

TASK 40

Sustainable biomass markets and international bioenergy trade to support the biobased economy

**Final Proposal for Task Prolongation for
the new triennium 2016-2018**

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Working Period 2016-2018

Task Title: Sustainable bioenergy markets and international trade: Securing Supply and Demand

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Objectives

The core objective of the Task is: ‘to support the development of sustainable, international markets and international trade of biomass, recognizing the diversity in biomass resources and applications for bioenergy and bio-materials in the biobased economy.’

Work scope

The focus on international biomass trade remains a vital priority in the current proposal for prolongation, but all current task members agree that biomass will increasingly also be utilized in the biobased economy (BBE) for new material purposes, such as bio-plastics, biomaterials and other applications before/next to direct use for energy. Developing the sustainable and stable, international, biomass markets for energy and materials is a long-term process. It is particularly important to develop both supply and demand for biomass and energy carriers derived from biomass in a balanced way and avoid distortions and instability that can threaten investments in biomass production, infrastructure and conversion capacity. The Task aims to provide a vital contribution to such (policy making) decisions for market players, policy makers, international bodies as well as NGO's. It aims to do so by providing high quality information and analyses. Also, much has been achieved to guarantee the sustainable production and international trade of biomass for energy, yet, these mechanism may also become barriers for trade, and they should also be applied for other end uses in the biobased / circular economy . Thus, the work scope of Task 40 will shift somewhat to include more markets and end-uses of biomass.

Work programme

Based on the first inventory of interests by current task members, four main fields/work packages have been identified:

1. Dedicated market studies. There is an urgent need to provide industry and policy makers with comprehensive overviews and sound insights into both reasonably established markets (e.g. wood pellets, wood chips) but also markets with less clear trade flows and new markets (trade of tertiary waste streams).

2. Continued analysis of how sustainable biomass production and trade for bioenergy and the biobased economy can be governed. Task 40 will critically assess the role of sustainability certification vs. risk-based approaches, binding legislation vs. BMPs etc. as means to ensure sustainable production, and discuss pros and cons of current systems and provide strategies to build-up sustainable biomass supply over time. This topic could also be further developed into a strategic inter-task topic.

3. Making things happen/ stimulate (investments in) trade. There is a huge discrepancy between the amount of bioenergy that (models show) we will need to achieved by 2030, and the amount of investments seen at the moment to realize this growth. Next to feedstock supply risks), investors – often only with a financial background – are confused by the extensive amount of conversion technology options. It is not clear to them which technology is more mature than others. Clearly this topic deserves further attention, possibly also as a strategic project.

4. Need for high-quality bio-fuels/feedstocks and advanced logistics. With the advent of biorefineries, the quality demands for pre-processed biomass feedstocks is increasing, e.g. in terms of chemical and physical homogeneity, energy and bulk density, to improve transport (density), handling (flowability), storability/stability, and conversion efficiency. Pre-processing technologies such as pelleting are already important, but advanced pre-processing such as torrefaction and/or pyrolysis are expected to play an increasingly important role in the coming years. In addition, innovative solutions of solid and liquid biomass logistics by truck, train & vessels need to be further explored, including the possibilities to integrate with existing supply chains. Ultimately, this should lead to cost price reductions. The share of logistics for long-distance supply chains can easily be 30-50% of total costs delivered, but need to be further reduced to supply feedstocks cost-competitively for the BBE. Linked to topics 2&3, Task 40 will (continue to) investigate opportunities to lower costs, e.g. by exploring synergies with existing supply chains, achieving economies of scale and improved pre-processing.

Deliverables and Target Groups

Task 40 aims for the publication of 4-5 reports per year on the four topics mentioned above. In addition, the (in many cases joint) organisation of 2-3 workshops per year and contribution to conferences remains a crucial dissemination strategy. As in previous triennia, cooperation will be sought with other tasks, other (EU/international) projects and other international organisations (e.g. GBEP, UNEP, IRENA, REN21 etc.). Task 40 will provide an international platform with a diverse range of target groups active in bioenergy trade and markets, covering supply and demand, sustainability, financial products etc. Findings of the Task are translated in analysis and advice for industry and entrepreneurs, policy makers and other stakeholders, such as NGO's, the financial sector, and the higher educational sector.

Management Qualifications

Joint Task Leaders: Peter-Paul Schouwenberg, The Netherlands (Industry Task leader), Head of Environment, Regulatory Affairs - Biobased Economy - Real Estate, RWE Generation SE | Hard Coal, Gas and Biomass Netherlands

Dr. Martin Junginger, The Netherlands (Scientific Task leader). Associate Professor and leader of the bioenergy research cluster, Energy & Resources group, Copernicus Institute, Utrecht University

Task assistant: Chun Sheng Goh, junior researcher, working on biomass trade and land-use change at the Energy & Resources group, Copernicus Institute, Utrecht University

Annual Budget: US\$165,000; Budget per participant; US\$15,000, assuming 11 countries participate.

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1. Background and rationale

IEA Bioenergy Task 40 has been active since 2004, and is currently consisting of 12 country members. Over the past decade, Task 40 has supported the global development of international sustainable bioenergy trade. Below, a number of ongoing developments and trends are described, which set the scene for the coming years and explain the scope of the task 40 work programme for the 2016-2018 triennium.

Both focus on & beyond 2020: With the triennium running between 2016-2018, obviously much focus will be on whether various targets around the 2020 timeline, e.g., on renewable energy or biofuels will be met. For example, in the US, the aim is to further increase the share of advanced biofuels towards 2022. In the EU, the renewable energy targets of the EU are binding, and many member states require large volumes of bioenergy to meet these targets. Both policy targets have already become drivers significant trade flows (e.g. wood pellets from North America to North-Western Europe and ethanol-trade between the US and Brazil¹). It is expected that these trade volumes will continue to increase until 2020, and very likely beyond. The climate and (renewable) energy policy targets for 2030 are currently being set in the EU, and whilst the 40% GHG reduction / 27% renewable energy target has been criticized by some as being not ambitious enough, it de facto will require more mobilization of biomass for energy – as long as it also contributes to GHG emission reductions. Thus, both monitoring of the progress towards the targets of 2020 (and evaluation of failures and problems) and assistance for the formulation of new policy for 2030 and beyond is needed during the 2016-2018 triennium.

Wider focus than bioenergy alone: in the past years, both the policy and market focus on the biobased economy (BBE) or the bio-economy² has been increasing; the 40/27% targets mentioned above explicitly cover more than just energy; the agricultural and chemical sectors will be involved as well. At the same time, concepts such as the ‘circular economy’ and ‘green growth’ are promoted, and R&D for the production of bio-chemicals, bio-plastics and other bio-materials (as part of biorefineries that may also produce biofuels, electricity and/or heat) is heavily promoted. Ultimately, the expectation is that the move towards a circular economy (of which the bio-based economy will constitute a significant share) will entail a far more efficient use of (bio-)resources, including the more effective utilization of biomass for various purposes, the reduction and clever use of waste streams (from agriculture, the food- and fodder-processing industries, but in the future also increasingly chemical and pharmaceutical sectors) for energy production. Cascading gains increasing importance, even though policy makers and industry struggle with how the cascading should actually be implemented, e.g. whether a cascading hierarchy should be based on maximizing added value or maximizing GHG emission reductions, and how this should be implemented in policy without causing major indirect effects. In any case, direct use of preprocessed biomass to ‘just’ produce electricity, stimulated at the moment in several EU member states, may possibly decrease after 2020 again, partially also due to the increasing availability of renewable electricity from wind and solar sources³. It is likely that both with regard to feedstocks (use of high quality lignocellulose for chemical purposes, waste wood and residues for energy) and/or intermediates (use sugars / high quality polymers for material purposes, lignin for energy), bioenergy may become a by-product rather than *the* main product in the bio-based economy.

