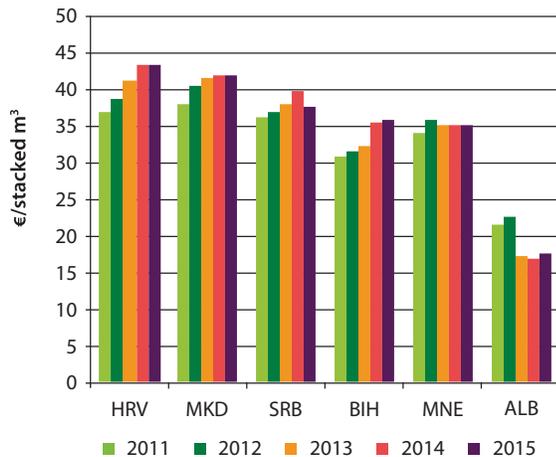
Source: Argus Media, 2016a.



Woodfuel pricing in the western Balkans is characterized by large country-level variation. For firewood, for example, Albania had the lowest prices in 2011–2015 and Croatia the highest, with a price differential of more than 100% per stacked m³ between the two countries (graph 9.2.4).

GRAPH 9.2.4

Average market price per stacked cubic metre of firewood in western Balkan countries, 2011–2015

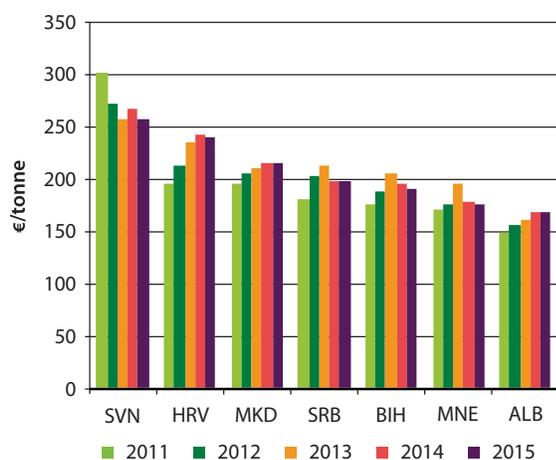


Note: HRV = Croatia; MKD = The former Yugoslav Republic of Macedonia; SRB = Serbia; BIH = Bosnia and Herzegovina; MNE = Montenegro; ALB = Albania. VAT included.
Source: Glavonjić, 2016.

Wood pellet prices in the western Balkans have experienced an overall upward trend, with a declining trend observed only in Slovenia (where, however, prices are, on average, still the highest among western Balkan countries) (graph 9.2.5). This is likely the result of market factors such as changing demand in the Italian market; moreover, the ample pellet stocks remaining at the end of 2014 led many pellet manufacturers to lower their prices in early 2015 to reduce stocks and improve cash flows.

GRAPH 9.2.5

Average market price per tonne of wood pellets in western Balkan countries, 2011–2015



Note: SVN = Slovenia; HRV = Croatia; MKD = The former Yugoslav Republic of Macedonia; SRB = Serbia; BIH = Bosnia and Herzegovina; MNE = Montenegro; ALB = Albania. VAT included.
Source: Glavonjić, 2016.

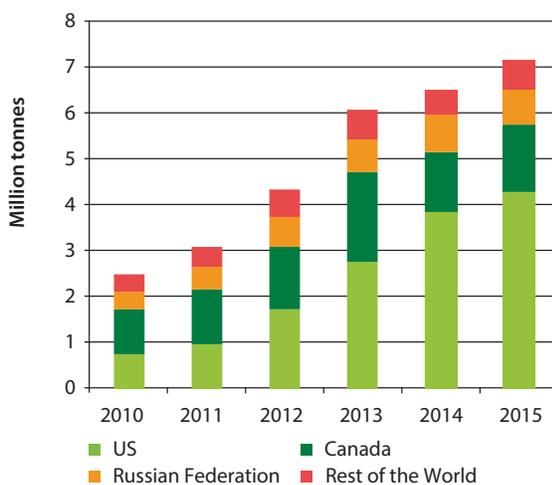
9.2.3 Trade

The importance of imported feedstock to the overall production of energy from solid biofuels in the EU28 continues to grow (Eurostat, 2016b). Imported solid biofuels generated 310.4 PJ of energy in the EU28 in 2014, which was 9% of all solid biofuels used for primary energy production in the subregion in that year (graph 9.2.1). The EU28 imported an estimated 7.2 million tonnes of wood pellets in 2015; the US accounted for 60% of this, followed by Canada (21%) and the Russian Federation (11%) (graph 9.2.6).

