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A Message from the President of the World Bioenergy Association

Uniting the World in Favour of Global Bioenergy Development

IN 2018, THE WORLD BIOENERGY Association (WBA) celebrates its 10-year anniversary. For any organization, such a relatively young age means an initial period of growth—establishment of a vision and mission, structure, course of action, relationships and collaboration, and many other operational procedures to be decided, settled, organized, and fulfilled. For a global organization, solving these questions entails multiple considerations. At the present time, developing international networks and fostering worldwide relationships remain as the main activities of the WBA.

Since our establishment in 2008, the association has been committed to carrying out our central mission: *To promote the increasing utilization of bioenergy globally in an efficient and sustainable way and to support the business environment for the bioenergy sector*. The global challenge of climate change and the need to step away from fossil fuels inspire us and remain the main drivers of our activity.

Biomass, being a CO_2 neutral renewable resource, can be converted to a solid, gaseous, or liquid alternative energy source. This reality allows us to switch from fossil fuels to renewable energy in heating and cooling, electricity, and liquid fuels for transportation markets. Promotion of the bioenergy sector enables the WBA to cooperate with scientific and research and development organizations, researchers, leading development companies, and nongovernmental organizations. Explaining the common position of the bioenergy business to decision-makers occupies the most important part of our activity.

With members from more than 60 countries representing all continents, the WBA is currently in a position to track bioenergy's developments, emerging technologies, new research, and policy changes across different countries and regions. We collaborate with global organizations including the United Nations Framework Convention on Climate Change (UNFCCC), the International Energy Association, and the International Renewable Energy Agency (IRENA) (official observer status), and we participate directly in different renewable energy alliances such as the Renewable Energy Policy Network for the 21st Century (REN21), the REN Alliance, Go100%RE, and others; proof that WBA has achieved international recognition as a reliable partner, advocate, and developer of renewable energy.

The publication of our annual flagship report (*Global Bioenergy Statistics*), factsheets and conference speeches, and delivery of seminars and international webinars promoted all over the world allow us to share our expert knowledge about bioenergy market changes and various challenges faced by the sector. Dissemination of best practices and celebrating success stories of bioenergy development is another element of our activity. This is the way to inspire decision-makers and developers to prepare plans and encourage action in the continued downsizing of fossil fuels use.

Continued on page 6

Remigijus Lapinskas
President
World Bioenergy Association

> For example, leading countries with well-developed sustainable bioenergy, like Sweden or Austria, show that bioenergy can serve as an environmentally-friendly solution to solve the problem of agricultural and forestry residues. This industry is proven to create jobs and improve national energy independence.

Continued from page 5

The WBA consistently participates at the annual Conference of the Parties, or COP, (organized by the UN Framework on Climate Change). In Marrakesh in 2016, after the Paris conference and agreement, the WBA announced a Fossil Fuel Exit Strategy—the only strategy which can fulfill the Paris Agreement. It is a step-by-step plan to be implemented in every country that leverages all available renewable energy sources to replace the use of all fossil fuels by 2050. Decision-makers can use different tools, as we still have a long way to go from the current 19 per cent market share of renewable energy in energy consumption, but we believe a simple carbon tax is the most likely to produce the desired result.

After 10 years, the WBA has found its voice in the international arena, but we want to go further. We have recently broadened our global presence with the planning and opening of WBA branch offices. With these, we intend to improve and expand our international reach with new access to local and regional bioenergy associations. The existing network of bioenergy experts and developers who work daily at our branch offices allows us to enhance the effectiveness of country missions and delegation visits. They help us improve the communication of expertise, ideas, and the latest in industry developments, ultimately contributing to opening markets for companies with a global approach.

The launch of *BIOENERGY* magazine is another initiative to unite the world in favour of global bioenergy development and help companies, researchers, and politicians consolidate their efforts to achieving a better, cleaner world. For example, leading countries with well-developed sustainable bioenergy, like Sweden or Austria, show that bioenergy can serve as an environmentally-friendly solution to solve the problem of agricultural and forestry residues. This industry is proven to create jobs and improve national energy independence.

Climate change brought all nations together in Paris, as politicians from all over the world declared their commitment to combatting its negative impacts. What is clear is that we are still at the beginning of that long path. Inspiring success stories and technological breakthroughs in the fields of heat and electricity production are not enough. The transportation sector is still far away from clear signs of changed behaviour and new technologies are crucially needed. The WBA is expanding its activity in this sector, as we are sure that aviation, maritime, and long-distance transportation will require solutions from liquid biofuels. International cooperation and united efforts will hasten this path to a better and cleaner world. ■

Worldwide Reach

Founded in 2008, the World Bioenergy Association (WBA) is the global organization dedicated to supporting and representing the wide range of actors in the bioenergy sector.

The WBA focuses on pressing issues, including certification, sustainability criteria, bioenergy promotion, and the debates about bioenergy's impact on food, land-use and water supply.

Members include bioenergy organizations, institutions, companies, and individuals.

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World Bioenergy Association Transitions to a New Era in Bioenergy

1. World Bioenergy Association representatives joined over 300 delegates at the European Bioenergy Future Conference in Brussels, Belgium from November 21 to 22, 2017.
2. The WBA board at a meeting in Istanbul, Turkey. The association's goals transcend national borders and promote the international trade of biomass.
3. The WBA opened its branch office in Changchun, Jilin Province, China in September 2017.
4. The WBA's exhibition stand at an event in Changchun, China.

The World Bioenergy Association (WBA) is undergoing a transformative change in both outlook and make-up since its inception. The WBA was formed in 2008 under a three-year sponsorship agreement with the Swedish Energy Agency, with the head office established in Stockholm and Kent Nystrom as president. The WBA set objectives to actively proliferate bioenergy development worldwide, focusing primarily on issues that transcend national borders, and to promote the international trade of biomass.

Establishing a globalized reach

At the World Bioenergy Conference in 2008, Nystrom globalized the reach of WBA with the first interim board comprised of leading international experts in the bioenergy field. At the start, WBA had the support of national associations predominantly in Europe. Later on, in 2010, Karin Haara took over as executive director, aiding Nystrom in implementing strategic direction. Now, 10 years since the organization was established, there are 250 members (including biofuel producers, equipment manufacturers, CHP plants, researchers, and national and regional associations, etc.) based in more than 60 countries—a truly global bioenergy community.

Forging new partnerships

Heinz Kopetz, former chairman of AEBIOM (European Biomass Association, now Bioenergy Europe), took over the helm as president in 2012 and set about forging new industry partnerships. Austria is one of the leading examples of a country with a highly-mature bioenergy technology sector. Kopetz, with his strong background in the agriculture sector and presence in the Austrian bioenergy sector, aimed to expand the association further. WBA began publishing factsheets, position papers and press releases to correct misinformation on bioenergy and inaugurated a new annual publication, *Global Bioenergy Statistics*, a source for global bioenergy data.

In addition, WBA formed alliances with international renewable energy groups and encouraged the formation of national bioenergy bodies, for example the Zambian Bioenergy Association and the Turkish Bioenergy Association. WBA also began holding side events at major bioenergy conferences on specific topics of interest, such as how bioenergy can reduce exposure to natural gas supply, as well as holding webinars on new dense bioenergy mediums such as torrefied biomass and pyrolysis oil.

Entering a new era

After a successful four-year tenure, Kopetz resigned, and at the WBA annual meeting in Istanbul in June 2016, the board voted in a new president, Remigijus Lapinskas, formerly president of the Lithuanian Bioenergy Association. In 2017, Bharadwaj Kummamuru, WBA project officer since 2014, took over as executive director, replacing Karin Haara to implement new directions. Under Lapinskas, the WBA entered a new era in the development

of bioenergy by establishing new objectives and strategies, both for funding and also for expanding WBA influence worldwide. One of the first strategies was to establish branch offices to better enable WBA to operate in 24 time zones. With the aid of board member Hong Hao, the WBA opened its first branch office in Changchun, Jilin Province in China in September 2017, which, combined with a memorandum of understanding WBA signed with the Ministry of Industry and Information Technology for Jilin, creates an unprecedented opportunity for bioenergy technology to enter the Chinese market. More branch offices are on the way in Indonesia, Canada, Brazil, Mexico, and Turkey.

Reaching international members worldwide

After having established its first branch office in China, WBA entered 2018 with a truly global presence. Membership has increased, and high member retention rates indicate high levels of satisfaction in being associated with WBA. New international webinars with two time zone options show our commitment to reaching our international members worldwide.

