Project InBio

A new biomass chain designed for large-scale production and bulk import of certified and affordable industrial pellets for co-firing and dedicated biomass plants.
Colophon

Date February 27, 2014
Status Final report
Project number DBI01006
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This study was carried out in the framework of the Sustainable Biomass Import regulation, with financial support from the Ministry of Economic Affairs and Foreign Affairs, by:

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Background
Following the launch in 2010 of the DBI tender (Sustainable Biomass Import) by NL Agency (now RVO), the Inbio consortium submitted a subsidy request.
On November 15, 2010 the project consortium, consisting of Everest Energy (EE), Control Union (CU), FRAM Renewable Fuels (FRAM) and Utrecht University (UU), has obtained within the DBI program, a subsidy with project number DBI01006.

Project Summary
The Inbio project aims "to develop a new biomass chain designed for large-scale production and bulk import of certified and affordable industrial pellets for co-firing and dedicated biomass plants." For this reason the InBio consortium has been created. The study performed has identified availability of feedstock sufficient to supply inputs to three pellet mills, each of 100,000MT/year capacity. Total export potential after five year operations is estimated up to 1,500,000MT. Commercial roll-out phase began already in 2012, nonetheless certification of the wood pellets has yet to be accomplished. No existing framework fully complies with the selected criteria and no buyer is interested in un-certified pellets.

Project History
Q1 2011 Long list of US potential feedstocks;
Q2 2011 Shortlisting input streams;
Q3 2011 Georgia Economic Development board expressed its support for the project;
Q3 2011 Test production of 4 MT using two of the three shortlisted feedstocks;
Q3 2011 Start certification by process description;
Q3 2011 Start Utrecht University Supply and Demand analysis South-East USA;
Q4 2011 Test pellets analysed and are equal to wholesale industrial pellets;
Q4 2011 Utrecht University Supply and Demand analysis Poland;
Q4 2011 Utrecht University Supply and Demand analysis Baltic states;
Q4 2011 Test production of 2 MT using third shortlisted feedstock;
Q1 2012 EE started cooperation with engineering consultants Make-Projects;
Q1 2012 CU and UU start with certification program pellets;
Q1 2012 EE start shortlisting buyers pellet program;
Q3 2012 UU finalized logistics value calculation pellet program;
Q3 2012 EE started development pelletizer asset Poland;
Q3 2012 EE started development pelletizer asset Netherlands;
Q4 2012 Project partners requested to extend the project (extension fully paid by project partners with no additional funding of RVO) – Request approved;
Q1 2013 CU started its InBio B project focusing on solving the certification challenges;
Q2 2013 Project partners focused on solving certification challenges;
Q2 2013 Project partners requested to extend the project (extension fully paid by project partners with no additional funding of RVO) – Request pending;
Q3 2013 Request for extension denied, project is requested to finish. Project partners to write final report;
Jan 2014 Draft final report handed in.
1. **Context and reasons for the project**

Trade of solid biofuels has increased rapidly in the last decade. Between 2000 and 2010, it expanded from 56.5 PJ to 300 PJ with the strongest growth for wood pellets (Lamers, Junginger et al. 2012). The IEA predicts that by 2035 global trade of biofuels for transport and solid biomass for power generation could grow by a factor of up to six (Matzenberger et al., 2013). In particular, the production of wood pellets increased from 6-7 Mt in 2006 to 14.3 Mt in 2010 with capacity increasing to over 28 Mt in 2010 and consumption approaching the 13.5 Mt (Cocchi, Nikolaisen et al. 2011).

![Figure 1: Global wood pellet production and consumption. Source: Matzenberger et al., 2013](image)

The most significant production capacity growth has been recorded in the US, Canada and Russia, whereas the main market for wood pellets continues to be the European Union. Between 2008 and 2010 European consumption of wood pellet has increased by almost 44%, exceeding the 11Mt and now representing over 80% of total worldwide wood pellet demand (Cocchi, Nikolaisen et al. 2011).

In the same period, the availability of sawmill residues, primary source of wood pellet production, decreased due to the developments in primary wood markets (e.g. housing sector crisis), but also due to the growth of the pellet market itself. Pellet producers have therefore broadened their supply portfolio with alternative feedstocks such as low grades of primary round-wood and forest residues (Hoefnagels, Junginger & Faaij, 2012).