Many biomass markets remain marginal and/or ‘under the radar’: The production and trade of high-value biomass commodities such as vegetable oils, biodiesel, ethanol and wood pellets is reasonably documented, although trade of vegetable oil and ethanol for energy purposes can often only be derived indirectly. Trade of low-value streams such as waste wood, low-quality wood chips, low-quality & waste

¹ In case of the ethanol trade, biofuels policies are only one of several factors impacting on trade flows.

² According to Kwant in Meester et al (2013), the BBE includes the production and processing chains for renewable vegetal and animal raw materials used outside the food and feed sector for the production of materials, chemicals, additives, fuels, and energy. The bio-economy encompasses the BBE, but also includes the food- and feed sectors.

³ On the other hand, with increasing shares of intermittent (renewable) electricity sources, biomass electricity production could help reduce power production variations. Another interesting field is thermal storage in CHP. Thus, the final end-use of biomass will depend both on policy targets and e.g. developments in the power sector.

vegetable oils and agricultural residues for energy purposes – while (most likely) constituting significant volumes – however are not properly mapped.

Sustainability of liquid and solid biofuels production under (continued) scrutiny: The general societal focus is on phasing out fossil fuels, and bioenergy is still seen as an important option to contribute to a renewable energy supply. However, bioenergy is still heavily criticized by some NGO's and some scientists, and bioenergy is seen by some stakeholders as an excuse to extend the lifetime of fossil energy options. It remains therefore important to showcase that biomass can be a sustainable option to produce both materials and energy (either through biorefineries or stand-alone options) that substitute fossil feedstocks. The ILUC (indirect land use change) debate has changed somewhat in tone, recognizing the complexity of the subject and the need to move from a reactive concept to a pro-active approach to mitigate or avoid ILUC altogether. This has also resulted in policy responses such as the double-counting of (first generation) waste streams and the capping of the use of food crops for liquid biofuel production with possible consequences and impacts on biomass trade for energy. For woody biomass, the debate on 'forgone sequestration / carbon debt' is still ongoing, and it remains to be seen if and how policy aiming to limit the use of feedstocks with potentially long GHG payback times may impact woody biomass production and trade for bioenergy. For both, current expectations are that until 2020, no (additional) sustainability criteria will be widely implemented on EU level, but for 2030, this is far more likely going to be the case. Also, in several current Task 40 member countries (Belgium, the Netherlands, UK and Denmark) this topic is strongly debated, and some of these countries develop regulations to avoid or mitigate potential negative ILUC/ carbon debt effects earlier than 2020.

Need for high-quality bio-fuels/feedstocks: with the advent of biorefineries, the quality demands for preprocessed biomass feedstocks are increasing, e.g. in terms of chemical and physical homogeneity, energy and bulk density, to improve transport (density), handling (flowability), storability/stability, and conversion efficiency. Advanced preprocessing technologies such as torrefaction, pyrolysis, or AFEX (ammonia fiber expansion) and other advanced preprocessing operations (i.e. deacetalation(sp)) are expected to play an increasingly important role in the coming years – pending they are able to prove technical and commercial viability in the coming years. Another interesting challenge is how a specific "biomass pool" / biomass resources in a geographic area can be fully and optimally utilized, and which role biorefineries can play in this / if and how they may be superior to current utilisation.

Lack of investments in bioenergy – scale-up of feedstock production, conversion facilities, and logistic infrastructure. As shown by previous Task 40 work (Matzenberger et al., 2015⁴) there is a huge discrepancy between the amount of bioenergy that (models show) we will need to achieved by 2030 e.g. a 450 ppm target, and the amount of investments seen at the moment to realize this growth. Next to feedstock supply risks), investors – often only with a financial background – are confused by the extensive amount of conversion technology options. It is not clear to them which technology is more mature than others. While a previous Task 40 activity has resulted (as a spin-off) in the imminent launch of a 'biotrade equity fund' aiming to invest in biomass production and logistic facilities; clearly this topic deserves further attention.

⁴ Matzenberger, J., Kranzl, L., Junginger, M., Vassilis, D., Tromborg, E., Future perspectives of international bioenergy trade, Renewable and Sustainable Energy Reviews 43 (May 2015) 926–941.

2. Objectives and Scope of Task 40

The further development of sustainable and stable, international market for biobased commodities for energy and material purposes is clearly a long-term process and this process is far from finalised – In fact, current biomass production and trade volumes for energy and new materials and bio-chemicals are only a fraction of what they will need to become in order to fully realize the role of bioenergy as anticipated by many scenarios for 2050. Eventually, biomass products may develop into large-scale commodity markets, which could have multiple benefits, such as much improved market stability and competitive prices. On the other hand, the sustainability of large scale biomass production and trading has yet to be secured and governance of developing biomass markets are at a critical stage, with the use of both food crops and woody biomass strongly scrutinized by policy makers and NGO's. At this moment, fundamental policy choices by both developed and developing countries can still be made on how sustainable biomass supply chains should be developed and how international biomass markets should be steered, controlled, and governed.

Therefore, the **core objective** of the Task is:

'to support the development of sustainable, international markets and international trade of biomass, recognizing the diversity in biomass resources and applications for bioenergy and bio-materials in the biobased economy.'

The proposed work programme consists of the following four topics (as further specified and elaborated in section 3):

1. Dedicated market studies, both focusing on existing markets (e.g. pellets, wood chips, waste streams) and markets for new bioenergy products (e.g. torrefied material & pyrolysis oil etc.), but also on regions which have not been charted before (e.g. the Pacific rim).
2. Continued (case) studies on how to mobilize sustainable biomass for trade and demonstrate benefits (of bioenergy) in the biobased economy (a.o. critically assess the role of sustainability certification vs. risk-based approaches, binding legislation vs. BMPs etc) – what can the BBE learn from bioenergy?
3. Making things happen / stimulate (investments in) trade – needs to increase dramatically over the next decade
4. Need for high-quality bio-fuels/feedstocks and advanced/smart logistics (dedicated infrastructure) to achieve cost price reductions – logistics typically are 30-50% of final costs of bioenergy. While advanced logistics and better feedstock may even increase cost at first, they are likely to reduce cost once deployed on a larger scale, and allow for system cost reductions (when taking the advantages at the end user, e.g. a biorefinery into account).

Linked to topics 2 (sustainability) and 3 (making things happen) proposals for strategic projects with other tasks (e.g. 32, 38, 42 and 43, possibly also 34, 36, 37) are also highlighted.

Similarly to previous years, the desired impacts and results of the Task emphasis will lay on:

- The support of emerging new biomass markets for energy and material applications and further development of existing markets, the stimulation of investments in sustainable trade and development of pilot and demonstration projects (e.g. between the Task member countries); with a global perspective, including developing countries.
- Outreach to industry, strategic policy-makers and the general public. An important element is increasing public awareness and understanding of perceptions of international bioenergy markets and sustainable development, since this is a vital issue for societal support of using biomass resources from other (world) regions.

Previous Triennia: 2004-2015

Task 40 membership grew considerably over the period 2004-2012, from 4 to 14 members and the interest in the field of sustainable international bioenergy trade, development of bioenergy markets, optimisation of supply chains and certification is now established globally. In the 2013-2015 period, membership remained constant with 12 member countries. Task 40 is currently recognised as a strong and unique international platform in this field, because of its content orientation, neutral position, and strong involvement of market players. The Task is considered a relevant partner for governments, market players, NGO's, and international bodies. Since the start of the task in 2004, more than 35 workshops have been organised, which have attracted key actors from academia, international policy arena and industry alike. The events organised to date resulted in considerable exposure, which is evident from the many invitations for presentations and written contributions to journals, newsletters, as well as the use of the Task 40 website (www.bioenergytrade.org) and its structural inclusion in a wide variety of relevant policy and research fora. Overall, Task 40 has succeeded in carrying out a broad work program, producing significant outputs, and receiving considerable interest internationally. With the finalisation of a book on international bioenergy trade (publication end of 2013), an even wider audience has been reached.

3. Specification of key content areas output and deliverables

In conjunction with the objectives, the identified topical areas of work are broken down below into different activities and outputs. Regarding the available budget, the amounts indicated below are based on the assumption of 11 member countries. As shown in more detail in section 4, we would expect over the entire triennium that about 250,000 US\$ would be available for studies performed by Task 40 members.