A new long-term agreement with a publishing company in Canada to restart our popular publication, *BIOENERGY*, (now bi-annual) ensures a constant supply of the latest knowledge on bioenergy and an additional platform for our members to showcase their products.

With a recently concluded study mission of a Chinese delegation to Scandinavia, which allowed participants from Chinese energy companies to visit bioenergy installations in Scandinavia, WBA inaugurated a new strategy to promote cross-border transfer of knowledge and technology. More delegate visits are proposed to different parts of the world and we are excited about organizing such events.

Enabling informed decision-making

One of our main priorities as a global association is to be a clearing house of all things related to bioenergy. We are a factual, non-biased repository of the latest information on bioenergy. To achieve this objective, we continue our work on publishing factsheets, which now focus on supply chains (logistics), liquid biofuels for transport, agricultural residues potential and use, and biochar potential as carbon dioxide removal technology and bioenergy with carbon capture and storage. Since data is crucial for informed decision-making, we aim to gather and make available the most recent, updated, and reliable data on bioenergy developments globally, so we will continue publishing our *Global Bioenergy Statistics* reports.

WBA is a small organization with great ambition. Bioenergy is—and will be—an important renewable energy source globally, and though the sector is under transition, WBA will continue to protect and promote international development of bioenergy supported by our strong network of members, proliferation of data and knowledge, and strategies to roll-out the latest bioenergy technologies. ■

Reap the Benefits of WBA Membership

1. Contribute to the global development of bioenergy and influence policy decisions at national and regional levels.
2. Receive our member exclusive newsletter.
3. Collaborate in working groups, webinars, projects, and conferences.
4. Participate in bioenergy events worldwide with exclusive discounts or complimentary passes.
5. Better understand bioenergy through factsheets, global bioenergy statistics, country mission reports, news, etc.
6. Access WBA's network of companies, associations, and experts.
7. Be represented on a global level.
8. As an associated member, your company can purchase access to the Bioenergy Equipment Directory, which allows you to create a profile, share news, and be visible on a global level.
9. Associations that join as full members receive one vote on the WBA's Steering Committee.
10. Depending on your support level, you may be represented in all WBA publications, factsheets, Global Bioenergy Statistics reports, website, presentations, and conferences and events attended by our secretariat or board.

Are you interested in being part of the global bioenergy community? Register online or contact info@worldbioenergy.org.

FEATURE

The Development of Machinery & Equipment Needed for Expansion of Bioenergy

***By Andrew Lang**, Senior Consultant, WBA &*
***Douglas Bradley**, President, Climate Change Solutions*

A mobile grinder to increase biomass bulk density for transportation.

The last 30 years have seen dramatic progress in development of bioenergy technologies, particularly in the area of forestry biomass to energy. Leaders include Finland, Austria, Germany, Denmark, Brazil, and Sweden. Each of these countries has excelled in different areas of bioenergy development, and in some cases, in the use of different forms of biomass. Many other countries follow, including Lithuania, Italy, China, India, Latvia, and Spain.

It is only since the oil shocks of the 1970s raised oil prices up to 10-fold that the incentive has been there to develop efficient, large-scale bioenergy plants able to replace oil or coal-fired plants to produce heat and power and develop the efficient supply chains to feed them. To bring this about, innovations had to happen at many points. In 1970, none of today's harvesters, processing heads, forwarders, chippers, furnaces designed for high moisture content woody biomass, or other aspects of biomass supply, processing, and conversion to energy, existed. Since then, every aspect of modern bioenergy has been developed so successfully that now biomass is the single largest source of consumed energy for at least three countries and provides a significant fraction of consumed energy in many others.

Modern residue gathering equipment in Finland.

Powerhouse in production and processing

Lacking any oil or gas reserves, Finland began early and soon became a

powerhouse in production of innovative forestry harvesting and processing machinery and now supplies a disproportionate amount of the world's demand for such equipment. Examples include wheeled harvesters with slewing forestry crane (Timberjack, Ponsse), harvesting heads and feller-bunchers (Keto, Kesla, Narva), self-propelled, self-unloading chippers (ProSilva, Valmet), one to 20 MW biomass furnaces (Valmet, Wärtsillä), even chip and sawdust transport trucks equipped with walking floors or side-tipping bins. Development was supported by uniquely close relationships between government, industry and technology institutes.

In 1970, with imported coal and oil supplying 73 per cent of its energy, Austria also turned to its domestic resource of wood. Austria became a leader in production of small- to medium-scale furnaces for pellet- and chip-fueled heating and of equipment for production and distribution of pellets. Examples include chip- and pellet-fueled furnaces for households, apartments, and smaller commercial premises from KWB, Hargassner, ÖkoFEN, Binder and many others.

Sweden has excelled in developing approaches for the aggregation and transport of very large volumes of biomass for supply to large combined heat and power systems, including energy wood forwarders (Ösa/FTG-Mowi, Rotne) and high-capacity drum chippers (Bruks). Germany excelled in production of chippers and processing systems such as pellet presses producing wood pellets from sawdust, as well as furnaces (Kahl, Viessmann). Denmark is a leader in design and construction of straw-fired furnaces (Burmeister & Wain), and handling systems for high volumes of low-density biomass materials (Lachenmeier Monsun). Italy has become a world leader in the manufacture and distribution of Organic Rankine Cycle systems to generate power at low temperatures from multiple sources, including biomass and waste heat (Turboden). Entering the picture now are technology companies from Lithuania, producing one to 20 MW biomass furnaces (Enerstena), and from Turkey, building and operating biomass power plants (Arti Enerji).

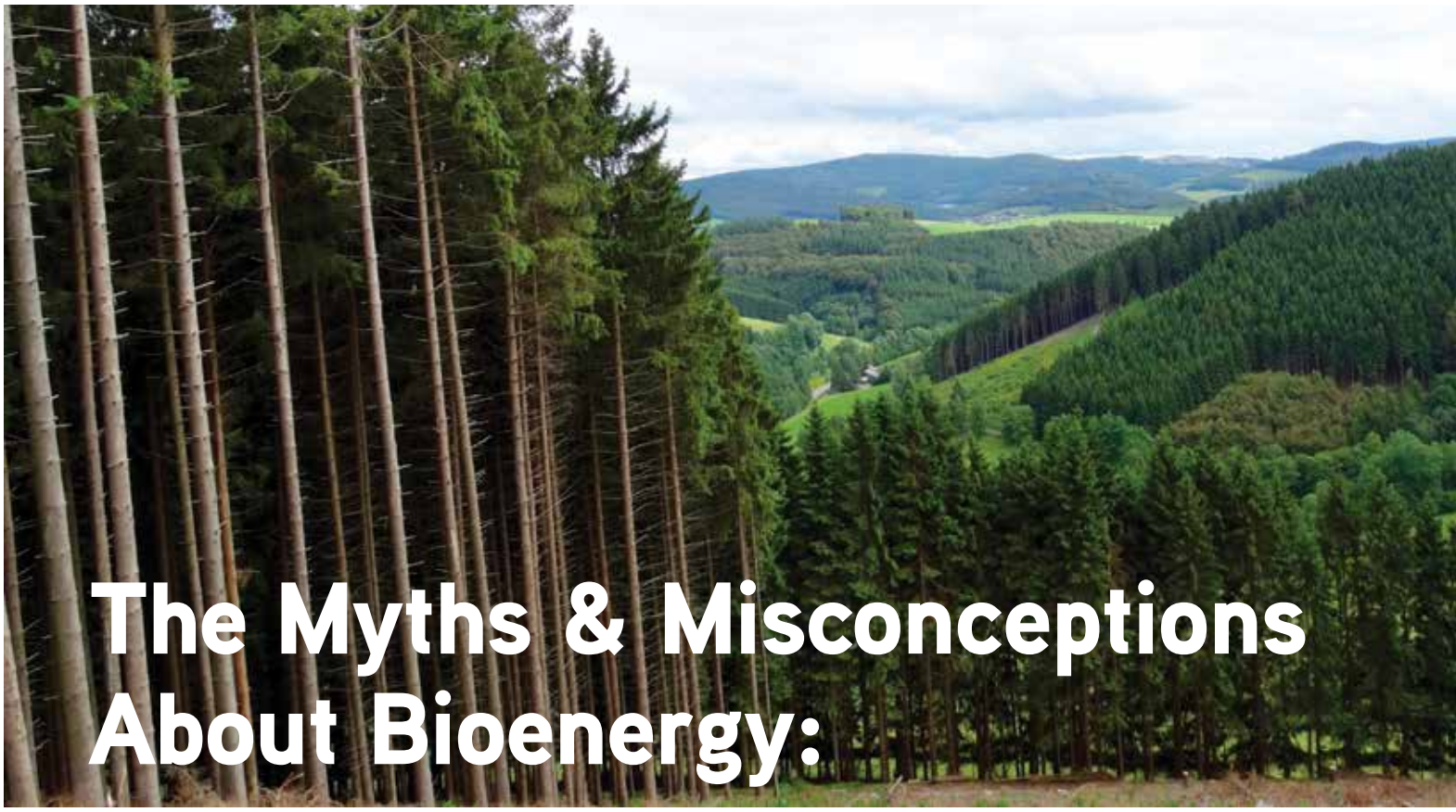
Enabling biomass to replace fossil fuels