With the expected global demand to increase to between 45 Mt and 80 Mt by 2020 (Cocchi, Nikolaisen et al. 2011), the wood demand for pellet production and alternative feedstocks will also increase (Hoefnagels, Junginger & Faaij, 2012).
With growing demand of solid biomass for bioenergy purposes, the importance to find alternative resources that could be sustainably produced also rises. In this context, RVO has developed two programs targeting biomass projects: the DBM and DBI. The DBM (Global Sustainable Biomass) program aimed to stimulate, support and facilitate the promotion of sustainability of the production, processing and import of biomass produced in developing countries, leading to the application of biomass for energy purposes. On the other hand, the DBI (Sustainable Biomass Import) program had a similar aim but with focus on production of biomass for export to the Netherlands rather than local markets. Overall, these two programs fit into the Netherlands' wider purpose of contributing towards the achievement of the UN Millennium Development Goals.

The Inbio project was sponsored by RVO in context of the latter program: the Sustainable Biomass Import (DBI). Specifically, the Inbio project aims to make low value residue streams, available for the production of certified, industrial pellets that are economically attractive for large scale electricity generation in Europe.

By-products from primary wood processing industries, the main source of wood pellet production, are already used today. For example, in the south of US, 99% of plant bark and wood by-products are used for industrial fuel, fibre products or miscellaneous products (Johnson, Bentley et al. 2009).
Moreover, the sawmilling industry retrenched due to the reduced demand of wood materials as a result of the recession, resulting in an imbalance between supply and demand of secondary wood residues (Hess, Jacobson et al. 2010).

There are, however, other low value wood residue streams that are currently underutilized and sold below market value or landfilled. Although most of these wood residues and wood wastes are, in their unprocessed form, unsuitable for the production of industrial wood pellets due to undesired properties such as a high ash content or contaminations, part of this material can become available when the biomass material is properly collected or if advanced pre-processing would be used. Processing of these low-value wood resources by pelletization, results in a high value energy commodity that can be transported efficiently over long distances and used in conversion systems such as co-firing in coal fired power plant.

2. Objectives of the project

The Inbio project aims to make low-value woody biomass streams that are currently underutilized and sold below market value or discarded as waste (usually because ample alternative wood resources are accessible or that is at present landfilled), available for the production of industrial wood pellets to be used in the European markets. Specifically, Inbio thus intends to:

1. Identify the net availability and test potential wood resources in the south-east of the United States and in the Baltic States (including Poland);
2. Produce of a bulk transport of industrial, certified pellets obtained from these wood resources to be exported to the European VARAGT ports;
3. Execute research on chain optimisation, evaluating for instance economies of scale and optimized logistics;
4. Evaluate sustainability certification and impacts on soil and GHG balance;
5. Scale up production of wood pellets from low-value wood resources and to start a similar project in other locations.

The consortium consists of a project developer and advising company (Everest Energy – penholder of this project), a wood pellet manufacturer (FRAM Renewable Fuels, LLC), a certification institute (Control Union) and a research institute (Copernicus Institute of Sustainable development). The team’s expertise and its wide and diverse sphere of specialization allows a clear understanding of the project from all angles and thus foster the capabilities to achieve the agreed objectives.

Figure 4: FRAM Renewable Fuels pellet plant (US)

Although low-value wood resources are globally available, two research focus areas were selected with the aim to identify the potential of low-value residue streams and to optimize the production in detail (Hoefnagels, Junginger & Faaij, 2012). These two regions are:
- the south-east of the United States (Florida, Georgia, North Carolina, South Carolina);
- the Baltic States of Lithuania, Latvia and Estonia and Poland.

Following RVO target market, the destination of wood pellets produced from both selected regions of this project is the VARAGT region (Vlissingen, Amsterdam, Rotterdam, Antwerp, Gent, Terneuzen).

The production of sustainable certified pellets from low-value wood resources represents an innovative project which will have (when fully operational) important impacts on the production of sustainable biomass for co-firing and dedicated biomass plants. Current markets look in fact only at medium/high value wood resources and not at residual woods.
In particular the InBio consortium has set the following project targets:

- **a)** shortlist target fuels for the production of the certified sustainable pellets;
- **b)** conduct a resource assessment on the shortlisted fuels in the two target regions (south-east of US and the Baltic states including Poland);
- **c)** test the production of pellets using the shortlisted feedstocks and analyse their characteristics, introducing the practices of cleaning and pre-treatment of input materials;
- **d)** draft the sustainability criteria of the shortlisted fuels;
- **e)** perform analysis of chain optimization, sustainability and sensitivity analysis;
- **f)** establish a sustainable certificate for the residual-wood industrial pellets;
- **g)** commercial development of future pelletizer plant;
- **h)** produce, transport and sell 12,000 MT of pellet production.