It should be kept in mind that any Task under IEA Bioenergy is first of all **a network in which activities and knowledge from its members are brought together**. The work of the task therefore strongly relies on the input provided or collected by its partners. Providing overviews and assessments of those activities is therefore a first priority. For this reason, bi-annually updated country reports will also remain a stable component of the work programme, and serve a variety of objectives of the work program. In addition, **the task funds can facilitate some additional analysis in dedicated task projects, but these are relatively small compared to larger national research and market activities**.

Finally, the work programme should be seen as a flexible **framework, allowing the development of concrete specific ideas by the group over time**. Also, there is some ‘spare capacity’ to deliver responses to ‘sudden events’ (such as the financial crisis and strong fluctuations in energy and food prices) relevant for the working field of the task. We have deliberately not included a specific time table for the publication of the proposed reports under the five topics, as this depends on the priorities of the task members. However, in general, we thrive for continuous and evenly distributed output of reports throughout the triennium.

The topics mentioned below are based on the ideas of task leaders Martin Junginger and Peter-Paul Schouwenberg, supplemented with input from the current Task 40 national team members. Ideas for cooperation with other Tasks have largely been discussed with the respective task leaders, and most deliverables have been suggested by specific members, who will also be expected to take the lead.

Furthermore, several national team leaders have expressed interest to take the lead in one of the 4 topical areas, e.g. the US (INL) on topic 4, and Germany (DBFZ) on topic 2. In many cases, the proposed deliverables link to on ongoing projects and work within the NTL’s institution. However, as membership is not yet confirmed, we have not yet defined the (lead) participants for each deliverable. Still, as requested by Kerckow and Forsum during ExCo 75, we indicate the potential member countries/institutions that may *take the initiative, manage and lead* each of the proposed studies under the 4 topics. We emphasize that this does not rule out the participation of other members; on the contrary: each study should at the least have contributions from 3-4 task members.

Topic 1 Market studies

In the past decade, Task 40 has published many different studies on the emerging and possible future trade of biomass and bioenergy, such as ethanol, biodiesel, wood pellets, wood chips, biojetfuel and biogas. Task members have often spent significant efforts in charting these markets, for which often no trade statistics exist. Continuing these market studies is deemed a vital part of the success of Task 40, as it provides hard-to-obtain insights and hard numbers for industry, policy makers and academics alike. In the past, scientific review & overview publications by Heinimö et al. Lamers et al. (2x), Cocchi et al. and Goh et al. have all been widely cited, some over 50 times.

Proposed work and deliverables

1.1 Renewal of comprehensive market study for wood pellets

Four years after publication, the 2011 wood pellet market study remains one of the best downloaded reports of Task 40, and we receive frequent requests for an update. While the market has certainly matured since 2011, it is still comparatively small compared to fossil commodities. Therefore, a dedicated effort to update and expand the 2011 wood pellet study is desirable. Elements will include

- an overview of main producing and consuming countries
- a description of the various markets (industrial consumption for electricity production and process heat, small- and medium scale residential heating, etc.)
- market trends (new producers and consumers)
- development of pellet prices
- overview of policy support schemes
- linked to deliverable 2.1) existing and ongoing legislation to govern the sustainable production and trade of wood pellets.
- An outlook to where global wood pellet production and consumption may be heading until 2025

Cooperation with Task 43, Bioenergy International (and their annual wood pellet map), Aebiom and various wood pellet associations (EPC, EIPS, WPAC, USIPA) will be sought. As part of the communication strategy, the publication of the study will be linked to a workshop or another event (e.g. the pellet map issue of bioenergy international conference).

Proposed budget: 30,000 US\$ (Task 40) (additional budget from T43 to be discussed if interested).

Proposed lead: Not decided yet. Italy led the previous wood pellet study, Belgium and Denmark also have active & diverse wood pellet markets. Possibly also Finland or Norway (?)

1.2 A joint study with Task 36 and Task 38 on trade of waste-to-energy (WTE) streams, starting with a European focus. The production of increased amounts of municipal solid waste (MSW) and refuse derived fuel (RDF) through mechanical and biological treatment in Europe has been accompanied by a trend to ship this fraction around Europe. The incentives for this shipment are multiple: including a desire to generate heat locally to feed district heating systems in the Nordic countries or a need to find waste for the current over-deployment of EfW plants in central-western Europe. This study aims to uncover how much waste feedstock is being transported for energy purposes around Europe and the drivers, incentives and implications of this trend.

The study will be a joint effort with task 36, and will in first instance focus mainly on ongoing trade in the member countries in Tasks 36 and 40. This study could encompass different types of solid waste:

- MSW is nowadays widely traded, and while it typically only contains 50% organic material, its combustion contributes a non-negligible contribution to the EU renewable energy target.
- Refuse-derived fuel (RDF)
- Recovered/recycled wood (e.g. demolition wood etc) tends also to be included in the WTE category and for recovered wood, many of the discussions on competition with existing markets (particle board etc) and cascading are connected to those for virgin wood or industry by-products.
- Used cooking oil and other liquid waste streams will not be investigated due to limited budget & different end-use markets. Trade of UCO has also been analyzed by Task 40 in 2014.

Elements that the study will cover:

- Recovered wood and MSW are clearly competing with “regular” biomass fuels in the heat & power sector. For example, an emerging topic in Sweden now is that the market for forest residues is shrinking due to increased competition from (imported) recovered wood and MSW.
- Task 36 will also include fuel properties of various waste streams compared to clean solid biomass streams.
- Next to traded quantities and trade flow directions, the aim will also be to understand what are the driving forces for the trade flows (is it carbon emissions, renewable energy, the need for heat? The fact that waste is often a ‘free fuel’ / users may in fact get paid to dispose of it? etc.) and what trends may be up until 2025.
- Task 40 will also aim to provide a global overview of main waste-to-energy trade flows
- Another element to be included is environmental impact of waste trade compared to other alternatives (e.g. landfilling or construction of domestic combustion facilities). The analysis will be led by Task 38 and will include GHG balances of waste trade, and selected other impact categories. In addition, data collection and analysis could be assisted by MSc students from Utrecht University with an Internship at Ricardo AEA.

Proposed budget: US\$ 20,000 (Task 40, lead) and US\$ 10,000 US\$ (Task 36) (possibly more, depending on T36 membership) + T38 Funding (US\$10,000)

Proposed lead: Not decided yet. UK could be a possible candidate (as Imperial has students work on this topic and Pat Howes would be the joint leader from T36). ?

1.3 One or two focused smaller studies

During the discussions for this work program, a large number of other potential studies have been mentioned by different task members. Below, a short list of possible topics is shown (a full description is given in Appendix 1). If and which of these studies will be carried out will be decided early 2016 when the total budget and participating countries are known. Most likely, one or max. two studies will be carried out with a clearly defined focus (possibly one or several topics may be joined), and with a budget of about 20 k\$ each.

- (1) A renewed / additional effort to map current wood chip markets. Particularly a study on the world trade with wood chips including prices, amounts, and potential assessment of new resources, including different quality.
- (2) Renewed/continued market studies for pyrolysis oil, torrefied biomass and aviation fuels (and the role/importance of international trade)
- (3) In 2017, the EU will lift the production and import quota for sugars and iso-glucose, creating a free market and significantly impacting production volumes. Expectations are that feedstock supply will increase and the EU may have several million tons of additional supply. Study to monitor and analyze resulting trade flows.
- (4) Bioenergy and ‘free’ trade, determine impact of measures like subsidies and market protection tariffs, possibly also indirect effects like certification criteria and cascading rules on trade flows.
- (5) Potential biomass demand in new industries (e.g. processing industries): a large number of industries (primarily “process” industries, e.g. breweries, mines, asphalt application) could switch to bioenergy. Map opportunities in T40 member countries.
- (6) The study on (promotion mechanisms for) advanced biofuels could be used as a starting point for a more developed study, including new “really” advanced biofuel resources (like arundo donax) and future updates of “old” chapters.
- (7) Macro algae’s: a study on the state-of-the-art of this market (Aquatic biomass), size, costs and barriers and potential for this new type of biomass resources in the bio-economy chain.
- (8) How do large single events (disturbances) affect bioenergy markets? Investigate the impact of natural disasters, e.g. storms (Klaus, Gudrun), large forest fires and power plant fires (Tilbury, Amager, Amer) on markets and what measures could be taken to mitigate price shocks.
- (9) Trade of biomass technologies throughout the supply chain – from equipment to plant seedlings to biomass conversion technologies
- (10) Trade of biomass, biofuels and biobased materials - status quo and demands for a sustainable bioeconomy.