Exports of wood energy from the western Balkans increased by 5.8% (by energy content) in 2015 compared with 2014, to 38 PJ. Firewood accounted for about 45% of the total, by energy content, followed by wood pellets (27%) and wood chips (18%); these values correspond to volumes of 1.88 million m³ of firewood, 679,000 tonnes of wood chips, and 583,000 tonnes of wood pellets. The export volume of firewood and wood pellets increased in 2015, but the volume of wood chips dropped slightly. The increase in wood pellet exports was due largely to an increase in pellet exports from Croatia (which accounted for 34% of all pellet exports from the subregion). Exports also increased from Montenegro and Slovenia, but they declined from Bosnia and Herzegovina and Serbia.

GRAPH 9.2.6

EU28 imports of wood pellets, 2010–2015



Source: Eurostat, 2016b.

An analysis of woodfuel trade flows among western Balkan countries showed that about 19% of the total trade occurred within the subregion in 2015, while 64% of total wood pellet production, 84% of total wood-briquette production, and 59% of total wood chip production were exported from the subregion. Italy remains the most important market for the export of all woodfuels from the western Balkans; about 71% of the total export of wood pellets went to the Italian market in 2015, which was 25% of Italy's total imports. About one-third of Italian firewood imports came from western Balkan countries (figure 9.2.1).



FIGURE 9.2.1**Wood-splitting and packing for export, Bosnia and Herzegovina**

Note: Firewood exported to Italy mainly consists of split logs 33 cm long, packed in pallets (1.8 x 1 x 1 m), with 20-25% moisture content.
Source: Glavonjić, 2016.

9.3 COMMONWEALTH OF INDEPENDENT STATES

9.3.1 Consumption and production

Demand for wood energy feedstock is increasing in the CIS as wood energy consumption (including pellets, briquettes and chips) grows in the subregion and neighbouring countries. Wood energy production increased in part due to the devaluation of the rouble (by 68% in 2015-2016), which also affected the currencies of other CIS states with close economic ties (for many post-Soviet states, trade with the Russian Federation represents more than 5% of their GDP). The devaluation of national currencies supported an increase in export sales of wood products (including wood energy products): production costs stayed relatively unchanged but the value of sales nearly doubled. Tied to changes in exchange rates, wood pellet manufacturing for export enjoyed very large increases in revenue in 2015. Wood pellet manufacturers have reportedly allocated some of this increased revenue to support capital investments.

Most district heating plants in the CIS are old and inefficient, and there is strong interest among local governments in modernizing heating plants and reducing wood energy costs. For example, many boiler houses in the Arkhangelsk oblast have already switched from coal or oil to wood pellets and chips, driven by production cost savings – the cost of locally available woodfuels (per unit of generated energy) in the subregion is 23% less than that for coal and oil (with the latter unavailable locally). In 2015, the local government in the Arkhangelsk area subsidized the collection of wood that otherwise would have been disposed of to increase use and reduce illegal dumping. The positive experience in Arkhangelsk was reproduced in the Komi Republic, where in

2015 the local government covered the cost of planning and constructing waste-wood collection areas, while the cost of producing wood pellets and fuel briquettes was subsidized directly from the regional budget. Financial support was provided in the form of direct subsidies for some companies and through tax deductions for woodfuel producers, and state subsidies gave consumers additional support for using wood energy. Woodfuels are cost-competitive with coal and oil in the Komi Republic within 100 km of railway lines.