Europe became a spawning ground for bioenergy machinery and equipment, not only for use on the continent, but also for export to Canada, the U.S., and other countries, to enable biomass to replace fossil fuels, particularly in those areas not on a natural gas pipeline. North America has become a biomass centre in its own right, focusing on technologies that convert its huge store of biomass to the volumes of pellets needed in Europe and enabling efficient supply chains to transport it. Large suppliers of pellets include Pinnacle Renewable Energy in Canada, and German Pellets and Enviva in the U.S. Giant leaps are also being made in supply chain equipment. Pinnacle operates a fleet of 760 rail cars to ensure timely pellet transport to ports and, in 2014, completed the Westview pellet terminal with all of the rail siding, storage, and loading capacity to fill 60,000 tonne Panamax ships destined for Europe and Asia.

Continual innovation increases efficiency

The continuing development of machinery and equipment shows that once a good policy environment is put in place, innovation and development can continue without further direct stimulus. While major advances have been made for final harvesting and log transport, and for efficient bioenergy plants, there is still scope for other equipment and systems that improve efficiency in various areas. For example, in Finland, we now see the development of the Fixteri forwarder mounted processor aimed at significantly reducing costs of thinning sites that were previously marginally economic. In Sweden, we see production by Elforest of hybrid diesel / electric harvester, forwarder, and a remote-controlled forwarder, and in Finland, of a hybrid diesel / electric chipper by Kesla.

Innovation continues in other areas, including automated handling, combustion, gasification, pyrolysis, logistics, and transport. All these developments mean more efficiency at a lower cost and with biomass able to be used in more diverse ways to replace fossil fuels. While many people are gloomy about the ability of many countries to reduce their greenhouse gas emissions, people involved with bioenergy development see a far more hopeful outlook, particularly when they look at what has already been achieved in the countries mentioned here. ■



The Myths & Misconceptions About Bioenergy:

From Native Forest Biomass & Straw

***By Douglas Bradley**, President, Climate Change Solutions &*
***Andrew Lang**, Senior Consultant, WBA*

In this series of articles, we identify and provide brief rebuttals of the most widely-held myths and misconceptions used against the use of woody biomass for energy.

Bioenergy is the largest renewable energy form and provides over 75 per cent of all renewable energy consumed worldwide. While environmental objections can be made against the inefficient use of biomass by billions of people for daily energy needs, these objections cannot legitimately be used against modern, efficient, and sustainable uses of biomass. Though bioenergy from sustainably managed sources was proven long ago to bring about net reduction of atmospheric CO_2 levels, articles written by people and organizations with little understanding of forest dynamics question these proven concepts but rarely provide scientific evidence. For example, one widely-disseminated 2017 anti-bioenergy article used terms like "evidence suggests," "various models have predicted," and "some have

Planting seedlings like this one renews forests and offers employment opportunities for students.

A mature managed forest beside harvested and renewed forest.

> In some areas, a portion of the branches at the stump are now being used for bioenergy, but only if biomass left behind leaves sufficient nutrients for the soil to maintain forest sustainability. In many countries, this is now enforced by law.

argued that" with virtually no scientific references to prove the statements.

It is often not known by bioenergy detractors that 18.5 per cent of energy consumed worldwide is from renewable sources, and that over 75 per cent of this is produced from biomass. Biomass, when sourced sustainably and converted efficiently to energy, is critical in many countries for meeting greenhouse gas (GHG) emission reduction targets while maintaining employment and growth of their regional and national economies. The critics of bioenergy usually ignore these facts. The opposition to bioenergy usually relies on myths or misconceptions.

Myth: That combustion of forest biomass results in the production and release of CO2 to atmosphere that can take 100-plus years to sequester again.

There are two major misconceptions here: that entire trees are burned in energy plants, releasing all of their carbon as CO_2 to the atmosphere; and that it can take 50 to 150 years or more for the recovering forest to reabsorb all the CO_2 released on burning. It doesn't work that way.

Whole mature trees are almost never used for energy production. Trees are too valuable for that. As much as possible of every harvested tree goes to the highest-value uses first, such as lumber or veneer, which actually puts tree carbon into long-term storage. For example, in Canada in 2004, of 160 Mm^3 (million m^3) of softwood timber harvested, 81.7 Mm^3, or 51 per cent, was made into structural lumber[1] for homes and other construction, storing carbon for decades. In addition, in 2006, 12.4 per cent of Canadian wood harvest was made into structural panels, thus, storing more carbon.

The next highest value product is pulp, to make paper. In Canada in 2005, 13.5 per cent of forest harvest went to pulp, thus, storing carbon for years, or in the case of books, for decades. When fine paper has finished its use, it is recycled back to papermakers to make newsprint, and when that use is completed, it is recycled to make tissue. Nowadays, tissue paper is made from 100% recycled fibre. What remains is sawdust, shavings, and bark at mills, and branches in the harvest site. Where economic, mill residues are used for bioenergy, including production of pellets from sawdust.

One anti-bioenergy publication correctly noted that mill residues are now in short supply in some areas, but naively added that climate change impacts would be mitigated by burning the biomass onsite to eliminate emissions transporting biomass or by using the residues to make particleboard. The writer clearly did not realize that forest products are driven by markets, not wishful thinking. If there is a market for particleboard and it pays more than making energy, the companies will do that. In some areas, a portion of the branches at the stump are now being used for bioenergy, but only if biomass left behind leaves sufficient nutrients for the soil to maintain forest sustainability. In many countries, this is now enforced by law. The forest industry is more aware of what it takes to ensure forest sustainability and diversity of flora and fauna than the public generally realizes.

Regarding emissions from transportation, it has been proven that GHG emissions from transporting biomass are miniscule relative to the savings by not burning fossil fuels. An IEA Bioenergy Task 38 (GHG) study showed that GHG emissions from biomass transportation (including fibre to pellet plant, pellets to port, and pellets Vancouver to Rotterdam) were about 70 per cent higher than shipping coal to Rotterdam; however, total GHG emissions from the biomass system, including pellet manufacture and transportation, were only 3.2 per cent of emissions from the fossil fuel system, including coal production, transportation, and utilization.[2]

Another Task 38 study compared GHG emissions of producing and transporting fossil oil and burning it in a pulp mill lime kiln versus producing, shipping, and burning pyrolysis oil, including CO_2, CH_4, and N_2O emissions and landfill impacts. Biomass transportation emissions were only 1.8 per cent of fossil system emissions, and overall, biomass system emissions were 4.3 per cent of fossil system emissions.[3]

Anti-bioenergy authors are generally not knowledgeable of forest dynamics, and mistakenly presume it is possible to "save a tree" or "protect a forest." Just

like people, trees live and then they die. When trees die, they decay and emit their carbon as CO_2 naturally over time, or a dead tree may burn in a natural forest fire and release its carbon as CO_2 quickly. In a well-researched white paper, FutureMetrics noted anti-bioenergy authors do not appear to grasp the size and scope of the forest products industry in the U.S. and Canada. Hundreds of millions of hectares are forested, and much of it is managed for wood products that we use in our everyday lives.[4] In Canada, most managed forests are owned by the Provinces, which establish Sustainable Forest Licenses, whereby harvesters must develop approved detailed plans for both harvesting and forest regeneration. For example, in 2009 in Canada, 537,000 ha were harvested, 349,000 ha were subsequently replanted, 11,000 ha were aerially-seeded, and 177,000 ha were purposely left for natural regeneration of diverse native species. The government determines what level of harvest is sustainable and then establishes an annual allowable cut (AAC). Harvest volumes are always less than the AAC. Though the U.S. has largely privately-owned forests, almost all large forest landowners have forestry plans that define an annual allowable cut.[5]