- (11) Valorisation of biomass. At different points in the supply chain, biomass will need to be tested for quality and value. The amount of testing will depend on the value chain and the value of the product/intermediate. How will this look like and can this be integrated into international standards?
- (12) Market study on the potential use of liquid biofuels for short- and long distance sea shipping.
- (13) Join forces with one or several international projects on biojetfuels for a market study on the anticipated volume of biofuel jet production,

Topic 2 Continued analysis of how sustainable biomass production and trade for bioenergy and the biobased economy can be governed

During the past years, the debate around sustainable sourcing of solid biomass has become increasingly important within the EU, especially as the European Commission has decided not to implement any binding sustainability criteria. Since early 2014, EU member states importing large amounts of biomass from outside the EU - especially the UK, Denmark, Belgium and the Netherlands importing biomass from the US (but also Canada and North-West Russia) have started to set up national governance schemes to assure the sustainable production of (predominantly woody) biomass. Also other Task 40 member countries (Norway, Italy) are considering to develop a biomass sustainability assurance framework. Other task member countries (e.g. Sweden, Finland, Austria) have so far relied on domestic regulations to ascertain sustainable biomass production.

Also for liquid biofuels, changes in the EU-RED such as the recent decision to cap the use of food crops to 7% to meet the 10% quota may cause large impacts on trade flows as well. As of today, it is unclear whether and how support for (1st) generation biofuels will continue beyond 2020, and how 2nd generation biofuels will be stimulated beyond 2020.

Proposed work and deliverables:

2.1 Two workshops with EU and North American policy makers and industry on the ongoing development of sustainability assurance frameworks for solid biomass and consequences for bioenergy trade

Based on the decision by the EU not to introduce mandatory sustainability criteria for solid biomass, several EU member states have started developing national legislation to govern the sustainable biomass production for bioenergy use (mainly for large scale electricity production). For example, in the Netherlands, a voluntary agreement between industry and NGO's has recently been reached, laying down detailed criteria for the sourcing of woody biomass, including SFM certification and provisions to avoid competition with material uses and mitigation of carbon debt risk. Also in the US, both on a state level and federal level, discussion regarding the sustainable production and use of solid biomass for energy are ongoing. At the same time, the bioenergy industries (mainly the EU utilities) have started the sustainable biomass partnership with the aim to provide a general sustainability framework. The implications of these initiatives and national laws on the production and international

These workshops will be follow-ups to workshops organized in 2011-2014 by amongst others Task 40, task 43 and the Pinchot Institute (November 2013), Utrecht University (Nov. 2014) and the BiograceII project (March 2015), on harmonization of ongoing policy developments in UK, DK BE and NL. Invited participants will include policy makes and industry from countries involved in the international production, trade and consumption of solid (woody) biomass for energy. We envision two workshops: one early 2016 (e.g. Utrecht/ The Hague) and one in 2017, possibly in the US, depending also on interest of local stakeholders.

Possibilities for cooperation: Pinchot Institute, Task 43 (both have confirmed interest), SBP and the Dutch Ministry of Economic Affairs/RVO.

Proposed budget: 10,000 US\$ for the preparation of the workshop (including a preparatory questionnaire in advance). No additional budget needed for the workshop organization itself (included in workshop budgets for meetings of 4800 US\$/meeting).

Proposed lead: UU (as part of inter-task strategic project, see below).

2.2 A comprehensive study on the governance of sustainable biomass production and trade

While deliverable 2.1 specifically focusses on the production of woody (biomass (especially wood pellets) and on current policy developments, but there is also a clear need for a broader, more general assessment. This study will highlight several (possibly all) of the following elements:

- Critically assess the different strategies to achieve sustainable production of biomass, e.g. role of sustainability certification vs. risk-based approaches, binding legislation vs. BMPs etc. as means to ensure sustainable production. Make an inventory of current policies (voluntary agreements, laws, etc.) and show pro's but also con's of current systems and provide strategies to build-up sustainable biomass supply over time. Focus on successful examples (e.g. Sweden, Finland) of sustainably managed forests that are (intensively) managed and of which a significant share is used for bioenergy.
- Investigate and in depth discuss potential consequences of different sustainability systems in different countries. Would it mean that certain biomass will be excluded from the market due to this? Where is it heading? How would the costs for sustainability certifications develop?
- Highlight and discuss positive and negative social-economic impacts of biomass production (& trade) both in developing and developed countries
- At the same time translate lessons from the discussion on the sustainability of feedstock production & trade for *bioenergy* to the production of feedstocks for bio-based materials / the bio-based economy: what can be learned/which mistakes avoided?
- Show the importance of biomass trade for the bio-based economy: what are the macro-economic implications of changing to e.g. a bio-based chemical sector in Europe or other OECD countries/regions, what does that mean in terms of transported biomass volumes (domestic supply vs. imports or exports) and highlight potential issues (e.g. direct and indirect effects of policies on biomass trade flows)

Completion of such a study by 2017 should provide timely guidance to policy makers and industry in both exporting and importing Task 40 countries, but e.g. also for the European commission which may develop new sustainability criteria for bioenergy beyond 2020. The results will also be used as input for the 2nd workshop of deliverable 2.1.

Suggested budget for this study: 35,000 US\$ (either stand-alone, or as input for strategic project)

Suggested lead: at the ExCo 75 in Dublin, UU was requested to develop a proposal for a strategic inter-task project proposal for this topic. Other countries with clear interest to deliver strong contributions are Germany (both DBFZ and IINAS) and Italy. If approved the elements described above will be covered within the inter-task project. If not, the study will be carried out by Task 40.

Possibility for a strategic project: This topic obviously can be extended beyond the trade aspects highlighted above: the sustainable production of biomass is also a core topic of task 43, GHG implications of various biomass production systems are assessed by Task 38, and the availability of sustainably produced biomass feedstock is a crucial prerequisite for the production of advanced biofuels for transport (Task 39) and bio-based commodities (Task 42). Thus, we see the opportunity to develop a strategic project with several other IEA Tasks involved to investigate how the sustainable biomass production and trade for various end-uses can be governed. Possible partners for collaboration could also be GBEP, FAO and UNEP.

Topic 3: Making things happen: stimulate (investments in) trade

Investigating the requirements for commoditization of biomass and biofuels will play a central role; next to the technical aspects, it is also important to analyse the necessary conditions for the development and successful market penetration of key biobased commodity.

Proposed work and deliverables:

Based on inputs from the current task 40 members, we have defined three topics for studies:

3.1 Investigate the role(s) of actors: i.e. companies and organizations, and the design of proper conditions for development of efficiency and competence. This could possibly be combined with a study on attitudes, acceptance, resistance, etc. with regard to bioenergy. Relevant questions could be: What is the level of market concentration on the production, trading and consumption segments for different fuels? What does the ownership structure look like? Are market actors national or international (e.g. international bioenergy trade might very well be international but it might also be transactions within a single company, how does this play into market analyses?) How can large investors (pension funds etc.) be convinced to invest bioenergy projects? And are there differences and similarities between different biomass fuel carriers?