Fuel-switching to wood feedstock occurred in several regions in the CIS in 2015. For example, coal was unavailable for technical and logistical reasons in parts of northwest Russian Federation for several days of extremely cold winter weather, and boiler houses quickly switched to fuel briquettes to avoid the freezing of district heating networks.

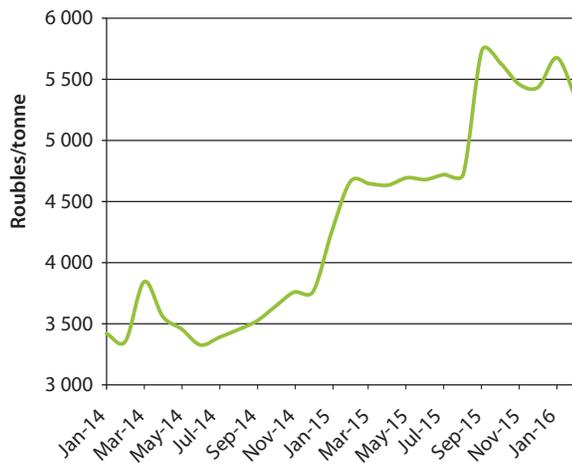
According to the official Russian statistics agency, Rosstat, total wood pellet production increased by 6.5% in the Russian Federation in 2015 compared with 2014, to 973,000 tonnes, the country's highest production since 2009. Pellet production increased throughout 2015, except in September-November, when it decreased. The majority of wood pellets were produced in the northwest, although production there was lower than in 2014. The country's new pellet-producing areas, the Far East and Central regions, experienced rapid production growth from both new and existing plants, driving up overall output. There are plans to establish new pellet factories in the Habarovsk region, the Vologra region, the Irkutsk region and others, with the biggest factories planned in the Irkutsk region (including two factories with a capacity of 105,000 tonnes and 75,000 tonnes, respectively).

9.3.2 Prices

Domestic wood pellet prices increased in the Russian Federation in 2015 (graph 9.3.1). The rouble-denominated cost of wood energy products rose due to higher production costs and increased competition. Unfavourable weather conditions, especially in winter, are generally associated with price peaks and other fluctuations. US dollar-denominated prices of wood pellets exported from the Russian Federation to Denmark, Finland, Germany, Latvia and the Republic of Korea decreased in late 2015 and early 2016 and the export volume increased. As of the end of 2015, export FOB prices for pellets were fluctuating between US\$100 and US\$117 per tonne.



GRAPH 9.3.1
Domestic prices for wood pellets in the Russian Federation, January 2014-February 2016



Source: Russian Timber Journal, 7/8-2016.

9.3.3 Trade

Net exports of wood pellets (i.e. exports net of imports and re-imports) from the Russian Federation increased by 6% in 2015 compared with 2014, to 932,700 tonnes (COMTRADE, 2016), but the trade value dropped by 20% when accounted for in US dollars (due to the depreciation of the rouble). The Leningrad region exported the most wood pellets (via the harbour), followed by the Republic of Karelia (the majority of exports going to Finland) and then Saint Petersburg. The biggest growth in pellet exports in 2015 was in the Irkutsk region, where there was a 710-fold increase. The biggest reduction in exports was in the Republic of Mari El, where there was a six-fold decrease.

Europe is the main destination for wood pellets manufactured in the Russian Federation. The biggest export market in 2015 was Denmark, which took 381,000 tonnes, followed by Sweden (154,000 tonnes), Germany (73,000 tonnes) and the Republic of Korea (72,000 tonnes).

It is expected that demand for wood energy feedstock (especially wood chips) in the Russian Federation will increase further due to positive export prospects. For example, Finland plans to open new renewable energy facilities that will consume woodfuel, and the decision of several energy-generating companies to switch from fossil fuels to wood chips and wood pellets could further increase trade. The ongoing geopolitical crisis in Ukraine has heightened the perceived commercial risks, and this was reported to be a major obstacle for Finnish companies trading with suppliers in the Russian Federation (Luke, 2014). Nevertheless, Karvinen and Mutanen (2015) reported that, as of the beginning of 2015, such geopolitical tensions had not had a direct, discernible influence on the wood trade between Finland and the Russian Federation.