The foundation behind bioenergy being carbon neutral is that when biomass replaces fossil fuel, it eliminates emissions from that fossil fuel, and though the biomass emits CO_2 when burned, growth in the remaining managed forest offsets emissions from burning. Anti-bioenergy groups argue that there is a "carbon debt" or "carbon payback period", and that carbon absorbed in growing forests takes decades or even centuries to attain levels lost due to burning biomass. But there is no carbon debt. In an illustration of a working U.S. forest, there are 40 separate plots at 40 stages of growth from seedling to mature. The mature plot is cut each year, and even if all that carbon is released in conversion to bioenergy, the carbon uptake in the remaining 39 plots is the same as that released in the mature plot. If wood used in pellets comes from forests where the stock of wood is not shrinking, then the carbon stock in those forests is not being depleted. Every ton of carbon emitted from the combustion of pellets is absorbed contemporaneously.[6]

In general, carbon balances are far better than portrayed by bioenergy's critics. Carbon in wood products becomes "stored carbon", and the remaining biomass residues produce energy that would otherwise be produced by burning fossil fuels. Using CO_2-neutral biomass for energy eliminates the CO_2 emissions of the fossil fuels. Increasing the production of energy from sustainably-sourced biomass is a key part of transition to a 100 per cent renewable energy world. To obstruct expansion of sustainable bioenergy is to handicap movement to this goal. ■

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World Trade in Biomass *Leaps Forward*

The Westview wood pellet terminal in Prince Rupert, British Columbia, Canada.

***By Douglas Bradley**, President, Climate Change Solutions &*
***Michael Wild**, President, International Biomass Torrefaction Council*

Mankind has used wood to make fire for tens of thousands of years, but biomass energy in today's sense truly started when oil price shocks in 1973 and 1979 sent energy prices soaring. Pulp mills and sawmills began replacing fossil fuel with zero-cost wood residues adjacent to the mill, primarily to reduce energy costs, not to reduce greenhouse gases (GHGs). This biomass was transported only a few metres.

Promoting the use of bioenergy

The 1992 Kyoto Protocol was put in place to drive reduction of GHG emissions and, soon afterward, it became understood and measured how effectively net GHGs could be reduced by replacing oil, gas, and coal with biomass energy. Policies, primarily in Europe, promoted the use of bioenergy. Communities began installing pellet and wood chip-fueled boilers fueled by locally sourced pellets and chips, and large biomass-fueled combined heat and power plants began generating renewable electricity and district heat.

Increasing demand for biomass forced suppliers to source biomass from further afield. To supply growing demand, pellets and wood chips soon needed to be transported hundreds of kilometres, requiring complex supply chains to gather and move biomass from the forest and residue from sawmills, to densify the biomass into pellets for transport by truck or rail, and eventually even ship in vessels across the Baltic.

Increased supply calls for bulk shipments

Particularly in the European Union (EU), demand for wood pellets and wood chips continued to outstrip regional supply, and transportation from greater distances became necessary. In April 1998,

Continued on page 18

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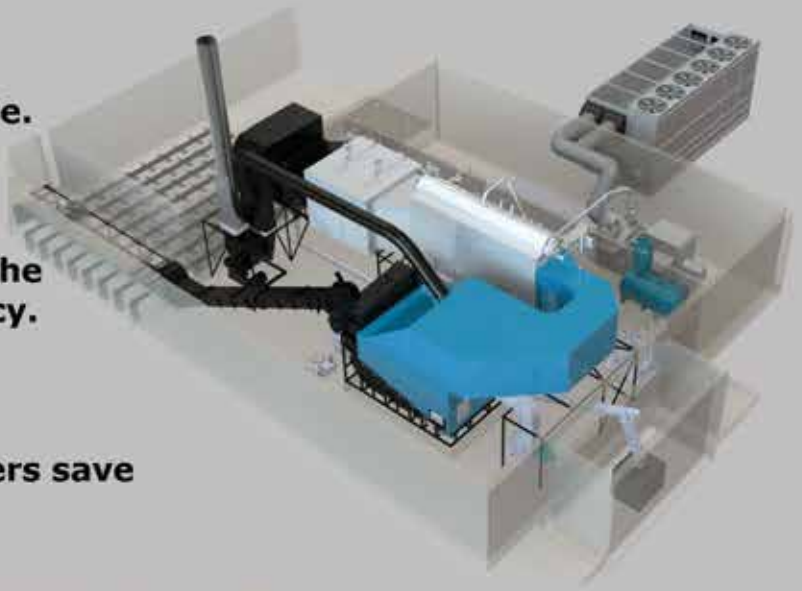

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KMW EQUIPMENT SHIPS FULLY ASSEMBLED AND SHOP TESTED

Continued from page 15

the first trans-ocean bulk shipment of wood pellets from North America took place, as 15,000 tonnes of white pellets were railed from the British Columbia Interior to the Port of Prince Rupert in British Columbia, Canada, loaded onto the vessel *Mandarin Moon*, shipped over 16,000 kilometres, and discharged at the Swedish port of Helsingborg for use as a renewable fuel in a power plant. It was a small volume put on a small ship and sent a great distance, but it was economic, and it changed the world of bioenergy trade.

Total world pellet production grew from under two million tonnes (MT) in 2000 to over 27 MT in 2015. Pellet exports went from a few-thousand tonnes to 15 MT by 2015. Over six MT was shipped from Canada and the Southeastern U.S. to Europe, 2.5 MT reached EU customers from the Baltic region, and now pellets are also being shipped from British Columbia, Malaysia, Vietnam, and Thailand to Japan and Korea.

Evolving supply chains reduce costs, remain competitive

To reduce costs and remain competitive, supply chains have evolved from small part cargos on Handysize ships loaded at multi-purpose terminals, to large purpose-built terminals built to fill 60,000-tonne oceangoing Panamax ships with pellets for transport halfway around the globe. An example is the Westview Wood Pellet Terminal in Prince Rupert, British Columbia, owned by Pinnacle Renewable Energy Group, one of the world's largest manufacturers and distributors of wood pellets. Large port enhancements are also underway in Southeastern U.S. Growth in pellet demand is particularly evident in Japan, which is leaning toward pellets as a way to increase energy production following the shutdown of the nuclear power industry and also to achieve renewable energy targets by replacing coal.

Turning to torrefaction

To further reduce costs and increase fungibility, companies in Canada, the U.S., and Europe have developed proprietary technologies such as torrefaction, which increase biomass energy density and change the properties of pellets. They are 50 per cent more energy-dense than white wood pellets, yielding supply chain and logistics advantages, and they act more like coal, so can be mixed with coal in any proportions or even replace coal completely to convert coal-fired power plants to 100 per cent renewable energy. The result is reduced power generator investment and handling costs.

Torrefied pellets, also called bio-coal, have already been shipped from the U.S. to Europe and from Norway to Canada. Technology companies are moving forward. Baltania is building a 180,000-tonnes per year plant in Estonia using clean electricity generation technology, with start-up targeted in late 2019. American BioCarbon is extending its TSI-based sugar cane straw torrefaction in Louisiana. Arsari Enviro Industries is developing a project to produce bio-coal from waste wood in degraded forests in Kalimantan, Indonesia. It will use technology from Torr-Coal to make torrefied pellets for export to Japanese power generators, and it also anticipates using technology from Torrgas to fuel local combined heat and power plants. Airex, a Canadian company, has developed a cyclonic bed reactor technology to make bio-coal from a large variety of feedstocks. Simple, energy-efficient Airex technology has cost and production stability advantages. Airex is now looking at building plants on the west coast of North America

Ensyn's 10-million-gallons per year pyrolysis oil plant in Port Cartier, Quebec, Canada is the largest thermal conversion plant in the world.

and also in Asia to supply the Japanese power market.

