

TASK 36

Integrating Energy Recovery in to Solid Waste Management

End of Triennium Report 2013-2015

**ExCo77
Rome, Italy**

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INTRODUCTION

This is the final report for the IEA Bioenergy Agreement Task 36 – Integrating Energy Recovery in to Solid Waste Management for the period 2013-15.

In this period, the Task aimed to examine issues that are important to policy development and implementation of energy recovery systems for solid wastes.

In the period 2013-15 Task 36 aimed to:

- Continue to inform decision makers on issues that are important to their decisions;
- Understand how policy decisions impact on the opportunities for and efficiency of energy recovery; and
- Continue to inform the IEA Bioenergy Agreement Executive Committee on progress of the Task.

The objectives of the Task in the period 2013-15 were to:

1. Hold a series of workshops alongside Task 36 meetings centred on topical issues for energy from waste. The proceedings from these workshops have been published on the web site.
2. Undertake specific studies in areas of key importance to participating countries, which have been published as summary papers on the web site.
3. Work with Task 37 on areas of overlapping interest.
4. Seek opportunities to publicise the work of the Task through national dissemination mechanisms.
5. Seek opportunities to publicise the work of the Task through presentation at national/international events.

This report summarises the work and results of the Task over the 2013-15 triennium, evaluating the work carried out and the significance of the findings.



Task 36 members with participants in BREF working group, Karlsruhe, March 2014

BACKGROUND

The proposal of work for the 2013-15 Triennium included four key activities to deliver the aims and objectives of the task:

- Task meetings, with associated workshops
- Collaborative work with Task 37 and 32
- Reports on key topics
- Communication through presentation of results on the web site and via international conferences.

The Task's core work was undertaken in newly structured Task meetings, each of which was accompanied with a themed workshop. The aim of these workshops is to allow Task members to present work on the nature of the issues concerned within their own country; to invite speakers to present work of relevance and to allow discussion of the issues presented.

The workshops held in the 2013-15 triennium were:

1. A joint workshop with Task 37 exploring relevant developments in anaerobic digestion and to explore areas of synergy between Task 36 and Task 37. *Stockholm, May 2013*
2. A workshop focussed on Solid Recovered Fuels. *Milan, November 2013*
3. A workshop held in association with the German BREF Working group on efficiency of energy from waste. *Karlsruhe, March 2014*
4. A workshop on Advanced Thermal Treatment of waste and emerging technologies, *Harwell, October 2014*
5. A workshop focussed on factors influencing the development of energy from waste, including public perception, legislation and policy changes, and health issues. *Bordeaux, June 2015*
6. A joint workshop with the International Solid Waste Association Waste to Energy working group on the role of energy recovery in a Circular Economy, *Berlin, October 2015*

In addition to the workshops outlined above, the Task also delivered three topic reports – Small Scale Energy from Waste, Gasification in the UK, and RDF/MSW Mass Balance.

In addition to the workshops and topic reports, we collaborated with Task 37 on the preparation of a report on the source separation of organic wastes from MSW and with Task 32 on a report on the health and safety aspects of solid biomass storage, transportation and feeding.

The work of the task was also presented at a number of international conferences and workshops, including:

- Factors Influencing the development of Small-scale EfW – paper presented at ISWA Annual Congress, Antwerp, September 2015
- Opportunities for Solid Recovered Fuel in a Circular Economy, presentation at the European Recovered Fuels Organisation Workshop, Brussels, April 2015
- An Evaluation of arising and markets for waste derived fuels. Paper presented at the Fifth International Symposium on Energy from Biomass and Waste, Venice, November 2014

REPORT ON THE TASK'S OBJECTIVES

This section reports on the Task's objectives and whether or not they have been achieved. In order to do this, the section is divided into a series of sub-sections dedicated to each specific objective, and the programme of work that was delivered as part of meeting the objective.

Objective 1: Hold a series of workshops alongside Task 36 meetings centred on topical issues for energy from waste. The proceedings from these workshops will be published on the web site. This objective was clearly met through the delivery of 6 workshops, summarised in Table 1. Presentations and summary reports from all workshops are published on the Task 36 website.

Table 1 : Summary of workshops delivered by Task 36 in 2013-15.