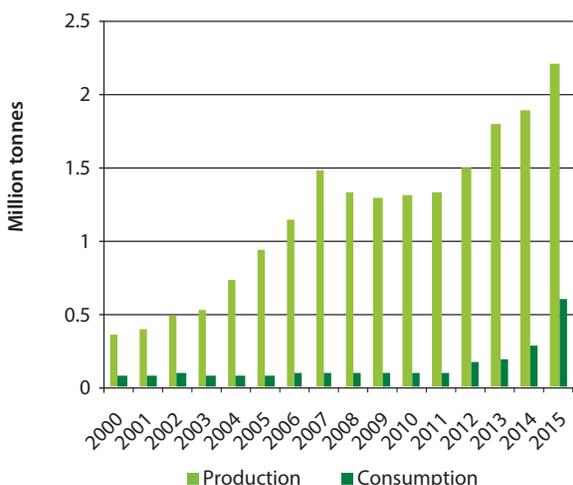
9.4 NORTH AMERICA

9.4.1 Consumption and production

There was a major increase in the consumption of wood pellets in Canada in the ten years to 2015 (graph 9.4.1). The recent spike might have been driven by colder-than-historical-average winters in eastern Canada in 2013-14 and 2014-15, with the consumption of wood pellets reaching an estimated 600,000 tonnes in 2015, which was about 27% of the country's total supply (Wood Pellet Association of Canada, 2016). Canada's installed bio-based electricity generation capacity is now over 2 GW, most of it in British Columbia (827 MW of capacity) and Ontario (681 MW) (Natural Resources Canada, 2016a); at conservative capacity factors of 50%, this translates to approximately 31 PJ of bio-based electricity. Canada's consumption of wood energy from residues continues to rise, reaching 261 PJ in 2014, 6% higher than in 2010. Canada also produced about 247 PJ from spent pulping liquor in pulp and paper mills in 2014, a 6% rise over 2010 despite a drop in chemical pulp outputs (Statistics Canada, 2016b). Increases in spent pulping liquor consumption is driven in part by the Pulp and Paper Green Transformation Program, which invested CAD 1 billion to upgrade generation capacity, ultimately supporting 98 projects across the country (Natural Resources Canada, 2016b). Biomass now generates approximately 381 PJ of industrial energy in Canada, which is almost 18% of the total energy requirement of the country's manufacturing sector (Statistics Canada, 2016c). The residential sector in Canada is estimated to be consuming 171 PJ of wood energy for heating (Statistics Canada, 2016b). Wood pellets contribute only a fraction – 4-8 PJ – of this wood-based residential heating, consuming from 250,000 to 500,000 tonnes of pellets annually (Rebiere, 2016; Wood Pellet Association of Canada, 2016). Wood energy for heating is concentrated in the provinces of Ontario and Quebec, which together account for some 60% of the national residential consumption of wood energy for heat (Rebiere, 2016). This high consumption is driven largely by population size, although Quebec has promoted biomass-based heat. Projects relying on woodfuels to generate electricity (e.g. the Thunder Bay and Atikokan generating stations in Ontario) have the potential to increase consumption, but they continue to face challenges of commercial feasibility. The Atikokan Generating Station reportedly could consume up to 90,000 tonnes of pellets per year (Walters, 2015).



GRAPH 9.4.1
Annual consumption and production of wood pellets in Canada, 2000-2015



Sources: FAOSTAT, 2016; Wood Pellet Association of Canada, 2016a; Statistics Canada, 2016a.

Canada is the world's third-largest wood pellet producer after the US and Germany, providing slightly less than 10% of global production (FAOSTAT, 2016). Canada has 37 operational pellet-manufacturing plants with an estimated total installed capacity of about 4 million tonnes (Rebiere, 2016). Canadian production of wood pellets continues to lag behind capacity, partly because of persistent fibre shortages in eastern Canada (Macklin, 2016). At least two facilities, with a combined capacity of 200,000 tonnes per year, were taken offline in 2015: Viridis Energy ceased operations at the Okanagan Pellet Co. plant in Kelowna, British Columbia, due to high costs (Bioenergy-news.com, 2016), and Boreal Pellet in Amos, Quebec, closed after a fire (Macklin, 2016). Thirteen facilities are in the planning or development stages (Canadian Biomass Magazine, 2016).