Proposed budget: 20,000 US\$

Proposed lead: Sweden (Svebio)

3.2. Develop a ‘layman’s guide to biomass trading’: Biomass for energy is still only traded by a handful of trading houses, and knowledge on the actual on the ground barriers, such as custom and safety regulations, import and export tariffs, quality standards, dedicated contracts, how to optimize logistics and achieve low costs, etc. The project members will develop a set of factsheets or a rough guidebook containing practical hands-on guidelines for different biomass markets/ feedstock types, e.g. on what pitfalls to avoid and how to set-up successful supply chains between producers and end-users.

Proposed budget: 20,000 US\$.

Proposed lead: Austria (Michael Wild).

3.3. Highlight bioenergy success stories. In the past decades, a number of large biomass/bioenergy related projects have been successfully developed – this includes

- large conventional ethanol & biodiesel plants
- the first 2nd generation ethanol/renewable diesel/biorefinery plants (e.g. Poet DSM, Neste Oil, Borregaard)
- large-scale wood pellet plants and torrefaction/steam explosion pellet plants and pyrolysis plants
- large-scale dedicated biomass electricity / CHP plants
- (large-scale) biogas digestion plants and biomass gasification plants (e.g. GoBiGas),
- large-scale dedicated investments in biomass logistic infrastructure (e.g. in exporting/importing harbours).

The factors behind these successes (and which conditions initially led to the required investments) have to our knowledge never been investigated thoroughly using a consistent set of criteria. The proposed study will investigate about 30-40 success stories (3-4 in each T40 member country) and then compare and discuss results. The work will also build on the ‘large-scale industrial users’ study carried out earlier by Task 40.

Proposed budget: 30,000 US\$. Proposed lead: Topic 3.3 is currently developed further into a strategic project, as requested by the ExCo during the Dublin meeting. Germany (Uwe Fritsche) is in the lead for this proposal, with support from Austria (Vienna University of Technology). The US (INL) is interested to contribute but will be unable to take a leading role. If there is sufficient interest from e.g. tasks 32, 33, 34, 39 and 42, and the ExCo approves the proposal, these parties would also lead the strategic project. Questions such as how to scale-up and what is driving the further development of the biobased economy (Feedstock supply opportunities or market demand (conversion)?) could be further investigated. Also the barriers could be assessed: Why does the industry not take off? What are e.g. the contributions of policy/regulatory risks, market risks or operational risks?

Topic 4 Develop, adapt and optimize biomass logistics

The development of optimized logistic chains has been on the Task 40 agenda for several years, but is certainly far from finished. Torrefaction has been the main focus for the past triennia. For 2016-2018, the scope should be widened to also encompass other elements in the logistic chain than pretreatment alone.

Proposed work and deliverables:

4.1 Best practices logistics study: The aim of this study will be to make an overview of innovative solutions of solid & liquid biomass logistics by truck, train & vessels, including: clever adaptation of existing infrastructure/ highlight custom-made solutions with technological innovations, and identification of further R&D needs. It will include actual show-cases from T40 member countries, e.g. brand-new / adapted port facilities / dedicated biomass terminals etc. For this aim, as also requested by Kerckow during ExCo75, large scale logistics entities will be contacted to contribute to the study (or to be interviewed).

Proposed budget: 15,000 US\$, Proposed lead: US (INL)

4.2 Logistics for biorefineries: Exploration study on what kind of preprocessing should be done at or within logistic terminals (e.g., depots) in order to facilitate the use of the feedstock for various markets (e.g. fodder, biochemicals, biofuels) and what this means for trade (i.e., the tradability of the feedstock). Also explain and highlight the cost structures and uncertainties/possible variations, and further R&D requirements.

Proposed budget: 20,000 US\$, Proposed lead: US (INL)

4.3 Update of the long-distance low-cost supply chains study: The share of logistics for long-distance supply chains can easily be 30-50% of total costs delivered, but need to be further reduced to supply feedstocks cost-competitively for the BBE. Task 40 will (continue to) investigate opportunities to lower costs, e.g. by exploring synergies with existing supply chains, achieving economies of scale and better preprocessing. Whereas the previous study mainly looked at hypothetical new trade routes, the aim of this report will be to look at the existing routes and how they may be improved with increasing volumes. Close cooperation with both the Dutch financed BiologikNL project will be sought, in which UU, TU Delft and 12 industrial partners in the Netherlands are involved (including RWE). As requested by Lefeuvre during ExCo 75, an analysis of the logistics of torrefaction will be included in this study.

Proposed budget: 20,000 US\$

Proposed lead: Undecided, possibly Belgium, Brazil, Norway or Finland (?)

4.4 Workshop: Biomass trade & co-firing across the Pacific Rim: joint outreach event

Linked to this study, but also to the updated wood pellets market overview study, the proposal is to organize a joint event with Task 32 (possibly also with 33 and 34 and ExCo involvement, to be confirmed) outreach workshop in an Eastern Asian country outside of the current implementing agreement. Both solid and liquid biomass trade for energy has developed strongly across Asia and the Pacific Rim, and a study on bio-energy trade focusing on Asia would obviously fill a gap, in perspective of the rapid development of both demand and production in the region. With the increasing demand for woody biomass (wood pellets in particular) by Japan and South Korea, these materials are exported by Canada, Vietnam, Malaysia, China and other countries across the Asian rim, often also with long transport distances. The proposal is therefore to organize a joint workshop on the wider role of pretreatment technologies and their implications for logistics/trade and final conversion/end-use. This workshop should on the one hand provide information to Asian industries on possibilities for biomass trade and end-use, but should also be an outreach of IEA Bioenergy to countries such as e.g. Malaysia and China to join the implementing agreement. Cooperation will be sought with policy makers and local biomass associations (preliminary contacts with Biomass-SP/Malaysia have already been laid / the possibility of a workshop in 2016 or 2017 discussed).

Proposed budget: 5000 US\$ additional to the 4800 US\$ budget for a normal workshop.

Proposed lead: UU & RWE (coordination), with inputs from all task members

Overview of proposed collaboration and funding

Based on key content areas output and deliverables, the table below summarizes the proposed deliverables, budgets and planned cooperation's.

Deliverables	Proposed T40 Budget (US\$)	Cooperation with other tasks (in brackets to be confirmed)		
1.1 Wood pellet study	30000	(T43)		
1.2 Study on waste to energy trade	20000	T36 and T38		
2.1 Two workshops policy developments solid biomass	10000	Inter-task project		
2.2. Governance of sust. biomass prod.& trade	35000	Inter-task project		
3.1 Role of actors	20000	(T43)		
3.2 Layman's guide to bioenergy trade	20000			
3.3 Highlight success stories	30000	Inter-task project		
4.1 Best practices logistics study	15000			
4.2 Logistics for biorefineries	20000			
4.3 Update of the long dist, low cost SC study	20000			
4.4 Outreach workshop to Asia	5000	T32 (ExCo)		
Total	225000			
Optional				
1.3 Two other focused market studies (e.g. Shipping and aviation)	40000			

The total budget of 225,000-265,000 US\$ is in line with the expected available funds based on 10-11 participating member countries (see section 4.4). Budget for 2.1, &2.2 and 3.3. are in principle the T40 contribution for the strategic inter-task project, or (if not approved) the budget for stand-alone studies.

Last but not least, as in previous triennia, Task 40 will reserve some room (in terms of budget and content) to handle 'surprises', i.e. issues that need rapid responses. Examples of previous 'rapid action' included for example the (joint) organization of workshop(s) on the topic of forest carbon sequestration and the impact of policy responses on biomass trade. Also in the coming triennium, Task 40 (as a networking organization) will maintain the aim to contribute to scientific / general discussions that may affect bioenergy trade. Decisions on commissioning new studies or workshops addressing such issues will always be done in consensus with all task members during task meetings or by email/telephone conference (in case a rapid response is needed).

Dissemination

Key dissemination channels will remain workshops, the Task 40 website and newsletters. However, in coordination with the development of a holistic IEA Bioenergy communication strategy, also new channels will be explored, such as webinars, Linked-in discussion groups and twitter, especially to highlight the publication of new studies or up-coming workshops.