WORKSHOP 1: A joint workshop with Task 37 exploring relevant developments in anaerobic digestion (AD) and to explore areas of synergy between Task 36 and Task 37. Stockholm, May 2013

Aims/Content - This workshop was designed to update Task 36 on relevant developments on AD and to investigate the areas where there are synergies in the two areas, where the work of Task 37 might overlap with the work of Task 36 and where there could be useful joint projects.

Outcome/Conclusions:

- Source separation is important to AD of waste and one of the major costs is collection system
- Substrates can make a major difference to economics, but local conditions are also important.
- There is evidence that source separation for AD is energy and carbon efficient, but the use of nutrients in the residue is important to this finding. If the residue cannot be used and is burnt in EfW or buried in landfill this important advantage is lost.
- Microbiology is complex and important in influencing the yields. In particular inhibition can make a big difference to performance. Trace elements (e.g. Co, Ni, Se) are a key, but so is understanding exactly what is happening within the digester. Methodologies are now available to rapidly identify the microbial population.
- Quality control of source separation is important.

WORKSHOP 2: Which future for the Solid Recovered Fuels (SRF) market? Milan, November 2013

Aims/Content - This workshop discussed end of waste for solid recovered fuels, the results to the EU supported Recombio project and experience with the use of solid recovered fuel in Italy.

Outcomes/Conclusions

The following conclusions were drawn at the workshop:

- The standards body, CEN/TC343, has produced useful definitions for SRF and tests for the characteristics of SRF, enabling evaluation of the quality of SRF and its management.
- Work is still needed to increase confidence in SRF, both for users and for public perception.
- Over 1 million tonnes of SRF are produced in Italy alone, signifying the increasing interest in SRF in Europe.
- It is not possible to classify SRF on the basis of a single sample, and an agreed monitoring and sample protocol is necessary.
- A mature market for SRF requires transparency, data sharing and accepted procedures.
- End of waste for SRF has been achieved in Italy. The requirements are challenging but should lead to easier transport, handling and the development of market for a true waste derived fuel.
- Users called for SRF characteristics that decrease polluting emissions, improve combustion characteristics, increase the sustainable use of biomass contained in waste, develop high quality SRF and reduce management costs

WORKSHOP 3: A workshop held in association with the German BREF Working group on the efficiency of energy from waste. Karlsruhe, March 2014

Aims/Content - This workshop was held in association with the German BREF Working group on Efficiency of energy from waste. The workshop discussed issues about energy efficiency and the upcoming revision of the WI BREF in Europe.

Outcomes/Conclusions

Key workshop conclusions were:

- The most efficient EfW plants are those supplying district heating. These may achieve over 60% efficiency, providing that the heat load is reliable. For this reason it is best to site the plant in an urban area where there are reliable heat loads available.
- Although it is possible to achieve higher efficiencies as presented at the meeting, this may make operation more complicated and increase costs. In reality operators have to achieve a balance between efficiency and costs. In addition any alterations should not result in corrosion in the superheaters or costs will increase significantly.
- There is a need to examine why electrical efficiency is so important. Are incentives resulting in this trend? Could we do more to encourage the use of CHP?
- Operators also need to be convinced that there are no significant impacts on running costs, although the plant designers pointed to Amsterdam as an example where running costs have been controllable and there has been no need to replace the superheaters to date.

WORKSHOP 4: Advanced Thermal Treatment of waste and emerging technologies, Harwell, October 2014

Aims/Content - The workshop examined the development of technologies that would allow flexible integration of energy into solid waste management and the circular economy, including issues of funding and incentives to bring these technologies in to commercial operations.