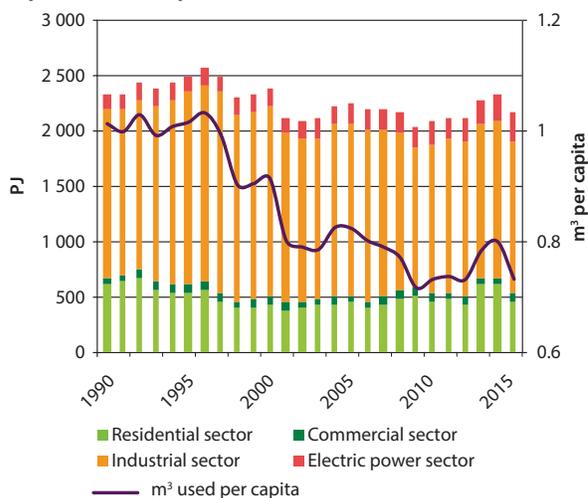
Summary statistics from the Monthly Energy Review (US Department of Energy, 2016a) indicate that national wood consumption in the US was 2,173 PJ in 2015 (graph 9.4.2), a decrease of about 7.6% compared with 2014. Most of the decline can be attributed to a reduction in residential wood energy consumption of 140 PJ, which in turn can be linked to the relatively mild winter and low-priced fossil fuels. Wood comprised 23% of all renewable energy consumption in the US in 2015, down from 25% in 2014 (US Department of Energy, 2016a). Of the wood-energy-consuming sectors, the industrial sector accounts for the largest share, at about 63%, followed by the residential sector, at 22%. The consumption of these two sectors has fluctuated over time, and the sector with the largest growth is electricity generation.

The consumption of wood energy for electricity generation in the US increased from 133 PJ in 2000 to 260 PJ in 2015. In contrast, however, per capita wood use for energy declined from 1990 to 2001, after which it levelled off at about 0.8 m³ per year (US Department of Energy, 2016a; US Bureau of Census, 2016). Among the factors associated with lower per capita wood energy consumption are lower prices for alternative energy sources for residential heating, urbanization, and income (Song et al., 2012). Overall, the likely short-term outlook is for

little change in the domestic consumption of wood energy (US Department of Energy, 2016b), in part because small reductions in industrial use are being offset by small increases in other sectors (e.g. power generation).

There were 107 operational wood pellet manufacturing facilities in the US at the beginning of 2016 (Forisk, 2016), with an estimated combined installed capacity of 10.3 million tonnes; total wood pellet production was 6.9 million tonnes in 2014 (FAOSTAT, 2016). A comparison of estimated capacity and production suggests that wood pellet plants were operating at about 80% of installed capacity in 2014. Large manufacturers of industrial pellets are actively seeking third-party certification to address sustainability concerns and account for carbon emissions. For example, all Enviva-owned pellet plants are now certified to the Sustainable Forestry Initiative (SFI) fibre sourcing standard and by the Green Gold Label programme – the latter covering the chain of custody, processing, and GHG and energy balance accounting. Enviva-owned plants also have chain-of-custody certification with the Forest Stewardship Council and the SFI/Programme for the Endorsement of Forest Certification (PEFC) (Enviva, 2016). Large wood pellet manufacturers and users state that most of the feedstock for the manufacture of pellets comes from low-grade fibres sourced from logging and mill residues (American Wood Council, 2015). Nevertheless, surveys of existing and proposed pellet production facilities indicate that mill residues are expected to comprise only 25% of feedstock for pellets, and logging residues and waste products are not cost-competitive at current prices. More information on feedstock should be forthcoming soon from the US Energy Information Administration's Densified Biomass Fuel Report (EIA-63C), a mandatory survey of manufacturers of densified biomass fuel products in the US, which requires pellet producers to identify their wood sources, including species for roundwood (by size and quality), wood chips from chip mills, logging residues, mill residues, bark, post-consumer wood products, and dedicated energy crops. EIA-63C respondents were notified in December 2015, and data collection was initiated in February 2016 (Pellet Wire, 2016).