For each of the described objectives of this project, the following two sections of this report will describe the activities that the consortium partners have undertaken in order to realize these goals and the specific results achieved.

### 3. Activities undertaken in the project

One of the activities that the InBio project implemented has been the identification of the target fuels to be used for the production of the pellets in the two regions of interest. A study on a long-list of seven commodities has been carried out, based on the following criteria:

1. demand (low to moderate);
2. availability/supply;
3. delivered price;
4. chemical and physical properties (size, moisture content, contaminants, ash content).

On the basis of the results of this first analysis a shortlist of three target commodities, that are currently underutilized (because of abundant available alternative resources) or landfilled as waste and with favourable availability and characteristics, has been identified and used for testing.

In order to identify the availability of the three shortlisted fuels, two specific studies have been carried out, one based on practical experience of FRAM Renewable Fuels and one report based on a statistical approach/desk study (making use of statistical and geographic databases, literature and expert knowledge from relevant institutes) of Utrecht University. The latter includes supply & demand and logistics cost study (Hoefnagels, Junginger & Faaij, 2012). In particular, the USDA Forest Service database has been relevant for the identification of the geographical and economic potential of the various biomass resources in the United States target areas. The emphasis of this research has been on the current supply potential and cost of biomass, but also short (2020) and medium term (2030) scenario projections have been executed.
These studies have also involved physical site visits in both target regions (south-east of United States, Poland and Latvia). In particular, the field study in Poland was combined with a short internship of three weeks at the Baltic Energy Conservation Agency (BAPE) located in Gdansk, Poland and three weeks at the engineering consultancy Ekodoma located in Riga (Latvia).

In United States, wood products are an important source of raw material for various sectors with residential construction being the largest consumer. Total consumption has illustrated an increasing trend from 1950 to 2005 with gaps during the oil crises and a sharp plunge after 2005 with the global financial crisis which has affected in particular the housing market (McKeever & Howard, 2011).

![Figure 5: Wood product consumption US 1990-2009. Source: McKeever & Howard, 2011](image)

The availability study performed in the states of Florida, Georgia, North and South Carolina has delivered encouraging results. In these states, the total volumes of low value wood streams, of the three shortlisted commodities, are sufficient to supply material to at least three pellet mills, each one with a capacity of 100,000MT/year output (Hoefnagels, Junginger & Faaij, 2012). In particular, most of the supply potential is provided by one of the three shortlisted feedstocks and by 2020 resources availability is expected to further increase by 1.5%.

In order to assess the supply cost of the raw material to the pellet facility, two existing plants were chosen. Both of them are located in Georgia and respectively in Baxley and Sylvania. Cost-supply curves have been estimates in order to identify the best size of each potential pellet mill. In fact, while larger plant size leads to decreasing costs of capital and O&M due to economies of scale, it also means higher costs of feedstock as a result of longer hauling distances necessary to meet the demand of the mill itself. The optimal size of the plant will depend on the price of the biomass shortlisted sources available.
Furthermore, in order to show the effect of different parameters and the related uncertainty on the total cost of the pellet production a sensitivity analysis has also been executed (Hoefnagels, Junginger & Faaij, 2012).
The results of the sensitivity analysis show that the choice of the locations of the production sites has a significant effect on the cost of pellet production as a result of hauling distances from supply sources. Additionally, the impact of varying the feedstock supply potential is especially high, with small pellets plants being less sensitive to this factor. On the other hand, variations on the price of boiler fuel will be of bigger impact for larger mills. Finally, changes in the electricity prices will have minimal alterations among different plant dimensions. (Hoefnagels, Junginger & Faaij, 2012).

Several potential sites for the production of the residual wood pellets have been identified in Georgia (United States) and either Brunswick or Savannah (both located in Georgia) are the most likely harbours in the United States for the export of the produced pellets.

![Figure 8: Focus area and exit harbours. Source: Google Maps](image)

Not so positive, on the other hand, are the data that emerged from the Baltic states (Estonia, Latvia and Lithuania) and the Polish market. The statistical research has been employed on a country level, and based on the current production of primary wood, secondary wood products and the amount of tertiary residues. In order to identify the wood streams and unused residue streams in these countries, a wood balance of the wood industry has been prepared. Moreover, estimated future trends in the wood sector were included to evaluate the long-run potential. Data of this study has showed that no large amounts of unused secondary residues can be identified and thus can be used in this project for the development of pelletizers (Jong, 2012).

