

TASK 39

‘Commercialising Conventional and Advanced Liquid Biofuels from Biomass’

Progress Report

ExCo74

**Brussels
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**Prepared by:
J.S. van Dyk, J.N. Saddler and J.D. McMillan**

**Verified by:
Ed Hogan, Natural Resources Canada**

TASK 39 PROGRESS REPORT

1. ADMINISTRATIVE TASK INFORMATION

Operating Agent: Ed Hogan (Natural Resources Canada)
Associate Operating Agent: Paul Grabowski (US Department of Energy)
Task Leader: Jim McMillan (National Renewable Energy Laboratory)
Associate Task Leader: Jack Saddler (University of British Columbia)

Sub-Task Leaders:

Maria Nyquist / Paolo Barbosa (Biochemical conversion)
 Axel Munack / Jürgen Krahl (Link to Advanced Motor Fuels IA)
 Dina Bacovsky (Fuel Markets)
 Michael Persson / Emile Van Zyl (Policy issues, EU, Africa)
 Les Edye/ Shiro Saka (Policy issues, Pacific Rim, Algae)
 Warren Mabee, Paolo Barbosa (Policy issues, North and South America)

National Team Leaders:

Les Edye	Australia
Dina Bacovsky, Manfred Wörgetter	Austria
Paulo Barbosa, Antonio Maria Bonomi, Eduardo Barcelos Platte	Brazil
Jack Saddler, Warren Mabee	Canada
Michael Persson, Henning Jørgensen, Claus Felby, Anders Kristoffersen	Denmark
Axel Munack, Jürgen Krahl	Germany
Alessandra Frattini, David Chiaramonti, Stefania Pescarolo	Italy
Shiro Saka, Kazumichi Uchida	Japan
John Neeft, Oliver May	Netherlands
Ian Suckling	New Zealand
Judit Sandquist, Gisle Johansen, Karin Øyaas, Berta Guell	Norway
Emile van Zyl, Bernard Prior	South Africa
Jin Suk Lee, Kyu Young Kang, Seonghun Park	South Korea
Maria Nyquist, Jonas Lindmark, Alice Kemp, Anders Holmgren, Leif Jonsson	Sweden
Jim McMillan	United States

2. FINANCIALS

Annual Budget (2014)

	Total Budget (US \$)
Contribution from Member Countries *	225,000
Less: contribution to Strategic Fund and TC	(22,500)
Sub-Total	202,500
Funds carried forward from previous year (2013) **	113,857
Total Budget for 2014	316,357

Annual budget of \$225,000 = \$240,000 original budget less \$15,000 contribution from Finland

The closing balance of **CDN\$122,902.67** equals **US\$113,857.03** based on the exchange rate of CDN\$1 = US\$0.9264 as at 31 December 2013.

Budget break down (2014)

Category	Budget 2014 (US \$)	Estimated Expenses Jan-Aug 2014 (US \$) *
Salaries and Benefits Susan van Dyk, (Task coordinator); William Cadham – research student (inter-Task activity); Ling Li – research student, (liaison with China); Gladys Tecson/Jack Saddler – (admin)	97,000	65,832
Travel, workshops, meetings (including distribution of travel funds to J. Mc)	50,000	10,776
Materials, supplies and support services (IT, web maintenance, library, etc.)	923	2,920
Commissioned work		
- Update algal report (Les Edey) (\$10,000 advance)	45,000	10,000
- GHG model comparison (Neeft)	45,000	-
- Advanced Fuels in advanced engines (Munack, Krahl)	45,000	-
- Update to demoplants database (Bacovsky)	10,000	
Subtotal	292,923	89,528
Overhead (8%)	23,434	7,162
Total	316,357	96,690

*Used average CAD-US dollar exchange rate as of Aug 2014 of \$1 CAD = .913601 US

3. SIGNIFICANT ACHIEVEMENTS SINCE THE LAST EXCO MEETING

During the past six months Task 39 published and publically released the full report and the executive summary of “The potential and challenges of drop-in biofuels” report (T39-T1a). These documents, both the final report and the Executive Summary, were extensively peer-reviewed by Task 39 country representatives and revised to incorporate their invaluable input. Based on ongoing feedback and suggestions, updating and modification of the report continued through June 2014. The full report and summary were made publicly available on the Task 39

website (www.task39.org) in August 2014. The drop-in report was profiled (lead article) in the 12 August issue of Biofuels Digest entitled: “The Hydrogen Wall. Looking at the prospects for drop-in biofuels” (<http://www.biofuelsdigest.com/bdigest/2014/08/11/the-hydrogen-wall-looking-at-the-prospects-for-drop-in-biofuels/>). The Biofuels Digest is widely read with many thousands of subscribers and 70,000 unique monthly visitors. The article attracted a lot of positive attention and resulted in increased visitors to the Task 39 website where the report could be downloaded.