GRAPH 9.4.2
US annual wood energy consumption by sector, and corresponding per capita wood consumption, 1990-2015



Source: US Department of Energy, 2016a.



9.4.2 Prices

Canadian wood pellets could be purchased on the retail market for CAD 220-250 per tonne in spring 2016 (Gildale Farms, 2016; PelletStoveStore, 2016), compared with the average price on the international market of close to CAD 175 per tonne FOB (Statistics Canada, 2016a). Canadian prices were slightly (about 5%) higher in spring 2016 than in 2014, year-on-year. The value of wood chips was also higher, approaching CAD 95 per tonne in 2015 compared with CAD 80 per tonne in 2014 (Statistics Canada, 2016a). Higher prices for bioenergy commodities may not be good news for the industry, however, given the slump in fossil fuel commodity pricing – it suggests that Canadian bioenergy products may be less competitive in the global marketplace.

In the US, domestic wood pellet retail prices (excluding delivery) reported by the State of Massachusetts Office of Energy and Environmental Affairs (2016) in winter 2016 were \$260 per tonne (bulk) and \$6.73 per 18.1 kg (40 lb) bag. In the US Northeast region, the price of premium wood pellets ranged from \$250 to \$290 per tonne in spring 2016, and the price of super premium pellets²³ ranged from \$308 to \$330 per tonne (BT Enterprises, 2016). These were all slight declines compared with the same period in 2015, with the drop in prices likely associated with weaker seasonal demand due to milder weather. Market uncertainty associated with potential changes to renewable energy targets in the EU28 seems to have led to lower delivered prices for pellets, affecting suppliers to European industrial consumers (graph 9.2.3). Argus Media (2016a) reported that “with both the premium and industrial markets grappling with high levels of uncertainty over how much demand is expected to come online in the next two years, many market participants are eyeing the market with increasing caution and are hesitant to consider trading beyond the first quarter of 2017”.

9.4.3 Trade

North America exported 6.2 million tonnes of wood pellets in 2015 (after accounting for re-exports of Canadian pellets via the US), with 1.6 million tonnes and 4.6 million tonnes reported by Canada and the US, respectively (COMTRADE, 2016). Canadian wood pellet exports in 2015, valued at CAD 284 million, were steady compared with 2014 and slightly down on 2013 values (Statistics Canada, 2016a). The top destination for Canadian wood pellet exports in 2015 was the UK (74%), followed by the US (13%) and Italy and Japan (5% each). This distribution was similar to 2014, but it is clear that the reliance of Canadian pellet exporters on the UK market has increased in recent years, likely due to ongoing purchase agreements between Rentech and Drax Power in the UK (McCormick, 2014).

The US exported nearly 4.6 million tonnes of wood pellets in 2015, which was a 13% increase over 2014. Previously, exports (by tonnage) had increased by 52% in 2013 compared with 2012 and by 41% in 2014 compared with 2013 (US International

Trade Commission, 2016). The UK continues to be the largest importer of US pellets, accounting for about 84% of the tonnage and value traded in 2015. This was an increase compared with 2014, when the UK was the destination for some 73% of the tonnage of US exported pellets.