4. Management

4.1 Participation

Current (2015) IEA Bioenergy Task 40 country members are:

1. Austria. Representing parties: Vienna University of Technology and Wild & Partners.
2. Belgium. Representing party: VITO
3. Brazil. Representing party: University of Campinas
4. Denmark. Representing parties: DTI and HOFOR.
5. Finland. Representing party: Lappeenranta University of Technology
6. Germany. Representing parties: IINAS and DBFZ
7. Italy. Representing parties: GSE
8. Norway. Representing party: UMB
9. The Netherlands. Representing parties: RWE Essent and Utrecht University.
10. Sweden. Representing party: Svebio and Stockholm Environmental Institute
11. United Kingdom. Representing parties Imperial College and Drax
12. United States. Representing party: Idaho National Laboratories

During ExCo 75 in May 2015, 9 current members indicated interest to continue membership in task 40 for the 2016-2018 triennium. The ExCo representatives from Brazil, Italy and the UK indicated that they had not yet decided on participation. The preliminary budget estimates have been based on 10-11 countries, with cost overviews ranging from 9-12 (see table 1 below).

4.2 Collaboration with Other Tasks

Collaboration with IEA Bioenergy tasks

Collaboration and exchange with other IEA Tasks is generally strongly supported by ExCo and over the past triennium, Task 40 has worked with Tasks 32, 37, 38, 39, 42 and 43. In section 3, we have already highlighted the suggested cooperation with other IEA Bioenergy tasks, mainly with Tasks 32, 36, 37, 38, 42 and 43. With two possible strategic projects with Task 40 in the lead, there will be a very strong cooperation with most other tasks.

Collaboration with other circuits

In the past triennia, next to cooperation with other bioenergy tasks, events have frequently co-organized with other international bodies and/or projects such as the EEA and JRC, Diacore and Biotrade2020+. Also in the future, Task 40 envisions cooperation with e.g. EC-funded projects (e.g. Biotrade2020+). Due to the establishment of the GBEP working group on water, there is now a direct link to GBEP, which should hopefully also result in one or several joint activities.

4.3 Suggested work program and outline of possible events / GANTT chart

A base frequency for public events is 2 per year, but in practice some 3-4 events are (co-) organised by Task 40 per year. The schedule of events should first of all match with the work program priorities and is ultimately determined by the priorities of the Task members. The mentioned dates and locations are therefore fully tentative. Furthermore, scheduling events will be combined with other activities such as business fairs, conferences and specific workshops when possible and appropriate.

As currently only out of twelve countries have indicated participation, the number and timing of the studies / deliverables will be discussed and finalized during the kick-off meeting in 2016. A possible *crude* outline of events for the period 2016-2018 is given on the next page.

Suggested date	Potential content of event	Parties/IEA Tasks involved and suggested location (*)
Beginning of 2016	Internal Task kick-off meeting for establishing and organising the work program for 2016-2018. Workshop on national biomass sustainability assurance frameworks and implications for trade	EZ/RVO, Task 43(?) Netherlands
Mid-2016	To be determined (possibly some final results of the ongoing T40 work in 2015, e.g. the torrefaction study)	To be determined, possibly Norway
End of 2016	Workshop on biomass logistic optimisation	To be determined, possibly Brazil
2017	Presentation of study on waste trade flows	e.g. UK or Sweden
2017	Presentation of updated wood pellet study	At an industry conference, e.g. at Aebiom conference, Brussels May 2017
2017	Outreach event in East Asia on biomass pretreatment, co-firing and trade	E.g. China or Malaysia
Early 2018	2 nd workshop on national biomass sustainability assurance frameworks and implications for trade	US
Mid-2018	Present the results of the 'making things happen' studies.	To be determined
End of 2018	End of Task meeting	In conjunction with the IEA Bioenergy conference (location to be determined)

(*) Typically, T40 events rotate among the member countries. Specific conferences, workshops (etc.) organised by non-task parties may justify holding meetings in other locations. Furthermore, internal task meetings are typically held connected to an open event. Regular task meetings normally last 1-1,5 days and allow for detailed discussion and organisation of task work. In the 2013-2015 triennium, meetings and/workshops are held in all members states except Brazil, Norway and the UK.

The same disclaimer applies: This is subject to the final number of task participants and member preferences. Also, a number of smaller studies mentioned in the work program have not been included as both the decision if these studies are going to be carried out (and when) will be taken during the triennium pending member preferences and available budget.

Adjacent to the workshops, Task 40 typically has 2-3 internal meetings. At each meeting, the progress and finalisation of deliverables is discussed, the task budget and ongoing ExCo developments are discussed, new studies are defined (including possibilities to use the ExCo strategic fund), events are planned, and joint sessions with other tasks are held.

4.4 Finance

Based on the performance and experiences of task 40 in the past triennia, and the expected carry-over from 2015, we propose to lower the annual member fee to US\$ 15,000 per year per member. This amount allows the tasks to operate smoothly, perform a significant amount of work and maintain a certain flexibility to respond to new topics during the triennium.

Cost factors

An overview of the income (depending on the number of participating countries) and the budgeted expenditures are presented in table 1. As requested during the ExCo 75 meeting, these costs have been specified as much as possible. The additional information presented below corresponds with the letters in table 1:

- a) For the calculations below, where applicable a US\$: Euro conversion rate of 1.2 has been used. At the time of writing (August 2015) the exchange rate was at 1.14. As the income is in US\$, but most costs of Task 40 are incurred in Euro's, this budget is therefore slightly on the conservative side.
- b) We expect a carry-over from 2015 of approximately 100,000 US\$. This amount has been added to the available funding for 2016-2018. This has also been approved by all Task 40 members during the meeting in May 2015 in Italy.
- c) The participation fee is dependent on the number of members joining for the triennium (but is fixed once the final nr of participants is known). If membership is 11 or below, the annual fee will be 15,000 US\$. If membership is 12 or 13, the fee will be 14,500 US\$/year. Above 13 members, the fee will be 14,000 US\$/year.
- d) Staff costs for **task management** consists of a lump-sum of 4 man-months and an average man-month tariff of 7,700 Euro. Management activities covered under this lump-sum include the secretariat, dissemination (including management of the website and publication of newsletter and papers), organisation of task meetings and 2-3 events/workshops per year, participation in ExCo events and annual reporting (IEA) requirements (progress reports, annual reports, triennium report, newsletters, etc).
- e) Furthermore, a budget of a *maximum* of 4 man-months is reserved for **content-related support**. This includes the following activities (not comprehensive): review and quality control of task documents (e.g. project and country reports), coordination/contributions to other inter-task strategic projects (both in terms of content and management, e.g. to the mobilizing biomass supply chains during 2013-2015), organisation of additional events (e.g. in years when we have 4-5 events), additional requests by ExCo for information, etc. These costs are a maximum; the hours spent are carefully recorded and presented during task meetings. In 2014, one man-month less than originally anticipated was used.
- f) **Travel cost** coordinating parties: typically between US\$ 10,000 (in years with only EU travel) and US\$ 13,000 in years with intercontinental travel. As a conservative estimate for the entire triennium, we estimate US\$ 35,000. Especially with many European Task members, travel costs are likely going to be lower.
- g) Budget for IEA Bioenergy ExCo **Strategic fund** initiated activities (10%)
- h) Funds for organisation of **task business meetings and workshops**: US\$ 15,600 per year (based on Euro 4000 per meeting/workshop and three meetings per year).
- i) **Costs for dissemination** are limited to hosting the website and the distribution of the newsletter, which amount annually to about 650 US\$. In the past triennium, Task 40 has decided not to print any leaflets or reports, and this is also not foreseen in the upcoming triennium.
- j) Based on these assumptions, task funded research activities (also for inter-task projects) vary between 30% - 46%, depending on membership status (See table 1 below). With the expected 11 members, it would be 39%; with the current 12 members 41%.

Table 1: Overview of income and anticipated expenditures for the entire triennium 2016-2018. Footnotes a-j refer to the text above this table.