Outcomes/Conclusions

- Advanced thermal conversion of waste has come a long way over the past few years and a lot of money has been invested, resulting in some full scale plants being established.
- In the UK a number of policies have supported the development of waste infrastructure and commercialisation of advanced thermal conversion options for waste.
- Changes or shifts in Government energy policy can be unsettling as advanced conversion technologies are still not commercially proven and continue to require development.
- The overall conclusion from this discussion is that Government renewable energy policy and regulation are important in developing advanced conversion options. Speakers asked for long term stability in policy and support for innovation to enable commercialisation of advanced thermal conversion of waste to renewable energy and other products.
- Some speakers pointed out that the long term nature of the development needs for advanced conversion technologies is important. Speakers discussed the need to adapt feed mechanisms, gasifiers and clean up to suit the waste fuel used (or alternatively to treat the waste fuel so that it is suitable for advanced thermal conversion).
- There were some questions about the comparison of efficiencies with conventional plants, with a plea that we ensure that information on feedstocks is provided when comparing efficiencies – particularly on the combustion properties of the feedstocks.

WORKSHOP 5: Factors influencing the development of energy from waste, including public perception, legislation and policy changes, and health issues. Bordeaux, June 2015

Aims/Content - The workshop examined the impact of government policy on the development of EfW in different member countries, and the impact this has on technology, application and outputs.

Outcomes/Conclusions

Whilst recycling of waste continues to increase in developed economies, the demand for treatment of residual waste continues to grow. The EfW technologies adopted in any one place are very much linked to what is driving their development in policy terms. The outcomes of the workshop include updates from all Task 36 members on how policy, public perception,

legislation and health issues were impacting on the development of EfW in member countries.

WORKSHOP 6: The role of energy recovery from waste in a Circular Economy, A joint workshop with the ISWA Waste to Energy working group, Berlin, October 2015

Aims/Content

The aim of the workshop was to facilitate discussion between Task 36 and the ISWA Energy recovery working group on the role of EfW in a Circular Economy. The workshop consisted of presentation by Task 36, ISWA, and facilitated workshops sessions.

Outcomes and significance The workshop consisted of facilitated sessions that concluded:

- Energy Recovery from waste is an integral part of a Circular Economy
- There is an opportunity to include EFW as an essential part of the Circular Economy
- It is likely that homogeneous waste will be recycled or upgraded, but EfW systems will need to be able to deal with increasingly heterogeneous residues.
- Circular economy initiatives are too focused on recycling rather than materials use. Countries that are already having issues with diversion from landfill may find it difficult to adopt to the circular economy without clear strategies that enable this.
- Terminology relating to the circular economy is vague and needs clearer definition.
- The circular economy should aim for climate neutrality.
- It will be important that Circular Economy initiatives do not result in export of problems, e.g. packaging mountains in emerging economies.

Objective 2: Undertake specific studies in areas of key importance to participating countries, which will be published as summary papers on the web site.

The planning of the 2013-15 work programme identified a number of key priority areas to member countries. These topics will include:

1. Small scale energy from waste:
2. Gasification;
3. Impact of changes in policy on energy recovery
4. Mass /energy balance for refuse derived fuels (RDF) compared with MSW

It was agreed that these topics would be explored in further detail depending on the number of members who subsequently joined the task, and available budget. Subsequently, the Task has undertaken studies in to Small Scale EfW, Gasification, and Mass/energy balance of RDF versus MSW. The work on impact of changes in policy on energy recovery was covered in Workshop 5 as outlined above. The specific studies undertaken are summarised below:

Small Scale EfW: The objectives of this study were to collate information on selected small scale waste treatment systems and to produce a status report of the technical and economic potential of such systems for waste treatment. A report was prepared and presented at the IEA Bioenergy End of Triennium conference in Berlin, 2015.

Gasification: a study was undertaken to investigate the apparent growth of the use of Advanced Conversion Technologies (gasification and pyrolysis) for the treatment of waste in the UK, and identify the number of projects in development and in operation, and state the reason for the growth experienced. A report was prepared and presented at the IEA Bioenergy End of Triennium conference in Berlin, 2015.

RDF/MSW mass balance: a study has been completed on the mass balance of RDF production compared to MSW production in the UK. This showed that increasing amounts of RDF are being produced from residual waste (i.e. waste after recycling). An additional trend is the increase in export of this RDF from the UK. The exported RDF is being used as a fuel in other European countries, notably Sweden, the Netherlands and Germany.

Objective 3: Work with Task 37 on areas of overlapping interest.