Double-down on energy density

Another transportable energy carrier is pyrolysis liquid, which is made from waste biomass but has twice the energy density of white wood pellets. Pyrolysis liquids have been produced commercially in North America by Ensyn and its partners for the specialty chemicals and heating fuel markets for almost 30 years. Ensyn is now ramping up production for the heating and cooling market and for use as a feedstock for oil refineries to produce renewable gasoline and diesel. Ensyn is now completing the largest thermal conversion plant in the world, a 10-million-gallons per year plant at Port-Cartier, Quebec, with start-up targeted for mid-2018. Ensyn will ship to customers by truck, rail, and barge. Fortum has already shipped pyrolysis liquids in rail cars loaded onto ships to cross the Baltic from Finland to Sweden. ■

FEATURE

Managing Expansion of National Biomass Supply

***By Andrew Lang**, Senior Consultant, WBA*

The successful development of a larger-scale bioenergy system requires that reliable biomass supply is maintained at a stable, competitive price. In many countries, the agencies that previously dealt solely with log sales are beginning to also supply the biomass market. Sometimes, government policy has played a major role in assisting this, including the subsidizing of costs of early thinning, chipping, and cartage.

Fueling a nation

In Sweden, biomass is now the country's single largest source of energy, and this is largely due to the development of an efficient supply of woody biomass to large city combined heat and power (CHP) plants. To enable this, regional facilities constructed near main rail lines have massive storage capacities of small diameter logs destined for pulp and paper production or for the biomass market, if unsuitable for pulp. Spur rail lines come off the main lines into these all-weather-surfaced sites, and large handling machinery allows whole trains to be loaded very quickly. Using the rail system (or lakes and rivers in Finland) allows the movement of biomass to be more economic than if it were transferred by road. A general estimate is that the cost of trucking biomass 100 kilometres by road is about the same as 400 kilometres by rail.

Continued on page 22 (bottom)

Baltpool, a state-managed biomass trading system, connects sellers with buyers and gives transparency on biomass pricing.

WBA News

Bioenergy is a complex and versatile energy form with a multitude of feedstocks, conversion pathways, and end products. Biomass is the only renewable energy source that can be used to provide heat, electricity, and transport fuels. Bioenergy is already the largest renewable energy form, and it has immense potential to make significant contributions to the future energy mix. At the same time, there are numerous challenges that must be overcome for the successful and rapid development of the sector. Adding to the complexity of bioenergy, many stakeholders are involved in the process: equipment manufacturers, farmers, power plant operators, end consumers, policy-makers, researchers, and many more. Finally, the energy sector is moving from a predominantly local and informal nature within the national boundaries to a more global and formal sector.

To capture all the complexities and potential of bioenergy, to challenge myths with facts, and to support stakeholders, there is a clear need for a global organization. That need is filled by the World Bioenergy Association (WBA). The WBA is the global organization dedicated to supporting the various actors in the bioenergy sector. Our mission is to promote the sustainable development of bioenergy on a global level. The WBA is a member-driven organization with a registered headquarters in Stockholm, Sweden.

ORGANIZATION

The organization is led by the president, who is also the chairman of the board. The president is ably supported by three to five vice-presidents representing the main geographical regions. Board members are elected every two years, while the president and the vice-presidents are nominated annually. The 2018 WBA board consists of 19 board members from 17 countries, who represent a wide range of professions, including farmers, researchers, associations, and private companies. The organization's daily operations are led by the executive director, who is elected by the board and supported by other staff members.

The WBA consistently participates at the annual Conference of the Parties event (United Nations Convention on Climate Change within the framework of UNFCCC). Shown here is the WBA exhibit booth at COP23 in Bonn, Germany from November 6 to 17, 2017.

MEMBERSHIP

Members are the foundation of the World Bioenergy Association. WBA strength lies in the vast network of members, comprised of 250 associations, companies, research institutions, and individuals coming from more than 60 countries. Membership is categorized into:

- Full Members: Mainly member-based associations.
- Associated Members: Companies, research institutions, consultancies, etc.
- Individual Members: Individuals.

Members pay an annual membership fee and receive numerous member benefits, including updates with the latest information on bioenergy, access to bioenergy data, invitations to WBA workshops and side events, discounts / complimentary access to WBA events and other supported events, and promotion through the various communication platforms.

ACTIVITIES

Networking: Study Trips

The WBA frequently organizes mission trips for delegates from different parts of the world to Europe and vice-versa. These mission trips include conferences and meetings, along with study visits, and offer an excellent opportunity for members and non-members to network and collaborate with leading companies and associations in the bioenergy sector. In 2018, WBA organized a study trip to Scandinavia for a delegation of energy companies from China. This provided an opportunity for the Chinese delegates to learn and connect with leading technology companies in the fields of combined heat and power, biomass handling, and processing technologies, etc. At the same time, European companies had an opportunity to learn about the current energy markets and policies in China.

Knowledge: Factsheets and Statistics Reports

A priority of the WBA is to be the clearing house for all things related to bioenergy. WBA aims to be a repository of information on bioenergy and ensure a fair, balanced, and fact-based approach to informing the members about the sector. To do that, the WBA publishes factsheets on different technologies and processes. Recent factsheets include *Energy Recovery from Waste, Biomass Supply Chains, Pellets, Carbon Neutrality, Combined Heat and Power,* etc. These factsheets are written by an expert (company / association) and reviewed by a steering committee made up of experts in that particular field.

Data is crucial for informed decision-making. Regular, updated, and reliable

Continued on page 22 (top)

WBA News

Continued from page 21

data is important for all relevant stakeholders. The WBA aims to improve the situation with bioenergy data with the annual flagship publication of *Global Bioenergy Statistics* reports.

Technology Transfer: BioED

A key pillar for promoting bioenergy is technology transfer. The transfer of technology and service from regions with a highly developed bioenergy sector to regions with a need for such technologies is important to promote the effective use of biomass globally. To facilitate a rapid exchange of technology between suppliers and clients, the WBA initiated the *Bioenergy Equipment Directory*. BioED is an online technology transfer portal which has a database of the leading technological solutions in the bioenergy field with equipment details, including capacities, costs, operation, and photos / videos. The database is organized geographically in order to further assist prospective clients in their search for solutions.

Outreach: Branch Offices

While the WBA secretariat is located in Stockholm, Sweden, WBA has a truly global network of members. In order to best promote the mission on a global scale, the WBA envisions a future where the organization has a physical presence on each and every continent. To this end, WBA set up the first branch office in China in 2017, with more branch offices in the pipeline, including offices in Indonesia, Canada, Turkey, Japan, Mexico, and Brazil. These branch offices will serve as a focal point for all relevant stakeholders in the country.

Projects: NGO Outreach

A key stakeholder in the bioenergy sector is the civil society represented by non-governmental organizations. Often, there are issues of misinformation surrounding the bioenergy sector. Currently, the WBA is working on discussing with pragmatic civil society organizations to develop a common understanding about the future role of bioenergy in a fossil fuel-free society. ■

WBA is a lean organization with a minimum set of staff. WBA is aided by the vast network of bioenergy experts worldwide who share the common vision of promoting the development of sustainable bioenergy on a global level.

Managing Expansion of National Biomass Supply

Continued from page 20

Using rail for moving biomass from these large storage areas to energy plants allows the development of additional large, biomass-fueled energy plants within Sweden. Due to their high efficiency and the use of both power and heat, these plants have helped Sweden achieve its European Union 2020 Renewable Energy Directive target by 2012.

Reducing reliance on natural gas

Another example is the Baltpool trading facility in Lithuania, which began operation in 2012. The national policy to reduce reliance on natural gas for heating and power has seen very rapid development in using forestry thinnings and wood residues. With the slow return of forests to private ownership following independence from the USSR in 1991, there was an urgent need for thinning and improvement of stands, and for the use of forestry thinnings and processing residues. Variations in biomass pricing between Lithuania's regions and states (and across the border with Latvia), over the annual demand cycle, became a problem as demand for biomass increased. To even-out biomass pricing, a state-managed biomass trading system called Baltpool was developed to allow efficient connection of sellers with buyers and give transparency on pricing. This online virtual marketplace has demonstrated the ability to expand, enabling it to handle tens of millions of tonnes of biomass annually.

The head of the trade division of BaltPool, Vaidotas Jonutis, describes how the biomass trading section of the Baltpool organization operates.

"The biomass exchange operator, JSC BALTPOOL, is a state-controlled company and is managed to stimulate competition and increase transparency," says Jonutis. "The Baltpool Biomass Exchange (www.baltpool.eu) was launched in 2012. At that time, about 30 per cent of heat energy in Lithuania was produced from biomass. Today, about 70 per cent of all our heat energy is produced from biomass. In order for biomass to become a strategic energy source, the launching of the biomass exchange was a plan for creating a transparent market. Today, it works on the same principles as the markets for natural gas, petroleum, and electricity."