The largest potential of unused wood residues is found in Poland (3.68 Mm³ solid wood equivalent). The biggest share of this potential comes however from tertiary residues, as all secondary residues are already used in this region (Jong, 2012). In both Lithuania and Latvia, the technical potential is estimated below 1 Mm³ of solid wood equivalent, respectively at 0.36 Mm³ and 0.68 Mm³. At last, in Estonia the estimated potential is insignificant, as current residues are either used or exported (Jong, 2012).
Figure 9: Production, use and potential of residues in the Baltic States and Poland. Source: Jong, 2012

All in all, residues are available (above all in Poland), but they mainly consist of tertiary residues, which are (at this point) mostly not mobilized (Jong, 2012). Furthermore, there is a lack of insight in both the quality and quantity of these wood streams (data was not available to the level of detail needed for this analysis). Finally, when looking at possible future developments, wood markets in Poland and the Baltic Countries are expected to grow, but the evolution of the residues potential is not linear due to more efficient processes and different product outputs (Jong, 2012).

Another key activity executed during the Inbio project has been the test of the input fuels. Pellet analysis of the shortlisted feedstocks has been executed by the Technical Laboratory Rotterdam in October 2011 and has shown positive results (ash contents values below 1%). Moreover, in 2012 a first test production of 6MT has been executed by FRAM Renewable Fuels in Georgia (United States). All three shortlisted fuels have been used and all input materials have been tested/analysed before use. Wood cleaning process has been executed by pre-cleaning and feedstock segregation.

Furthermore, the InBio consortium, and in particular Control Union, has evaluated existing certification frameworks with the aim to identify be the most suitable for the compliance with EU’s Renewable Energy Directive for solid biofuels (Sikkema, Meyers & Schipper, 2012). Among state of the art certification systems, three main frameworks have been considered: Green Gold Label (GGL), NTA8080, and ISCC. In particular, in order to test the suitability of each certification system five selection criteria have been taken into account (Sikkema, Meyers & Schipper, 2012):

- coverage of the sustainability criteria (as of European Energy Directive (RED) and possible country specific binding requirements;
- GHG Balance (70% GHG emission reduction);
- Cost efficiency in meeting the objectives;
- Consistency with existing policies;
- Operationality and scalability potential on an international level.
<table>
<thead>
<tr>
<th>Major items</th>
<th>NTA 8080 (NL)</th>
<th>ISCC plus (D)</th>
<th>GGL RWE (NL, etc)</th>
<th>CRM</th>
<th>IWPB (E-sector)</th>
<th>ENplus (Aebiom EU-27)</th>
<th>SPB Drax (UK, etc)</th>
<th>BVP Electrabel (B, etc)</th>
</tr>
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<td>2. GHG calculation tool</td>
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<td>✔️</td>
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<td>5. Consistency with policies</td>
<td>✔️</td>
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<tr>
<td>5. International scale &amp; operationality</td>
<td>?</td>
<td>?</td>
<td>✔️</td>
<td>X</td>
<td>X</td>
<td>?</td>
<td>✔️</td>
<td>✔️</td>
</tr>
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</table>

*Figure 10: Suitability of Certification Systems. Source: Sikkema, Meyers & Schipper, 2012*

There is no framework that complies 100% with our selection criteria. Thus, in order to have an appropriate context in place to evaluate the use of possible new feedstock for the wood residue pellet production, Control Union has selected the one closest to the Inbio project needs at the preparatory stage: Green Gold Label (GGL).

The research to establish a sustainable certificate for our wood residue pellets has been executed. However, the implementation of the certification has not yet been accomplished. The pellets are not eligible for certification under the current certification systems, especially GGL system being the project preferred choice. The major change to the current GGL certification Protocol needed is the incorporation of post-consumer waste wood (grade A) and the explicit exclusion of the other grades for the pelletization processes in the Inbio A (Sikkema, Meyers & Schipper, 2012). Getting our residual wood streams accepted as input and thus auditable can take much time. As a result, we have contacted also another certification party: NTA8080. At present, the process is still ongoing and the discussion with both certification parties continues. The scope of any applicable certification framework for solid biomass (e.g. wood pellets, chips) has to be enlarged in the future with clean residual wood (Sikkema, Meyers & Schipper, 2012).