This objective was achieved in the delivery of both a joint workshop and the publication of a joint report. The joint Task 36/37 workshop is detailed above and contained presentations made by both Task 36, Task 37 and invited speakers, and included:

- Strategies for collection of organic waste in Stockholm, Johanna Nilsson (City of Stockholm)
- Biogas production in Sweden – role of nutrient composition and effects on microbial composition, degradation capacity and rheology, Professor Bosse Svensson (Linköping University)
- Biogas from organic residues and outlook to heterofermentative alcohol production, Günther Bochmann (Task 37)
- Update on Joint Task 36/37 report on international practices on the source separation of organics, Kathryn Warren (Task 36) & David Baxter (Task 37)
- Valorgas project: Collection and AD of Food Waste, Sonia Heaven, (University of Southampton)
- WRAP Organics Programme, Nina Sweet (WRAP)
- Trends influencing energy recovery from waste, Pat Howes (Task 36).

In 2014, a report authored jointly by Task 36 and Task 37 on the Source Separation of MSW. The report presented an overview of the source separation and separate collection of the digestible fraction of household waste, and of other similar wastes from municipalities, aimed to be used as feedstock for anaerobic digestion in biogas plants.

Objective 4: Seek opportunities to publicise the work of the Task through national dissemination mechanisms.

This objective has been met by the policy of Task 36 to invite key national stakeholders to our workshops. This has the benefit of both inputting key stakeholder knowledge in to the work of the task, but also disseminating the work of the task to the stakeholders themselves. Invited stakeholders have included academia, industry representatives, trade organisations and government officials.

Where possible, we have also sought joint working and engagement of national stakeholders in the delivery of our workshops. For example, our workshop on Solid Recovered Fuels in Milan in 2013 was supported by Regione Lombardia and Energia Ambiente. The Task's workshop in Karlsruhe in 2014 was organised in conjunction the BREF working group. Most recently, the joint workshop delivered in conjunction with ISWA was attended by representatives from 20 countries, all of whom have an interest in energy from waste.

In addition to this, presentations were delivered at all site visits to inform our hosts of the work of the Task. Information sheets were also provided.

Objective 5: Seek opportunities to publicise the work of the Task through presentation at national/international events

This objective was met by presentations made by Task 36 members at the following workshops, seminars and international conferences:

Workshops and seminars

- ISWA joint working group – presentation and workshop on role of EfW in Circular Economy. Berlin, October 2015
- Opportunities for Solid Recovered Fuel in a Circular Economy, presentation at the European Recovered Fuels Organisation Workshop, Brussels, April 2015
- End of waste for SRF – presentation to workshop in Milan, 2013, following Italian legislation in this area.

International conferences

- Gasification of waste in the UK – IEA Bioenergy Conference, Berlin 2015
- Factors Influencing the development of Small scale EfW – paper presented at ISWA Annual Congress, Antwerp, September 2015
- An Evaluation of arising and markets for waste derived fuels. Paper presented at the Fifth International Symposium on Energy from Biomass and Waste, Venice, November 2014

SUCCESS STORY

In 2004, the International Energy Agency Bioenergy Task 36 – ‘Integrating Energy Recovery in to Solid Waste Management Systems’ (Task 36) published a topic report “Review of small scale Waste to energy conversion systems”. The objectives were to collate information on selected small scale waste treatment systems and to produce a status report of the technical and economic potential of such systems for waste treatment. However, there are many other aspects that are of interest when considering the development of small scale energy from waste in general, and not just the technologies used. Therefore, in the 2013-15 work programme, the Task decided to revisit this topic and to provide an update to that report, focusing in more detail on the reasons behind the decision to build a small scale plant and exploring further the different drivers and limitations and how these can impact positively or negatively on the viability of small scale EfW. This included a review of drivers and barriers such as legislation, policy, public acceptance, and financing and technical data such as plant size – both in term of input and thermal capacity, and the output of heat and electricity.

Key conclusions

The study identified clear policy drivers which are influencing EfW development in general, but that the decision to develop facilities on a small scale are more relevant to local politics and situation. The costs, both operational and capital, are higher for small scale EfW facilities, but, there are often other drivers which take precedence over economics alone. Whilst it may be challenging in some cases to demonstrate value for money, other benefits will support a case for small scale EfW.