Over the 2017 calendar year, Jonutis says the biomass section, dealing mainly in wood chips but also in pellets, had a trade volume of 63 million euros and 4.8 million megawatt-hours (MWh). Over this calendar year, Jonutis says the number of contracts exceeded 5,000.

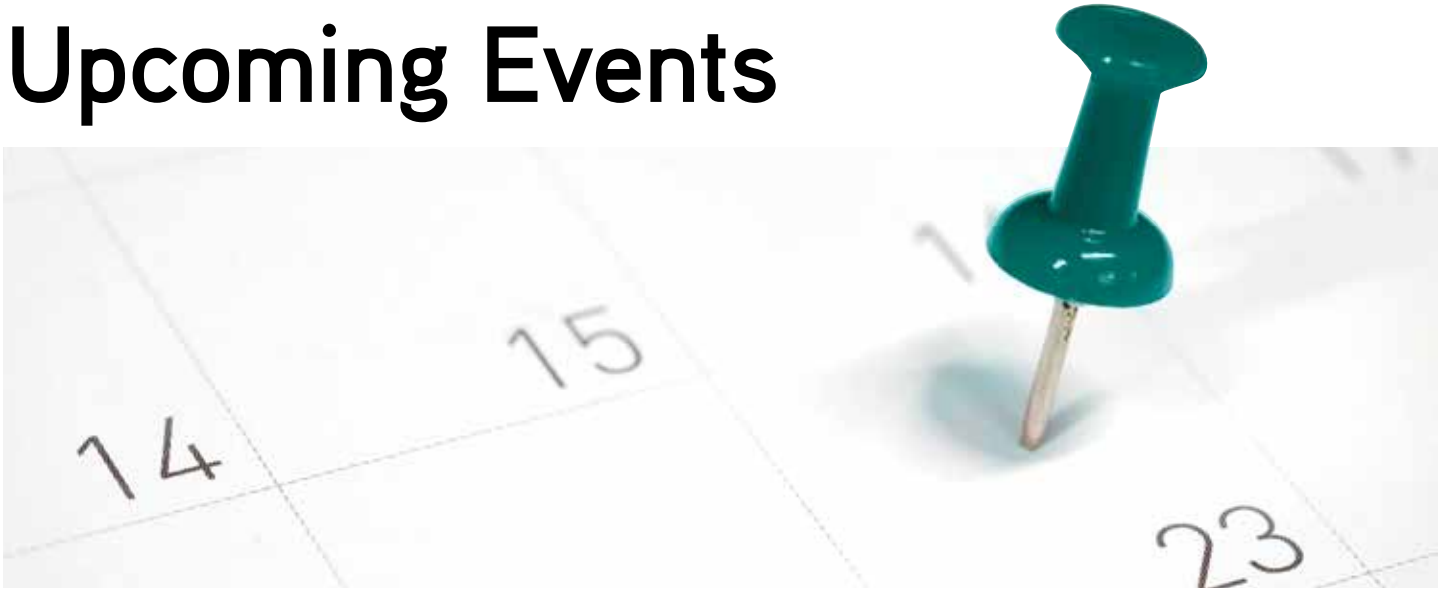
"There are contracts exchanged for both spot supply and longer-term supply," he says. "The average amount of biomass per spot contract was about 500 MWh, while the average amount of long term contract (which run for a month, a quarter, or a half-year) was 6,000 MWh. Baltpool doesn't have any contract period longer than a half-year."

"Our trading unit is the tonne of oil-equivalent (toe) where one toe equals 11.63 MWh. Biomass trading is able to specify quality and energy content because all delivered biomass for any contract processed within the BaltPool Exchange must be weighed and evaluated for energy value, with figures provided for moisture content, ash content, and energy value of dry material," says Jonutis "At this moment, Lithuania doesn't have any special regulation according sustainable sourcing, but I think in a couple of years, that area of regulation will be implemented."

Within the BaltPool Biomass Exchange, Jonutis says there are seven tradable products: four different grades of wood chips and three different grades of wood pellets. The most traded forms are two products of wood chips, SM2 and SM3, which make up more than 90 per cent of all turnover. To learn more about the SM2 and SM3 wood chips, go to www.baltpool.eu/en/products, where you can read about the required parameters for biomass products.

"Regarding the payment for biomass delivered under contract, the market participants settle this at the bilateral level and Baltpool doesn't participate in that process. But Baltpool holds financial collateral for every contract provided by the parties of the contracts. So, in the case of any settlement dispute, Baltpool has the possibility to activate the collateral once a decision is made on the individual case," says Jonutis. "For the average distance biomass is transported, we don't have accurate statistics, but knowing the usual practice, it's usually from 50 to100 kilometres. The Baltpool Exchange covers both Lithuania and Latvia, but the part of the market for Lithuanian biomass going into Latvia is minor. In Lithuania, we have about 70 per cent of all the market." ■

Upcoming Events



Stay informed on exciting industry developments by attending these informative events throughout the year. For more information, visit the WBA's Upcoming Events page, www.worldbioenergy.org/upcoming-events. For event organizers, if you wish to be included in the list of upcoming events, please contact the WBA Secretariat at info@worldbioenergy.org.

2018 EVENTS

October 3
Biofuels – Law, Markets and Trends
CBE Polska
Warsaw, Poland

October 10 to 11
International Biomass Congress and Expo
Bioenergy Insight
Berlin, Germany

October 16 to 18
Biomass North Forum 2018
Biomass North Development Centre
Thunder Bay, Ontario, Canada

October 29 to 31
Argus Biomass Nordics and Baltics
Argus
Copenhagen, Denmark

November 7 to 8
European Biomass to Power
ACI
Stockholm, Sweden

November 8 to 10
World Community Power Conference
WWEA, MFC, ISEP
Bamako, Mali

November 26 to 29
Study Mission China*
World Bioenergy Association
Changchun, China

December 3 to 14
COP24
UNFCCC
Katowice, Poland

December 4 to 6
Ethanol Latin America
F. O. Licht
Mexico City, Mexico

December 5
World Bioenergy Forum*
WBA, KIB, PIGEOR
Katowice, Poland

2019 EVENTS

January 16 to 17
Biomass Trade Summit Europe 2019
ACI
Rotterdam, the Netherlands

April 29 to May 3
WBA Annual Meetings 2019*
World Bioenergy Association
Washington, DC, USA

November 11 to 22
COP25
UNFCCC
Location: TBC

Event listings are current as of September 2018. Exact dates and locations may change. Please contact event organizers for confirmation.
**** denotes events hosted by the World Bioenergy Association.***

WBA members may get discounts on registration fees. For more information on how you can become a member and represent WBA, please contact info@worldbioenergy.org.

The Future for Biomass Energy is Bright: Enviva

John Keppler, Enviva Chairman & CEO

WBA interviewed John Keppler, Enviva Chairman & CEO, in July 2018

MARKETS

Q. Enviva covers around 15 per cent of the global production of industrial grade wood pellets and is an important part of the global pellet trade. What are your future projections of the pellet sector, and which are the most promising markets for the sector?

A. Biomass use around the world is at record levels, and industry experts expect continued growth for many years to come. Within Enviva's expanding customer set, we see the same growth profile. In Europe, which has been our largest market, we anticipate continued growth in both industrial and retail wood pellet demand through the 2020s, reflecting the shift away from coal and other fossil fuels.

Through the Renewable Energy Directive (RED) II, the European Union (EU) has reaffirmed the importance of biomass for heat and in dispatchable, baseload power generation applications, especially in combined heat and power (CHP) stations. In accordance with this new framework, national-level efforts to phase out fossil fuels could potentially create new demand for woody biomass. For example, we are watching developments in the Netherlands as they seek energy solutions that will reduce demand from the Groningen gas field while enabling the phase-out of coal by 2030. Likewise, in Germany, the recently formed coal commission is focused on the pathway to reduce dependence on coal, and other northern European nations such as Denmark continue to pursue new specific biomass power and CHP projects. We also expect steady ongoing growth in residential thermal markets across Europe.

We are confident that U.S. wood pellet exports will continue to play a key role in meeting Europe's energy and climate objectives—while ensuring grid reliability—well into the future.

In parallel, we anticipate significant growth in the industrial pellet market in Japan and South Korea. We are excited that wood pellets are becoming a globally traded commodity.

We are especially optimistic about the Japanese market and continue to

The Port of Wilmington in North Carolina.

invest in growing Enviva's physical presence in Japan. The Japanese government's feed-in tariff, carbon emissions targets, Best Energy Mix policy, and minimum generation efficiency requirement, coupled with a strong public aversion to coal and nuclear power, have created a strong set of incentives for power generators that is driving demand for biomass, particularly wood pellets.