The commercial roll-out phase began in 2012. We have had positive reactions from potential commercial partners and the results of pellet analysis reports are very good and give a strong basis for commercial development. Nonetheless, the certification issue has to be resolved first.

Cost price for our pellets has been established and commercial terms for buyers have been defined. Several pitches have been done. Nonetheless, the production of the 12,000 MT of test pellets has not yet been executed because no buyers interested in the un-certified pellets have
been found. Clean tertiary wood residues are not allowed in many European import wood pellet purchase contracts. This is due to perceived contamination from various potential hazards. Getting acceptance of residual wood as certified input material proved to be time consuming, therefore the production of the test quantity has suffered significant delays. Buyers will not pay our production cost price as long as the pellets are not certified. Hence, at present, we have an unsellable product.

4. Results of the project

The production of sustainable certified pellets from low-value wood resources represents an innovative project which will have (when fully operational) important impacts on the production of sustainable biomass for co-firing and dedicated biomass plants. The InBio project, even though not entirely finalized, has been able to achieve important results. Here we present for each of the previously mentioned targets the corresponding results.

a) Shortlist target fuels for the production of the certified sustainable pellets:

The InBio consortium has, based on criteria of demand, availability, delivered price and chemical and physical properties, shortlisted from seven commodities three target fuels to be used for the project (Hoefnagels, Junginger, Faaij, 2012 and Sikkema, Meyers & Schipper, 2012).

b) Conduct a resource assessment on the shortlisted fuels in the two target regions (south-east of US and the Baltic states including Poland):

Based on these selected fuels the InBio has given an overview of the net volume of low-value residues that are available for large-scale industrial production of certified pellets, by applying cleaning process, in two target regions: the south-east of the United States (Florida, Georgia, North Carolina, South Carolina) and the Baltic States including Poland (Hoefnagels, Junginger & Faaij, 2012). Research has focused not only on the current supply potential and cost of biomass, but also on the short (2020) and medium term (2030) projections. Furthermore, the study has combined desk research with physical site visits in both target regions.

Positive results have emerged from the availability study performed in the United States. The total volumes of low value wood streams from the three shortlisted biomass sources in the south-east of the US are sufficient to supply material to at least three pellet mills, each one with an output capacity of 100,000MT/year pellets. Furthermore, feedstock availability is expected to increase in the future (Hoefnagels, Junginger & Faaij, 2012).

On the other hand, the results of the study conducted in the Baltic (Lithuania, Latvia and Estonia) and Polish regions were not as encouraging. In these countries, in fact, the study has showed that no large amounts of unused secondary residues for development of pelletizers can be identified with the statistical approach used in this project (Jong, 2012). The only residues available are
tertiary residues (mainly in Poland), which are at present to a large extent not mobilized. Furthermore, possible future developments, presume growth in the wood markets of these countries, but the evolution of the residues potential is not linear due to more efficient processes and different product outputs (Jong, 2012).

c) **Test the production of pellets using the shortlisted feedstocks and analyse their characteristics, introducing the practices of cleaning and pre-treatment of input materials:**

Pellet analysis of the shortlisted feedstocks has been executed by the Technical Laboratory Rotterdam in October 2011 and tests have proven that, from an operational point of view, the residual wood pellets have the same quality of normal wood pellets (Sikkema, Meyers & Schipper, 2012). Furthermore, in 2012 a first test production of 6MT has been executed by FRAM Renewable Fuels in Georgia (United States), making use of all three shortlisted fuels.

d) **Draft the sustainability criteria of the shortlisted fuels:**

Control Union, has evaluated existing certification frameworks with the aim to identify be the most suitable for the compliance with EU’s Renewable Energy Directive for solid biofuels. There is no framework that complies 100% with our selection criteria. Thus, we have selected the one closest to the Inbio project needs: Green Gold Label (GGL) (Sikkema, Meyers & Schipper, 2012).

e) **Perform analysis of chain optimization, sustainability and sensitivity analysis:**

The InBio consortium has been able to identify several potential sites for the residual wood pellets production is the south-east of the United States (Georgia). Possible exit harbours are, as mentioned previously, either Brunswick or Savannah, both also located in Georgia. Sensitivity analysis has also been carried out and in particular, the impacts of changes in the possible locations of the pelletizers and in the feedstock supply potential are the most impacting for the outcome of the project (Hoefnagels, Junginger & Faaij, 2012).

f) **Establish a sustainable certificate for the residual-wood industrial pellets:**

At present, we still have not been able to provide a new or modified certification system for our wood residual pellets. This is due to perceived contamination of the feedstock. The scope of any applicable certification framework for solid biomass (e.g. wood pellets, chips) has to be enlarged in the future with clean residual wood (Sikkema, Meyers & Schipper, 2012).