Since the last ExCo meeting in April 2014, the Task has published and circulated two Newsletters: Issue #36 profiling activities in the USA was published in April 2014, while issue #37 was published early September 2014 and featured an article on Brazil’s biofuel industry. These newsletters are available on Task 39’s website (www.task39.org).

Based on the Task’s deliverables for the current triennium (2013-2015), two reports have been completed – The Drop-in Biofuels report (T39-T1a), and the update of the Biofuels Implementation Agendas report (undertaken by UBC and Queen’s University) (T39-P1a). Three further deliverables are currently being addressed:

- Update on the Status and Potential for Algal Biofuels Production (T39-T1e);
- Comparisons of GHG models (T39-T1d);
- “Advanced Fuels in Advanced Engines” with AMF (T39-T2b).

A draft roadmap for integration of advanced biofuels (T39-T1b) undertaken by NREL and UBC is ongoing.

Task 39 members presented (Oliver May (DSM), Sergios Karatzos (UBC/Steeper)) and attended the joint IEA Bioenergy/Advanced Motor Fuels (AMF) workshop held on 20 May 2014 in Copenhagen, Denmark. On 21 May 2014, Task 39 held a formal business meeting in Copenhagen, hosted by Professors Claus Felby (University of Copenhagen) and Henning Jorgensen (DTU). The agenda for the Task 39 business meeting is attached. As the detailed country reports had been presented fairly recently, at the last Task 39 meeting in Berlin in early 2014, this aspect of our regular business meetings was not covered. Instead, we used presentations from Anselm Eisentraut and Sergios Karatzos to generate discussion on: (a) The update of the IEA HQ Biofuels Roadmap and (b) Drop-in Biofuels and the drop-in report. In the past, Task 39 has provided a considerable amount of data/information to IEA HQ when they have been preparing/updating their bioenergy/biofuels road map. The group agreed that this would be priority activity for the group as IEA HQ updates the information in the road map over the coming year.

Regarding the Drop-in report, the group felt that it was a well-researched and delivered document that should remain a priority area for the group. With companies such as Boeing, Airbus, SkyNRG, and groups such as the US military showing great interest in renewable fuels for aviation and shipping applications in particular, it was recommended that drop-in biofuels remain a priority topic for the coming triennium.

The topics/areas that Task 39 should focus on in the future were also discussed, so that these suggestions could be incorporated into the prolongation proposal for the next triennium (2016-2018). A draft proposal will be prepared and circulated within the group prior to the next ExCo meeting in October. The group will continue to focus on technical and policy issues that influence the commercialisation of all biofuels including conventional, advanced and so-called drop-in types.

Details of Task's major deliverables and progress are described below.

Task 39 reports and communication deliverables

a. T39-T1a - Drop-in Biofuels report. This report was completed and published and is now in the public domain (All IEA Bioenergy Task 39 country representatives and ExCo members had access to drafts of this report through its development).

This 210 page report provides a comprehensive background to so-called advanced "drop-in" biofuels, including an assessment of the various approaches/technologies that are being developed, and an overview of the challenges to commercialization.