The projected demand growth from South Korea is also encouraging, and we look forward to continuing robust participation in that market. Historically, South Korea has tended to focus on the spot market for volume; however, there have been signs of a shift in this market to long-term contracts as additional projects have been announced for co-firing and full conversion to wood pellet fuel. This is consistent with policymakers' proposal that the renewable portfolio standard require large energy companies to source at least 28 per cent of their power from renewable sources by 2030. This is up from 10 per cent in 2023.

Enviva's Sampson plant in North Carolina.

Q. How is Enviva prepared to serve emerging markets for wood pellets, in terms of expanding production or building new plants, etc.?

A. We operate in the U.S. southeast, where well-managed working forests and increasing forest inventories make it one of the most productive wood producing regions in the world. The U.S. southeast is uniquely positioned to meet this demand because its abundant resources and stable cost position give power generators and traders confidence to make infrastructure investments to use biomass fuel with the knowledge that reliable supply at a stable cost position is available for the long-term.

In terms of production and infrastructure, we are very focused on growth to meet anticipated demand. We are currently constructing a new plant in Hamlet, North Carolina, and increasing the capacity of our existing plants.

Earlier this year, we announced our second joint venture with John Hancock, which will facilitate development of another deep-water marine terminal, potentially in Pascagoula, Mississippi, and additional production plants, including one potentially located in Lucedale, Mississippi.

SUSTAINABILITY & CERTIFICATION

Q. Enviva recently implemented Track & Trace™, a system to verify every ton of wood procured for pellet production. What is the motivation for Enviva to implement such sustainability / certification schemes?

A. We invested in our industry-leading Track & Trace™ (T&T) program because transparency into our supply chain is an essential pillar of our commitment to sustainability. By collecting data on our sourcing and publishing that data on our website, we are accountable in a very public way for every ton of wood we purchase. That gives our customers and environmental and other stakeholders confidence in the sustainability of our product, and it gives all of us at Enviva certainty that our sourcing is consistent with the value we place on people and forests.

Q. Keeping in view the increasing trade of pellets worldwide, is there a need for a global standard for certification of wood pellets?

A. Certification provides our customers with independent confirmation that Enviva is doing the right thing and is being held accountable. Being certified means that an independent third party has audited our sourcing practices and certified us to be in compliance with rigorously established sustainability standards. Having multiple, internationally established certification systems and sustainability standards are positive developments for our maturing industry.

Enviva foresters and staff across the enterprise dedicate significant time and effort to maintaining our various certifications, which demonstrate the sustainability of our sourcing and pellet production. We currently maintain three types of certifications.

One certification I am particularly excited about is the Sustainable Biomass Program (SBP). SBP is the first credible standard for biomass used as a raw material input for power generation, which has not been a specific focus of other certification systems. SBP exists because no one has yet focused on biomass as a commodity input. Enviva holds SBP certification at all our facilities.

The next is Chain of Custody certification, which validates that biomass supply companies adhere to the highest industry standards of responsible fibre procurement, which includes provisions for preserving biodiversity, contractual requirements for the use of forestry Best Management Practices, legal and regulatory compliance, and management oversight and participation in sustainability processes.

And third, Forest Management certification validates that a landowner is managing his or her land according to commonly accepted management principles.

While certification is a great tool, we continuously seek ways to go even further than these requirements. As previously mentioned, Enviva's own Track & Trace, which is not a certification but instead a voluntary and proprietary program, has had the greatest impact on Enviva's wood sourcing. Thanks to T&T, we can provide our customers and stakeholders with unprecedented visibility into our sourcing.

We are also proud of our efforts to support conservation of environmentally sensitive forests. The Enviva Forest Conservation Fund will invest $5 million in grants to support the protection of at least 35,000 acres of bottomland forests. We also convened a Bottomland Hardwood Taskforce, comprised of conservation groups, scientists, and stakeholders from the forest products sector to recommend meaningful actions we can take as an industry through our sourcing and through working with landowners to support bottomland conservation and restoration.

POLITICS & POLICY

Q. How much do political uncertainties and policy changes (e.g. Brexit and the U.S. Pullout from the Paris Agreement) influence / change Enviva's business plans?

A. Policymakers around the world agree that biomass is an important part of a low-carbon renewable energy solution. We saw this most recently through the RED II deliberations in the EU. The EU seems to be in favour of a risk-based approach to biomass energy use that allows for cost-effective imports with proven sustainable sourcing.

We are confident this trend will continue as governments pursue science-based policies to reduce reliance on fossil fuels.

At the same time, it is good business to diversify our customer base, and we are doing that by moving into new regions such as Japan and the Caribbean and supplying pellets for other uses such as district heating, while continuing to support our traditional power generation customers in Europe.

In other regions, there is a growing recognition that predictable regulatory structures are necessary for meeting goals for carbon reduction. For example, in Japan, the regulatory certainty and willingness of counterparties to enter into 15- to 20-year agreements gives us the conviction to devote substantial resources to our Japanese customer set, not only by maintaining a local presence in Japan, staffed by commercial, logistical, and support professionals, but also to a pipeline of new plant and port infrastructure required to support the market's growth.

TECHNOLOGY & PRODUCTS

Q. What is Enviva's opinion on off-gassing and self-ignition of wood pellets? Are all problems technologically solved or is there still demand in research and development?

A. We cannot compromise on safety. By design, we make a combustible product, and our job is to make sure it can be safely handled by our employees, partners, and customers.

Whether the issue is off-gassing, self-heating, or fines, dust and the like, the key to producing a safe and stable wood pellet is not only understanding the bio-chemistry and thermodynamic and mechanical applications of the manufacturing operation, but also prioritizing safety and making operational discipline a part of our company's culture so that we do things the right, safe way every time. Safe practices and strict protocols are instilled in our culture at every level of the company. We invest heavily in safety, training, and professional manufacturing practices.

This approach has allowed us to continue to grow the production capacity at each plant and make substantial improvements in quality, safety, and product stability.

CHALLENGES & OPPORTUNITIES

Q. What are still the major hurdles for rapid uptake of pellets in terms of regulation, environmental groups, misinformation, economics, etc.?

A. We still have work to do to educate policymakers, potential customers, the environmental community, and our critics about the many benefits of biomass and the science our industry is based upon. As the company and industry grow, we have a stronger voice to tell what has sometimes been seen as a complex story. Biomass produced sustainably in southeastern U.S. is playing an increasingly important role in improving the environmental profile of energy generation in a cost-effective way and in providing economic benefits throughout our entire supply chain. It is a powerful story about the carbon benefits of replacing coal with biomass and about the positive relationship between the rates of forest harvest and forest regrowth.

Q. What would be your message at UN Climate Conference in Katowice, Poland in December 2018 and to the wider international energy and climate community on the potential of pellets to replace fossil fuels?

A. Our message is that woody biomass is a clean and renewable source of energy that allows power and heat generators to eliminate coal and reduce their carbon footprint up to 85 per cent on a lifecycle basis. For power generation, wood pellets provide reliable and dispatchable energy that complements the intermittency of wind and solar energy, ensuring a stable grid without having to rely on fossil fuel-fired back-up. Switching from coal to wood pellets can often be done without undergoing major renovations to existing power plants, making biomass a quick and cost-effective solution as well. There is also a growing number of applications for biomass in heat and CHP at many different scales. So, in short, the future for biomass energy as part of a low-carbon suite of technologies is bright. ■

Reasonable Investments in Wood Biomass for Clean Energy: Enerstena Group of Companies

Global energy consumption is still dominated by fossil fuels. In 2017, renewables accounted for 18 per cent of the energy share, while oil, natural gas, and coal together account for a little bit less than 80 per cent. Bioenergy is the largest renewable energy source, accounting for 14 per cent of energy consumption, most of which is used for heat and steam production and electricity generation. Usage of renewables ideally has a positive impact for the economy and the environment. One of biggest modern environmental concerns is the negative effects of anthropogenic climate change from CO_2 emissions, 65 per cent of which are from industrial processes involving the burning of fossil fuels.