Thanks to additional research capabilities offered by RVO we have been investigating the exact differences between our process and the existing frameworks: GGL, ISCC and NTA8080. In particular, the (pre-certification) tests for integrating post-consumer residual wood with the GGL certification framework identified four possible certifications bottlenecks (Dam, Ugarte, Spijkers, 2013):

- legality: it should not lead to any corrective action request as the post-consumer waste is exempted from legally requirement;
- sustainability: as long as more than 70% (PEFC) and 85% (FSC) of fibers is from recycled content, the certification of pellets can comply with present standards. The remaining percentage still needs to be evaluated for sustainability;
- carbon footprint: according to preliminary calculations in the Inbio project, the GHG savings will be larger than 85% and thus possibly conform with future EU legislation;
- non-contamination: not valid, when clean waste wood is guaranteed by suppliers.

Furthermore, the evaluation of the GGL certification system with ISCC and NTA880 showed discrepancies between the three systems on the following issues (Dam, Ugarte, Spijkers, 2013):
- how are wastes and residues defined;
- recognition of forest management systems (FSC, PEFC) or not;
- the point of origin in the supply chain for certification;
- contamination pre-requisites.

Each system has its advantages and disadvantages. For waste wood pellets the less complex certification is offered by NTA8080. In the case of forest residues, the best option is GGL because of the recognition of FSC and PEFC. As the wood pellets from the Inbio project consist of a combination of these resources (waste and residues), there is not a single, most suitable certification system (Dam, Ugarte, Spijkers, 2013). The analysis has shown how strict the traceability rules in these systems are. Nonetheless, once our certification request will be successful, we will contribute to the sustainability and certification of the biomass chain by adding these elements (not yet looked at) to the standards.

g) *Commercial development of future pelletizer plant:*

Consortium partners have also been able to create commercial demand for the residual wood pellets among European top buyers. Nonetheless, buyers will not purchase our residual wood pellets as long as they are not certified (Schade, 2012).

h) *Produce, transport and sell 12,000 MT of pellet production:*

The production of the 12,000 MT of test pellets has not yet been executed by FRAM Renewable Fuels. Getting acceptance of residual wood as certified input is taking more time than expected. Consequently, we still have an unsellable product (Schade, 2012).
5. Lessons learned

The InBio project has allowed the consortium to learn many important lessons that will be used when executing future similar projects. In particular, with respect to the promotion of sustainability of the biomass chain we want to mention the following key points:

- Start as early as possible with certifying the production process and product. The absence of a certification seal has in fact caused major delays to our project;

- Sustainability systems are divers, costly and non-uniform. The absence of one system makes the commercial roll-out difficult and therefore represents a key burden. We had estimated that the acceptance of residual wood for one specific certification system would/could be done quicker;

- A unified and clear European certification system is needed in order to speed up commercial development of low-value wood resources and thus allow a further expansion of bioenergy markets which will be of great value for the achievement of the EU 2020 goals.

Furthermore, with respect to project planning positive feedbacks have arisen. The management style implemented has left ample room for each project partner to implement its best practices. This has also allowed a pro-active and proficient knowledge sharing. Each project partner has demonstrated to be very professional and to appreciate others’ knowledge level and inputs.

6. Follow up of the project

The results of pellet analysis reports are very good and give a strong basis for marketable development. The commercial roll-out phase began already in 2012. We have had positive reactions from potential commercial partners. There are several interested buyers (even in the R&D stage) but the certification issue has to be resolved first. Work is being executed to get the residual wood accepted as part of the GGL or NTA8080 framework.

At this point, the only missing piece of the puzzle that is holding us back from the full commercial development of the project is the fact that the pellets are not yet certified. This creates a delay in the commercialization/export phase of the sustainable produced pellets.

Meanwhile, as mentioned previously, potential sites for the production of the residual wood pellets and shipping harbours have been already identified in Georgia, United States. When fully implemented, this project will be able to produce up to 300,000MT/year of new sustainable pellets that will be exported to the VARAGT region (Vlissingen, Amsterdam, Rotterdam, Antwerp, Gent, Terneuzen). The project will run for at least five years, thus the total export potential is estimated at 1,500,000MT of pellets.
References