9.5 POLICY, STANDARDS AND REGULATORY INFLUENCES

The UNFCCC's Paris Agreement has created a set of policy goals with potential to influence the role that wood energy plays in national energy portfolios. Each signatory to the Paris Agreement is expected to develop nationally determined contributions to reducing GHG emissions, and the role of wood energy is therefore likely to vary from country to country (United Nations Treaty Collection 2015). For example, Canada has stated a national long-term goal of decarbonizing its economy and shifting from fossil fuels (Canada 2015). The most crucial policy tool under discussion at the federal level for achieving this aim is a national price on carbon (Cheadle, 2016). The adoption of a federal policy on this would mirror action taken by four of ten provinces. An economy-wide carbon tax has been in place in British Columbia since 2008, currently set at CAD 30 per tonne (Government of British Columbia, 2016); the Government of Alberta recently pledged to impose a carbon levy that would reach CAD 30 per tonne by 2018 (Government of Alberta, 2016). Quebec has a cap-and-trade system that is pricing carbon at about CAD 16 per tonne (Government of Quebec, 2016), and Ontario is moving towards implementing a cap-and-trade system in 2017 that would likely see prices similar to those in Quebec (Government of Ontario, 2016). The impact of carbon prices on the bioenergy market is unclear, with some researchers expecting they will increase bioenergy uptake (Peterka, 2015). In practice, jurisdictions like British Columbia have not seen major increases in bioenergy use under a carbon tax regime, perhaps because of the “revenue-neutral” design of the tax system, which offsets carbon bills with lower income or corporate tax (Bradburn, 2014).

As the backbone of the US commitment to the Paris Agreement, the US Environmental Protection Agency (USEPA) has outlined GHG emissions reduction targets for power plants. Targets and tools for achieving reductions are outlined in the US Clean Power Plan, which could potentially encourage the greater use of wood for energy. The extent to which the Plan affects wood as a feedstock in power generation will hinge on the prices of other renewable energy sources and the biogenic carbon emissions guidelines of the USEPA (McCabe, 2015). However, the US Supreme Court has stayed the implementation of the Clean Power Plan, pending a judicial review (USEPA, 2016). Concerns that the Plan could curtail the potential carbon-reducing benefits of wood energy have led to a filing for relief from wood suppliers (American Wood Council, 2015). Legislation being discussed in the US Congress supports the role of US forests in addressing national energy needs; US Senate Bill 114-2012 is

²³ Super premium pellets are intended for applications where a very low ash content (less than 0.5%) is desirable.



directed at the departments of Energy and Agriculture, along with the USEPA, and has two aims: 1) to ensure a federal policy that is consistent across federal government agencies and recognizes the energy, conservation and forest management benefits of using forest biomass; and 2) to establish clear, simple policies for the use of forest biomass as an energy solution, including policies that reflect the carbon-neutrality of forest bioenergy – provided that the use of forest biomass for energy production does not cause the conversion of forests to non-forest use, encourages private investment throughout the forest biomass supply chain, and improves forest health.

In Europe, the Dutch government has released draft sustainability criteria and means of compliance for solid biomass for open consultation under the SDE+ (“Encouraging Sustainable Energy Production”). The SDE+ is an operating grant for producers to provide financial compensation for selected unprofitable (compared with fossil fuels) renewable energy generation. The SDE+ is available for the production of renewable electricity, renewable gas, renewable heat and CHP. Grant recipients can demonstrate compliance with the sustainability criteria via certification (e.g. FSC, PEFC, SFI, American Tree Farm System, and Canadian Standards Association); if none is available, verification can be used to demonstrate compliance (a verification protocol is under development). The current draft identifies five types of solid biomass, of which three are forest-based: 1) woody biomass from large forest management units (≥ 500 hectares); 2) woody biomass from small forest management units (< 500 hectares); and 3) residues from nature and landscape management. All three categories will have to meet sustainable management criteria and chain-of-custody principles. Certification/verification of carbon and land-use change are only required for woody biomass obtained from forest management units. Following consultation with stakeholders, a final protocol is expected to be published in September 2016 (Netherlands Enterprise Agency, 2016). The UK has announced a reduction of subsidies and tax benefits (which were financed through utility bills) for generating renewable energy from biomass (UK Department of Energy and Climate Change, 2015). There are a number of reasons for the reduction – including advances in the efficiency of renewable energy technology, higher-than-expected demand-led feed-in tariffs, and the Renewables Obligation – which, collectively, are expected to result in the generation of more renewable electricity than previously projected. The EU has commissioned a study on the impacts of pellet production on southern US forests to help in setting targets for solid fuels and their role in meeting renewable energy aims beyond 2020 (Tenders Electronic Daily, 2015).