Based in Lithuania, the Enerstena Group has been in the energy market since 2002. Well-known in the Baltic States as the company providing solutions for energy production from biomass, the Enerstena Group has implemented around 200 complex projects in Lithuania, Latvia, Finland, France, Denmark, Estonia, Belarus, and Ukraine. Company activities include engineering services, designing and manufacturing equipment, and project management. Keeping in mind the global climate challenge, the company actively follows pollution reduction policy and creates solutions for efficient heat generation while protecting the surrounding environment. The biomass combustion equipment manufactured by the company has always conformed to—and even exceeded—the requirements of European Union directives for the concentration of pollutants in combustion products. All of the efficient heat generation solutions are focused on environmental sustainability.

Out of almost 200 projects executed by the Enerstena Group, the majority relate to energy efficiency improvements through the installation of condensers in existing boiler houses and implementing boiler houses for district heating companies for hot water production. Over the last five years, many industrial companies have expressed interest in installing biomass boiler houses for steam generation or combined heat and power generation. The Enerstena Group is the first company in Lithuania to install a biomass firing steam boiler house for the industry.

An Enerstena wood pellet boiler house for steam generation for an industrial company in Lithuania.

Since biomass is carbon-neutral, there is significant emissions-reduction potential for electricity and heat production sectors by transitioning from fossil fuels to biomass. The electricity and heat production sectors are already increasing biomass usage, but the industrial sector is still struggling. Based on our project experience, there are some myths in the industrial sector surrounding biomass that must be disproven to increase biomass usage, including:

1. **Reliability:** A modern burning system can operate continuously for up to 8,000 hours yearly. The typical lifetime is 20 years.
2. **Flexibility:** Energy systems can be designed with the capacity to cover short-term peak demand for energy.
3. **Efficiency:** Hot water or steam boilers can reach a boiler efficiency of up to 90 per cent. Additional heat recovery equipment such as flue gas condensers can be installed to further improve efficiency. This efficiency can be achieved with low electricity consumption: 10 kW_{el} / 1MW_{th}.

Continued on page 29 (bottom)

Example No.	Energy Consumption, MWh	Primary Fuel for Energy Production Before / After	Investment, EUR	RES Shares Before / After, Per Cent	CO_2 Savings, t	Investment, EUR / CO_2 Savings, t
Object 1	14.160	Coal / Biomass	1.550.000	0 / 60	4.180	371
Object 2	21.200	Coal / Biomass	2.550.000	0 / 50	8.690	293
Object 3	101.400	Gas / Biomass	8.960.000	0 / 80	24.170	371
Object 4	7.200	Heavy Fuel Oil / Biomass	517.500	0 / 89	2.040	254

Table 1. Feasibility study findings from representative examples.

Bioenergy in Sweden

An aerial panorama of Stockholm, Sweden.

The World Bioenergy Association team at the secretariat in Stockholm, Sweden. From left to right: Viktorija Kazluaskaite, Karin Haara, and Bharadwaj Kummamuru.

KEY FACTS

Population: 9.9 million
Country Area: 447,435 km^2
GDP: 514 billion USD
Energy Consumption: 34 Mtoe
Emissions: 37.1 Mt CO_2
Renewable Energy Share*: 54.1%
Bioenergy Share*: 36.9%
**As a share of final energy consumption*

Scandinavia has always been a success story for a sustainable society. The Scandinavian countries consistently rank among the top nations in terms of social, economic, and environmental indicators. They have stable economies, high social awareness, and impressive environmental standards. While there are many other nations with similar situations, the Scandinavian countries stand out in their success with decreasing fossil fuel dependence, and the country leading in this green transformation is Sweden.

During the 1970s, the country was almost completely dependent on fossil fuels, with oil accounting for 70 to 80 per cent of the Swedish energy system. Since the oil crisis during that decade, the country has slowly moved toward a more sustainable and renewable energy system.

Currently, bioenergy dominates the energy mix. In 2017, biomass was not just the largest *renewable* energy source, but was, in fact, the largest single source of energy consumed in the country. The share of bioenergy in the energy system (37 per cent) is more than all fossil fuels combined (31.7 per cent). Biomass in the country is converted to supplies of reliable and clean energy to consumers in the form of electricity, heating, and liquid and gas fuels for the transport sector.

Continued on page 29 (top)

Bioenergy in Sweden

Continued from page 28

The most common use of biomass in the country is for heating, either by way of large-scale combined heat and power plants or district heating plants to supply via district heating grids or through direct use in individual boilers. Biomass heat currently accounts for more than half of all space heating. Various types of predominantly forest-based biomass are used for bioheat production in the country.

Electricity from biomass is the fourth largest electricity source in Sweden, providing seven per cent of the electricity for the country. Biopower in the country is produced in an efficient way and has numerous advantages, including continuous and reliable production of electricity (no intermittency), low-distribution losses (plants located close to population centres), flexibility of fuel use, co-generation of heat, and decentralization of energy generation. The most common biomass sources include bark, wood chips, pellets, and black liquor.

Sweden is also the leading country in the use of renewable fuels in the transport sector, with biofuels playing a major role. The major biofuels include ethanol, hydrotreated vegetable oil and rapeseed biodiesel, along with an increasing share of biomethane in the natural gas grid used for vehicles, including city buses. Biofuels currently make up more than

20 per cent of transport fuels—far higher than any European country and more than double the European Union targets for 2020.

The bioenergy and renewable energy sectors in Sweden have received widespread support to increase its uptake in the past with green certificates, tax exemptions, investment support, etc. One of the main drivers for reducing the use of fossil fuels and increasing the use of bioenergy, however, has been the introduction of a carbon tax.

A carbon tax is a simple and effective way to reduce fossil fuel use, increase energy efficiency, and allow renewables to compete against fossil fuels on a level playing field. The tax can be tax neutral (e.g. by reducing income taxes), easy to calculate and apply, and very efficient by following the polluter pays principle. Sweden has the highest carbon tax in the world, at more than 120 euros / tCO_2e for both general and industrial sectors. The high carbon tax has enabled the country to increase its share of renewables in the energy mix, and Sweden has been able to successfully decouple emissions from the economy. Since the carbon tax was implemented in 1991, the economy has grown by 75 per cent while the country's emissions have been reduced by 26 per cent. A key benefit of carbon tax is that it can be applied to all sectors.

Looking ahead, there is strong public support and political will for Sweden to be a world leader in renewable energy. The country already has an impressively high share of renewables in the energy sector and has a target to be one of the world's first fossil-free countries. The success story of bioenergy in the country provides an important lesson for other countries on how the sustainable development of bioenergy can help a nation reduce its energy imports, create jobs, reduce greenhouse gas emissions, and protect the environment. ■

Reasonable Investments in Wood Biomass for Clean Energy: Enerstena Group of Companies

Continued from page 27

4. **Environmental:** Flue gas cleaning equipment can ensure less than 20 mg / Nm^3 of solid particles in emissions.
5. **Automatization:** Advanced biomass systems require the same amount of manpower as fossil fuels systems, with similar remote-control possibilities.

To summarize, biomass burning systems in the range of 1 to 20 MW power production (which is most often the range the industry falls into) can perform comparably with fossil fuel systems, from a technical perspective. To achieve our objectives, the Enerstena Group suggests a turn-key project implementation solution or reliable partnership within the scope of equipment supplier in relevant projects while delivering the above benefits.

Every industrial plant has unique energy needs; therefore, pre-project evaluations must be performed properly. The scope of pre-project evaluations should include estimates for several key factors—fuel market analysis, analysis of a plants energy production / consumption situation, technical-economic estimates for alternatives, and a project development plan.

Project example: Philip Morris International

The Enerstena Group performed a worldwide feasibility study for Philip Morris International affiliates in 2017-2018. The goal of the feasibility study was to investigate how to reduce CO_2 emissions with a positive economic effect and eliminate coal firing equipment. The study showed that reliably supplied biomass could be a promising alternative to cover basic energy needs for the affiliates.

Fuel market analysis showed that an evaluation should be performed for each affiliate with its own unique biomass sources. Potential biomass sources include waste wood, wood pellets, rice husk, olive residues, and tobacco production waste among others. Energy from biomass is economically feasible and could reduce cost of total energy production by 50 to 90 per cent with a payback term of four to six years. Biomass can replace coal firing systems, but the final energy price (EUR / MWh) after implementation of the biomass systems should be comparable to the preexisting situation. Installation of biomass equipment for the industry can greatly reduce CO_2 emissions, and investment in CO_2 emission reduction can exceed 250 to 375 invested EUR per saved CO_2 tonne.

In conclusion, biomass is a reliable and stable energy option to replace coal in existing energy plants and Enerstena Group of Companies is working towards ensuring a clean and renewable future. ■

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