Table 1									
Exchange rate US\$/		1,2 ^a		Carry-over from 2015:				100000 US\$ ^b	
All budgets are in US\$									
Nr of members	Annual Fee ^c	Total Budget	Max. staff cost ^{d,e}	Max. travel cost ^f	10% ExCo ^g	Workshop cost ^h	Dissemination costs ⁱ	Minimum budget for studies ^j	% of budget for studies ^j
9	15000	505000	221760	35000	40500	43200	2000	162540	32
10	15000	550000	221760	35000	45000	43200	2000	203040	37
11	15000	595000	221760	35000	49500	43200	2000	243540	41
12	14500	622000	221760	35000	52200	43200	2000	267840	43
13	14000	646000	221760	35000	54600	43200	2000	289440	45
14	14000	688000	221760	35000	58800	43200	2000	327240	48

Mobilising other funds

As in previous years, Task 40 members will attempt to link work to other ongoing projects. Possible EC-funded projects are e.g. Biotrade2020+, S2Biom and BioSustain and ongoing national projects, e.g. financed by RVO, TEKES, DECC, STEM, DTI, GTZ, FNR, GSE, DoE etc.). These typically result in shared costs for workshops and meetings, e.g. shared venues, bus rentals etc. Other possibilities are that Task 40 members jointly acquire news projects (e.g. Biotrade2020+) which are content-wise related and offer opportunities for cooperation. Currently, there are no plans to charge for events (e.g. workshops) or reports, or to find other ways of income.

4.5 Management structure

The structure of the management (combined leadership of the E&R group, Copernicus Institute, Utrecht University and RWE, with supervision from RVO as Operating Agent) is proposed to be continued.

The E&R group of the Copernicus Institute will, supported by the bioenergy research activities (with some 25 research staff involved) coordinate the scientific content of the Task and be responsible for synthesis and integration work and reporting, combined with supporting everyday management of the Task.

RWE is a leading utility in the import and co-firing of wood pellets in the Netherlands and the UK, but also a major producer of wood pellets, is responsible for the management and finance issues.

A brief description of both parties and CV's of the current Task leaders Peter-Paul Schouwenberg (RWE) and Martin Junginger (Utrecht University) is given in appendix 2), as well as the short CV of Chun Sheng Goh (Utrecht University) who performs key activities for the Task on both content and management field. Over the course of 2016, we anticipate that the activities of Chun Sheng Goh will be carried over to Ms. Thuy Mai-Moulin, as Chun Sheng hopes to defend his PhD thesis in the 2nd half of 2016.

Appendix 1) Long list of potential topics for market studies

- (1) A renewed / additional effort to map current wood chip markets, agri-residue markets & trade flows for energy on a regional and global level. Linked to this could be an effort to better map the production and trade of fuel wood, typically in the ‘informal economy’, e.g. often traded without proper registration in statistics. This issue is very important to the IEA, which has a great consideration for the proper evaluation of the household biomass energy use. Our experience in this area is great, not only in terms of monitoring what is happening, but also in terms of developing proper procedures to handle uncertainties, convert the quantities into energy, etc. Such a line of research would be very interesting as it could also reconcile statistics on the availability of biomass, flows import-export and use, etc. Particularly a study on the world trade with wood chips including prices, amounts, quality, stats could be of interest, possibly also including the potential assessment of new resources, including different quality.
- (2) Renewed/continued market studies for pyrolysis oil, torrefied biomass and aviation fuels (and the role/importance of international trade)
- (3) In 2017, the EU will lift production and import quota for sugars and iso-glucose, creating a free market and significantly impacting production volumes. Expectations are that feedstock supply will increase and the EU may have several million tons of additional supply of feedstock that can potentially be used in fermentation, ethanol production or other purposes. -> monitor and analyze resulting trade flows (?)
- (4) A possible analysis by T40 would be dealing with “Bioenergy and free trade”. It could cover measures like subsidies and market protection tariffs, possibly also indirect effects like certification criteria and cascading rules. Preferably, also the policies and drivers behind the measures should be included (both those of political bodies and of pressure groups). The background could be a comparison of “naked” prices for imported vs local bioenergy. Obviously, there are great differences between different bioenergy chains (ethanol, HVO, pellets, recovered wood, etc.)
- (5) Potential biomass demand in new industries (e.g. processing industries): This reflects what is going on at present in Sweden. The “marketing” of bioenergy is focusing on all major energy users, not only the traditional ones; forest industry and CHP/heat utilities. A large number of industries (primarily “process” industries) were found and for many of them a transfer to bioenergy would be feasible and economic. The range covers breweries, mines, asphalt application, etc. A similar mapping could be made in T40 member countries.
- (6) The study on (promotion mechanisms for) advanced biofuels could be used as a starting point for a more developed study, including new “really” advanced biofuel resources (like arundo donax) and future updates of “old” chapters.
- (7) Macro algae’s production is currently in its infant state with a handful of commercial production in Europe but more frequent in Asia. Current productions mainly focus on the food and food additive market but there are, considering the large growth rates of especially macro algae’s, potentials for mitigating eutrophication of the seas and at the same time produce of large quantities for bio- energy and biorefineries. This should also be combined with a brief investigation on other biobased resources from the sea such as bio-waste from the fishing industry. E.g. it is only half the weight of a fish that is actually ending up as food on the table, the rest is a bio-waste which is not allowed to be dumped and can only partly be used for feed production. New rules for not allowing dumping of by-catch will increase this type of bio-waste. Propose a study revealing the state-of-the-art of this market (Aquatic biomass), size, costs and barriers and potential for this new type of biomass resources in the bio-economy chain (Denmark would be interested to take the lead on this)
- (8) How do large single events (disturbances) affect bioenergy markets? For example natural disasters such as storms (Klaus, Gudrun) forest fire (just had a big one this summer in Sweden, potentially flooding markets with damaged wood) and power plant fire (Tilbury, Amager, Amer...)
- (9) Trade of biomass technologies throughout the supply chain – from equipment to plant seedlings to biomass conversion technologies...

- (10) Trade of biomass, biofuels and biobased materials - status quo and demands for a sustainable bioeconomy.
- (11) Valorisation of biomass. At different points in the supply chain, biomass will need to be tested for quality and value. The amount of testing will depend on the value chain and the value of the product/intermediate. How will this look like and can this be integrated into international standards?

Appendix 2) Background coordinating parties

The Energy & Resources Group of the Copernicus Institute, Utrecht University

Energy and resources form the key challenges for society to change towards more sustainable development paths. The Energy & Resources (E&R) group is a key player in this area, internationally, nationally, and at Utrecht University. E&R focuses its research on transitioning to a sustainable energy and resource systems, with special attention to integrating the efficient use of energy and resources with renewable energy supply solutions, at various scales. The future development of the E&R Group will build on the current strengths of the group, and develop these further by strategically linking the research themes and researchers to develop collaborative research areas, i.e. the bio-based economy, energy and resource efficiency, (ex-ante) technology assessment, policy development and evaluation, the underground in sustainable energy supply, and smart grids and cities.

It is the ambition of E&R to make a difference in the transition towards a sustainable energy and resource system. The research theme energy and resources addresses a number of the grand challenges. The ever-growing energy and materials demand of our society puts enormous pressure on our natural resources, renewable and non-renewable, reducing the quality of our environment and increasing the constraints on resource availability. The response to these challenges requires a different approach to fulfil the energy services demand by society. These include efficient use of energy and materials, shifting to renewable energy sources, mitigating risks of and adapting to climate change, reducing unsustainable land use change, and redirecting industrial metabolism. This transformation is a multi-disciplinary process with a large number of stakeholders, requiring understanding and inputs from a variety of disciplines to come to collaborative solutions. The E&R group offers a unique multi-disciplinary environment to develop knowledge and collaborative science projects in this complex field.