Public policies and programmes affecting forests and wood energy continue to evolve in the western Balkans. The Albanian parliament has approved a ten-year moratorium on logging for industrial purposes and export (due to the deteriorating condition of Albanian forests). The law has a provision allowing local authorities to cut a limited amount of wood for heating (IHB, 2016).



Source: D. Hanlon, 2016.

As illustrated by the Sustainable Biomass Partnership (SBP) and ENplus certification, private-sector stakeholders continue to develop and adopt standards for wood pellet sustainability and quality. The SBP has introduced a new funding model, in which SBP certificate-holders and any entity taking legal ownership of SBP-certified biomass and selling supply with an SBP claim will pay fees to support the SBP; previously, only utilities supporting the scheme had paid a membership fee. The fees for wood pellet producers will be €0.15 (\$0.17) per tonne sold, effective from 1 October 2016, and wood chip producers will pay €0.08 per tonne, effective from 1 April 2017. Traders will be charged an annual fee, depending on volume: those handling more than 250,000 tonnes per year will pay €25,000, those trading between 100,000 tonnes and 249,900 tonnes per year will pay €10,000, and those selling less than 100,000 tonnes per year will pay no fee (Argus Media, 2016a). The SBP has approved two certification bodies, NEPCon and NSF International, to certify compliance with SBP standards. In the US, the first SBP certificate-holders include Georgia Biomass and Varn Wood Products; in both cases, the certificates were issued in 2016 (Sustainable Biomass Partnership, 2016). ENplus certification is being adopted increasingly widely: some 8 million tonnes of ENplus certified pellets were expected to be produced globally by the end of 2015 (Calderon et al., 2016).



9.6 INNOVATION

Small-scale, highly-efficient CHP units using woodfuels present opportunities for development. Some seem close to commercial market feasibility, although financial hurdles remain. An example is Entrade Energiesysteme's E3 biomass CHP plant for decentralized energy supply (Institution of Mechanical Engineers, 2015): it has a high-temperature reactor to generate syngas (synthesis gas) from solid biomass, which is then burned to generate electricity. E3 units can reportedly be produced at €2,500 per kW installed capacity, which is price-competitive with large-scale biomass power plants; in the UK, the E3 is able to deliver electricity at 6.3 pence per kWh. A single E3 system can generate a total of 8 GWh of electricity and over 19 GWh of heat per year.

There has been little progress, however, in the production of advanced biomass-based liquid fuels at commercial and research scales. The development of such fuels is highly dependent on policy targets, which seem to be at a cross-point in both the EU and the US. In the EU, the primary production of biofuels was 12,800 tonnes of oil equivalent in 2013. The Renewable Fuels Standard Guidelines published by the USEPA in November 2015 indicate that cellulosic ethanol production was about 9.5 million litres in 2015, with a potential range of production in 2016 of 0 to 83 million litres,

indicating considerable uncertainty about the production of this fuel (USEPA, 2015). This production occurred in only two commercially operating cellulosic ethanol plants -- neither of which was using wood. In Canada, the Enerkem project in Edmonton, Alberta, has begun production of methanol and plans to produce ethanol from municipal solid waste. This project, although delayed from its original timeline, represents a technologically new approach to renewable fuel production (Enerkem, 2016).

The use of torrefied wood pellets could reach commercial scale in Canada. The Thunder Bay Generating Station in Ontario, a converted coal-fired power plant, has been built to operate on torrefied biomass, although there are no local suppliers of this fuel in Ontario. Should the plant prove successful it will provide a template for the conversion of other coal-fired plants, but questions remain about its cost-effectiveness. According to Ontario Power Generation (2016), the Thunder Bay Generating Station project has received public attention because of the relatively low cost of conversion (CAD 5 million, compared with CAD 170 million for the Atikokan power facility using pellets), but energy generation costs seem much higher. Walters (2015) noted that power generation costs at the Thunder Bay Generating Station were about 25 times those of other biomass plants in Ontario, due largely to the lack of local suppliers of, or a competitive market for, torrefied pellets.



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