After considerable and productive debate within the Task 39 membership, a consensus was reached on the definition of drop-in biofuels. The final definition, as now listed in the report, is that drop-in biofuels are "liquid bio-hydrocarbons that are functionally equivalent to petroleum fuels and are fully compatible with existing petroleum infrastructure." While describing the opportunities for progress in the "drop-in" biofuels arena, the report analyzes various potential challenges, such as the requirement for substantial amounts of inexpensive, sustainable hydrogen (H₂), the ability to integrate biofuel platforms into existing oil refineries, the effects of market demand (e.g., sulphur-free diesel) and direct and indirect biofuel policies. The on-going commercialization efforts to develop drop-in biofuels are described and the activities of some of the leading companies in oleochemical, thermochemical, biochemical and hybrid or mixed conversion platforms are reviewed. At present, oleochemical approaches represent the only fully commercialized drop-in biofuel platform. However, lessons learned from this platform can be used to facilitate the commercialization of thermochemical and biochemical platform (and hybrid) approaches that are at earlier stages of industrial development. For most platform approaches, it is likely that there will be significant trade-offs between the need for hydrogen and the total fuel yield as well as the capital and operating costs of the process. For example, pyrolysis platforms that can leverage petroleum refining infrastructure are likely to entail relatively low capital costs and can be developed at a relatively small scale. However, their requirements for hydrogen and specialized consumable catalysts will likely be high. The effective hydrogen to carbon ratio of the feedstock for each platform is strongly correlated with its processing costs. For example, the oleochemical platform uses relatively costly vegetable oil-based feedstocks that exhibit high H_{eff}/C ratios enabling the costs of processing to remain relatively low. The reverse is true for the pyrolysis platform where low H_{eff}/C biomass (lignocellulose) is much less costly to procure but much more energy and carbon intensive and costly to process to liquid biofuels. These and other insights as well as some techno-economic considerations for each drop-in biofuel platform are provided in the report. This report (210

pages) and its associated summary report (20 pages) were made publicly available on 12 August 2014 and can be downloaded from Task 39's website (www.task39.org).

b. T39-P1a - Biofuel Implementation Agenda (Comparison of Task 39 country biofuel policies)

The Task 39 Implementation Agenda report compares and contrasts developments in biofuels production and market penetration for 19 different countries. These countries include the Task 39 member countries as well as important emerging economies such as China and India for completeness and comparison. The report includes details of biofuel policies and the extent to which these biofuels policies have been implemented. The report also assesses the measures taken by member countries to develop or stimulate their respective biofuels industries, including incentives and investment in research. The report also provides updates on the current status of biofuel sustainability assessments and related discussions that factor into policy development. This report is also available on the Task 39 website (members-only access).

This comparison between each country's policies highlights the diversity of drivers being used, which vary from energy security concerns (USA) to reducing net greenhouse gas emissions (EU). The amount of biomass available within different countries varies widely, with some countries having abundant biomass resources available for biofuel development (e.g., USA, Brazil), while others have a limited supply of such biomass resources available (e.g., Japan, China). This affects the growth and development of biofuels in these jurisdictions. Under conditions of limited biomass supply, these resources may preferentially be used for alternate forms of energy, such as electricity generation. In most countries the production of advanced biofuels, such as cellulosic ethanol and drop-in fuels, is making slower-than-hoped-for progress. However, although the pace of commercialisation of most of the biomass-to-liquid biofuels technologies is slower than previously forecast, several demonstration- and commercial-scale plants in Task 39 member countries are expected to become fully operational this year. Continuity of some of the more successful policy drivers already put in place to catalyse advanced biofuels commercialisation is essential to maintain or increase the rate of technology development and commercialization.

c. T39-T1e - Update on Status and Potential for Algal Biofuels Production

Task 39 published a report entitled "Current Status and Potential of Algal Biofuels" in 2010 and a joint Executive Summary report on this topic, with IEA AMF, in 2012. In this current triennium our network had planned to update the 2010 report and we had already encouraged the authors of the original report (Les Edye and colleagues at NREL) to prepare an outline of what they would cover in this update. However, at the Copenhagen ExCo meeting held on 22 May 2014, the ExCo raised the issue of how IEA Bioenergy collectively might consider the topic of algal biofuels in the next triennium. Thus, in response to advice from ExCo the original Task 39 Algal update project has been extensively modified and expanded to become more of an inter-Task collaboration with Task 39 taking the lead. Dr. Les Edye, one of the original authors of the 2010 Algal Biofuels report, will lead this project and he is in the process of assembling a "steering team" of Task 39 and ExCo members or stakeholders that will help/advise him on how to tackle this assignment, while both updating the Algal Biofuels report and making

recommendation to ExCo on how Algal Biofuels might be tackled in the next triennium. Les has been liaising with the various Task leaders on how their Tasks might contribute to an expanded and more comprehensive update. This will likely include broader topics relating to algae and make use of the different foci of other IEA Bioenergy Tasks (e.g., the need for co-products in a biorefinery concept, the GHG balance of algal biofuels, etc.). With the broader scope of the report and involvement of other Tasks, a proposal will be presented to ExCo in October requesting strategic funds to match the Task 39 contribution to this project. By the time of the ExCo meeting in Brussels, the members of the “steering team” should have been established and the contributions from other IEA Bioenergy Tasks to this project should be better defined. Kyriakos Maniatis and Cees Sagt (DSM) have already indicated their interest in participating on the steering team for the algae biofuels report update.