The research of E&R focuses on sustainable energy and resource systems. The energy system faces a large transformation away from the current system to a sustainable one. Environmental sustainability, affordability, security, and social acceptance are key criteria for future energy and material systems. Pressure on the world's ecosystems and resources is increasing rapidly, necessitating the accelerated deployment of technologies, systems, measures and governance. The issues are interconnected; specific technologies and pathways can quickly lead to trade-offs and conflicts with other issues. In the E&R group (and the Copernicus Institute) those challenges are analyzed in a variety of dimensions: from fundamental material sciences, technology assessment, to governance, scale (local to global), time, and combining bottom-up and top down approaches. Based on the wider research environment within the Copernicus Institute, a number of areas are identified, in which we currently can be considered leaders in The Netherlands and internationally, as well as areas in which we can develop a major presence if we fully exploit the available knowledge and synergies offered by the available resources and researchers in E&R, the Copernicus Institute and Faculty.

One of the collaborative focus areas within the E&R group is the Bio-Based Economy: The bio-based economy encompasses all activities related to biomass production and subsequent conversion to energy and materials. It aims at reducing the carbon footprint of energy and material supply, and the dependence on finite and increasingly costly fossil fuels. E&R research focuses on production, trade, conversion, use and end-of-life options of biomass to deliver renewable alternatives for energy and materials. On the supply side, a broad set of issues surrounding biomass production (both residues and dedicated crops) requires increasing attention from a natural resources management perspective, including land-use, biodiversity, water, soil, carbon stocks, and various socio-economic factors. To secure significant volumes of biomass, scaling-up and optimization of (international) supply chains provide new challenges. On the conversion side, we focus on modeling conversion processes and understanding the impacts of novel technologies and opportunities to sustainably (co-) produce of value-added products and energy.

Key activities on biomass, bioenergy and bio-based economy include:

- Performance of advanced conversion technologies (fuels, power, biorefining, bio-CCS, etc.)
- Biomass potentials and modeling land-use patterns and changes.

- Bioenergy trade and bioenergy markets
- Sustainable production of biomass feedstocks
- Full impact and performance analysis of bio-energy systems, strategies and scenario's.
- System analyses, optimization and related model development; Studying non-technical barriers, development of policy, RD&D and implementation strategies.

For more information see:

<http://www.uu.nl/en/research/copernicus-institute-of-sustainable-development/research/research-groups/energy-and-resources>

Short CVs:

Martin Junginger is Associate Professor at Energy & Resources (E&R) of the Copernicus Institute, Utrecht University, and leads the bioenergy cluster of the E&R group. He has a background in chemistry and environmental science, and joined the staff of E&R in 2001 as PhD student, doing extensive research on the technological development and associated cost reductions of several renewable energy technologies, including onshore and offshore wind farms, biomass CHP plants in Sweden and biogas plants in Denmark. After obtaining his PhD in May 2005, he has mainly been working Sustainable International Bioenergy Trade. He is leader of IEA Bioenergy Task 40 on Sustainable International Bioenergy Trade (see www.bioenergytrade.org), in which topics like development of biomass sustainability assurance frameworks, bioenergy markets and logistic chains are investigated. He works amongst others on charting and projecting international trade in biomass and biofuels (with a special focus on wood pellets), and identifying limitations and opportunities for bioenergy trade. His expertise includes solid biomass logistic supply chains and GHG balances including forest carbon accounting. He is currently member of the Dutch commission Corbey advising the Dutch government on biomass sustainability topics. The topics mentioned above are also featured in ongoing projects, e.g. the EC-funded projects Biotrade2020+, BioSustain and DiaCore, and the TKI-BBE funded project BioLogikNL in which Martin has a leading role. Within the frame of these projects, Martin has organized several workshops (in the Netherlands and abroad) and given numerous presentations and lectures, amongst others in Brazil, Canada, the USA, Malaysia and more than 10 European countries. He also was contributing author to the bioenergy chapter of the IPCC Special Report on Renewable Energy Sources (SRRES).

A few facts & figures:

- 50 titles published in peer reviewed scientific journals Hirsch index: 24 in Elsevier Scopus (as of April 2015)
- Co-author of >45 scientific reports and >60 conference papers
- Main editor of the book “Technological Learning In The Energy Sector. Lessons for Policy, Industry and Science” (together with eds. Prof. Dr. André Faaij and Dr. Wilfried van Sark), Edward Elgar Publishing Limited. Cheltenham, UK, ISBN 978 2 84844 834 6, p. 332.
- Main editor of the book: Junginger M, Goh CS, Faaij A (Eds.) International Bioenergy Trade: History, status & outlook on securing sustainable bioenergy supply, demand and markets. Springer, Dordrecht.
- Contributing author to the bioenergy chapter of the 2011 IPCC special report on renewable energy sources.
- Broad experience with >35 projects and programs for amongst others the European Commission, the Netherlands Organisation for Scientific Research (NWO) and AgentschapNL, international bodies and the private sector.
- Regular reviewing of publications for journals as Energy Policy, Biomass and Bioenergy, BioFPR, Energy, Biotechnology for Biofuels, International Journal of Energy Technology and Policy, Journal of Cleaner Production, Scandinavian Journal of Forest Research, the International Journal of Energy Sector Management, and others.
- Supervised 6 Ph.D.-trajectories as co-promotor to date, 7 trajectories ongoing.
- More than 70 oral presentations at national and international events since 2004.

Relevant scientific and social positions (selection):

- Leader of Task 40 on “Sustainable Bioenergy Trade” under the IEA Bioenergy Agreement; participation of bioenergy academia and industry parties from 12 countries on three continents (coordinator between 2005-2012, leader from 2013 onwards).
- Member of the commission Corbey as of September 2013 advising the Dutch government on biomass sustainability topics.

More detailed information about Martin, including a full list of publications, can be found on:

<http://www.uu.nl/staff/hmjunginger/>

Chun Sheng Goh works as a researcher at the Copernicus Institute, Utrecht University, The Netherlands. He is also the task assistant of IEA Bioenergy Task 40 "Sustainable International Bioenergy Trade" and responsible for coordinating and supporting task activities. He has published over 11 papers in peer-reviewed journals. Previously he worked on the pretreatment of oil palm biomass and the development of bioenergy in Southeast Asia for his M.Sc. degree at Universiti Sains Malaysia. He has also worked as a visiting researcher at Université Henri Poincare in France. In 2011, he won the Australian Endeavour Research Award to carry out a 6-months practicum at University of New South Wales in Australia. Since August 2011, he started his work at Utrecht University in the area of sustainable biomass and bioenergy trade.

More detailed information about Chun Sheng can be found on:

<http://www.uu.nl/staff/CSGoh/0>

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Short CV Peter-Paul Schouwenberg (1958)

Peter-Paul Schouwenberg has a legal and business administration background and currently working as Senior Officer Regulatory Affairs and Project Manager Biobased Economy within Essent. Previously Peter-Paul was Vice-President Biofuels & Development within Essent Trading International SA in Geneva, and for more than 10 years responsible for the sourcing, trading and development of biomass (solids and liquids) on a global scale. Due to his leadership Essent became one of the authorities in the biomass market. He developed furthermore an unique track and trace system (Green Gold Label), which can be used worldwide in the discussions regarding the sustainability of biomass. Furthermore he was one of the initiators of the standard Gafta (trading) contract for Biomass and the introduction of a forward curve for wood pellets. He was also involved in the development of several new (bio)fuels for the production of sustainable green electricity. The most important one, a worldwide primeur, was the development of a fair-trade coffee husk pellet in Brazil. For this project, he received the SCAA (Specialty Coffee Association of America's) Sustainability Award.

As of 2010, Peter-Paul Schouwenberg is within RWE Generation Hard Coal, Gas and Biomass Netherlands responsible for the new programme named Biobased Economy. Peter-Paul Schouwenberg is chairman of the Rotterdam Biomass Commodity Network (RBCN), Task leader of the IEA Bioenergy Task 40, Member of the Commission Corbey, Biomass Renewable Business Platform.

Peter-Paul Schouwenberg is furthermore one of the Board Members of the Sustainable Biomass Partnership (SBP) and Director of the Foundation Biobased Economy (TKI BBE) in the Netherlands.