*d. T39-T1d - Update of GHG Emissions and energy balances for advanced biofuels:
Comparing different GHG models on biofuel systems*

Life cycle assessment (LCA) plays a major role in biofuel policies, and this report will compare different LCA models which sometimes come to different conclusions when ostensibly using the same model inputs. This project tentatively will be a collaboration between Task 38 and Task 39 and will focus on 4 main models (potential contributors in brackets):

- GHGenius (Don O’Connor, Canada)
- GREET (US EPA) (Michael Wong, via Helena Chum)
- SimaPro (CTPE, Brazil and Task 38)
- BioGrace (John Neeft, Europe)

Discussions are underway with Task 38 to progress this work. Dr. John Neeft is taking the lead for Task 39.

e. T39-T2b - “Advanced Fuels in Advanced Engines” with the Advanced Motor Fuels (AMF) Implementation Agreement (IA)

Planning of this report is still in the development stage, as the ExCo has recommended that this work should be carried out in collaboration with the AMF Implementation Agreement (IA).

A brief outline of the proposed project (see attached) was sent to Nils-Olaf Nylund of the AMF, with a proposal to jointly fund and carry out the indicated work. AMF indicates they cannot commit funds to a joint study until they have had a chance to discuss this at their next ExCo meeting. However, they did identify individuals within the AMF who might be able to contribute advice as the joint project is being developed. It was also suggested that this topic should be incorporated into the future work (next triennium) of both Task 39 and the AMF.

Task 39 meetings and collaborations

The Task continues to achieve significant knowledge exchange between its members by organizing and delivering symposia, workshops and business meetings which entail:

- a) Formalized and detailed Country Reports;
- b) Discussions on the topics described in the Task's program of work; and
- c) Presentations made in Special and/or Parallel sessions at established biofuels events occurring in close conjunction with scheduled business meetings.

Task 39 members participated in the ExCo's joint workshop with Advanced Motor Fuels IA on 20 May and joined in the excursion to Haldor Topsoe on the afternoon of 22 May 2014. Task 39 also held a formal business meeting in Copenhagen on 21 May 2014, hosted by Professor Claus Felby (University of Copenhagen). As mentioned above, the meeting profiled two topics, (a) The IEA Biofuels Roadmap and (b) Drop-in Biofuels and the drop-in report. Anselm Eisentraut presented data from the IEA Biofuels Roadmap, which includes projections for future biofuel production. The recent set-backs and failures of some of the advanced biofuel companies imply that the IEA HQ targets for advanced biofuels in the transportation sector might be overly optimistic. It was agreed that Task 39, with strong industry representation, was in a unique position to offer more "realistic" assessments and predictions to update the next edition of the IEA Biofuel Roadmap targeted for 2015.

The presentation given by Sergios Karatzos on the drop-in report resulted in an extensive discussion. Many of the suggested changes and modifications arising from this discussion were incorporated into the final report.

The ongoing and upcoming deliverables for Task 39 during the current triennium were also discussed at length.

The Task also progressed with planning of its next business meeting to be held in Gwangju, South Korea in conjunction with the International Symposium on Alcohol Fuels (ISAF) on 10-14 March 2015. Task 39 will host two sessions at the ISAF conference with five presentations in each session given by Task 39 members.

At the Copenhagen ExCo meeting, (May 2014), Task 39 was asked (via Kyriakos Maniatis) to participate in the 4th International Conference on Lignocellulosic Ethanol (ICLE) which will take place in Landshut-Munich, Germany on 23-25 September, 2014. Attempts were made to arrange a formal or informal Task 39 meeting in association with this meeting, with a primary goal of providing input into the draft Task 39 program of work for the next triennium. However, only three Task 39 members indicated that they would be able to attend this conference. Thus, only an informal Task 39 meeting will be held during the ICLE conference.

Meeting	Date	Status/Result
Business meeting of Task 39 in Copenhagen, Denmark	May 21, 2014	A Task 39 business meeting was held on 21 May

Meeting	Date	Status/Result
Informal meeting of Task 39 in Landshut-Munich	Sept 23-25, 2014	An informal meeting of the Task 39 members in attendance at the conference will be held
Business meeting in March 2015 in Gwangju, South Korea	March 10-14, 2015	To take place in conjunction with the International Symposium on Alcohol Fuels (ISAF) in Gwangju, South Korea

Collaborations between Task 39, other Tasks and IEA HQ

Task 39 is participating in the inter-Task collaboration project “Mobilising sustainable bioenergy supply chains” and has contributed a chapter to this report entitled “Challenges and opportunities for the conversion technologies used to make forest biomass based bioenergy/biofuels”.

Other collaborations with IEA AMF and other tasks include work on the three ongoing deliverables as described above, namely the Update on the Status of Algal Biofuels (and products); Advanced Fuels in Advanced Engines; and Comparison of GHG models for advanced biofuels. Task 39 has been and will continue to collaborate with IEA HQ in updating relevant IEA reports. As examples, Dr. Jim McMillan recently contributed to Section 7 of the Medium-Term Renewable Energy Market Report and Dr. Jack Saddler will contribute to the writing of the Biofuel Roadmap during an upcoming sabbatical.

4. WEBSITE STATISTICS

The Task 39 website continues to serve as an effective information dissemination tool for Task 39 members and stakeholders. The website received a large number of new visitors in recent months, and the publication of the drop-in report saw a surge in visits, presumably to access and download the now publicly accessible drop-in biofuels report.

Month	Pageviews	Users	Sessions	% New Visitors	Avg. Session (min)
Apr-14	1117	284	378	65.61%	3.2
May-14	637	210	256	71.90%	2.3
Jun-14	826	228	286	67.50%	3.3
Jul-14	927	266	333	68.80%	2.7
Aug-14	1643	459	583	73.20%	3.0
TOTAL	5150	1447	1836		14.41
Average/month	1030	289.4	367.2		2.9

	Country	Percentage
1	United States	18
2	Canada	14
3	Brazil	6.7
4	Japan	4.4
5	Germany	4.2
6	Australia	4
7	Austria	3.9
8	United Kingdom	3.5
9	Sweden	3
10	Spain	2.8
11	France	2.8
12	Netherlands	2.7
13	Italy	2.6
14	South Korea	2.6
15	India	2.5
16	Denmark	2.4
17	Mexico	1.4
18	Belgium	1.1
19	Finland	1.1
20	China	1
21	Norway	1
22	South Africa	1
23	Switzerland	0.9
24	Taiwan	0.8
25	Indonesia	0.7

5. PROBLEMS, DELAYS, ADDITIONAL FUNDING, AND COOPERATIONS

The Task has operated normally since the last ExCo meeting and is on-track to deliver on all projects.

GANTT CHART OF TASK 39 WRITTEN DELIVERABLES, 2013-15

Project No.		Topic	Status	2013				2014				2015				Alarm
				Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
REPORTS	T39-T1a	The potential and challenges of “drop-in” biofuels	Planning													Completed
			Actual													
	T39-T1b	Roadmap for Integration of advanced biofuels	Planning													Upcoming
			Actual													
	T39-T1c	Co-product generation and <u>biorefinery</u> applications (with Task 42)	Planning													Completed
			Actual													
	T39-T1d	Update of GHG Emissions and <u>energy balances</u> for advanced biofuels (with Task 38)	Planning													Upcoming
			Actual													
	T39-T1e	Update on Status and Potential for <u>Algal</u> Biofuels Production	Planning													Upcoming
			Actual													
	T39-T2b	Advanced biofuels <u>in advanced engines</u> (with the AMF)	Planning													Upcoming
			Actual													
	T39-P1a	Updated Implementation Agendas	Planning													Completed
			Actual													
	T39-P1b	Assessment of <u>large-scale</u> demonstration plants (with Bioenergy 2020+)	Planning													Ongoing
			Actual													
	T39-P2b	<u>Spatial</u> analysis of biofuel feedstock reserves (with Task 43).	Planning													Ongoing
			Actual													
T39-P2c	Biofuel production and consumption in <u>emerging economies</u> (China, India, etc.)	Planning													Upcoming	
		Actual														
OTHER	--	Task 39 Newsletter	Planning												Ongoing	
			Actual													
	--	IEA Annual Report (Task progress)	Planning												Ongoing	
			Actual													