In the future, financial incentives, and energy and resource drivers may further drive the development of smaller scale EfW facilities using Advanced Conversion Technologies. These technologies enable flexibility in the way in which outputs from EfW are uses, and are likely to be at a smaller scale. For example, the conversion of syngas for use as a fuel in dedicated gas engines, for conversion in to liquid fuels, or use as ammonia or methanol, which can be used in transport fuels and as a chemical feedstock. Energy and resource drivers will also add to this, in addition to waste management and landfill diversion targets.

Why has this been highlighted as a success story?

The finding of the study help demonstrate that whilst the costs, both operational and capital, are higher for small scale EfW facilities, there are often other drivers which take precedence over economics alone and that small scale EfW may be a preferred option in some cases. Whilst it may be challenging in some cases to demonstrate value for money, other benefits will support a case for small scale EfW. Geography can be a driving factor for small scale EfW, but in many cases there are additional drivers. The advantages offered by small scale EfW, such as the treatment of waste close to the point of generation, the generation of jobs in the local community, and lower transport distances, all serve to increase the public acceptance of such facilities. With their smaller footprint, smaller scale EfW facilities can be more easily integrated in to existing industrial areas.

The final report is available on the website, and the findings were presented at the ISWA Annual Congress in Antwerp, 2015 and at the IEA Bioenergy End of Triennium conference in Berlin.

Other success factors:

Participation from all Task 36 member countries, including:

- Development of data collection templates
- Contributing to data collection
- Visiting case study sites to undertake interviews

CONCLUSIONS AND RECOMMENDATIONS

The 6 workshops delivered were an excellent way to maximise the output of the limited budgets of the small task. The workshops allowed member countries to take ownership of the workshops and their content, and to leverage in additional input from stakeholders within each country, hence maximising the outreach and visibility of the task.

The workshops were extremely well attended, with over 50 delegates at the SRF workshop in Milan, the Advanced Treatment Technology workshop in the UK, and the ISWA joint workshop on circular economy in Berlin.

The major outcomes of the task are:

- six key priority issues have been explored by the task through the delivery of workshops
- three topic reports
- increased level of stakeholder involvement and co-operation
- increased level of dissemination of work of the task
- working relationships established with ISWA and ERFO



SRF workshop, Milan 2013



Study tour, Sweden 2013.

The delivery of Task 36 is always a challenge due to the small number of members and therefore limited budget. However, the number of strategic proposals that the Task was invited to participate in shows the relevance of the work of the task to other tasks in the IEA Bioenergy agreement.

Our conclusions for the Executive Committee of the IEA Bioenergy Agreement from this work are:

- The development of energy from waste is relevant to the majority of countries in the world. Globally the amount of waste produced is increasing, particularly in areas where there is rapid urbanisation. Increasingly regulation of waste management takes the nature of the waste into account and aims to maximise resource recycling and to optimise energy recovery from residues. This means that energy from waste is and will remain a key issue globally. Our work in this Trienniums leads us to recommend that IEA Bioenergy concentrates its efforts on providing information that allows decision makers to make the right decisions on integration of energy into solid waste management, in particular on the most appropriate technology for their local needs.
- Related to the above, there are many opportunities to reach out to countries that are not in IEA Bioenergy. This may be done initially by joining forces with other international groups (such as the International Solid Waste Association, ISWA, or Asian international waste groups). Ultimately the aim of such work should be to draw more countries into the IEA Bioenergy Agreement, by demonstrating the advantages of membership.
- In the past triennium there have been a number of important trends that have impacted on the integration of energy recovery in solid waste management. These include the integration of energy from waste with targets for increased recycling in Europe. This has resulted in increased recycling in Europe and increased production of refuse derived fuel (RDF) from the residual waste (as shown in our report on the mass balance of RDF versus municipal waste in the UK). We have also captured trends towards improved development of waste as a fuel for specific purposes, though our work on Solid Recovered Fuel (SRF) (see, for example, our workshop on SRF in Italy).

- Trends towards recycling and the circular economy mean that lower quantities of residual waste are being produced for energy from waste plants and that this residual waste is usually heterogeneous. Treatment of this residual waste requires flexibility, smaller scale energy plants or integration of residual waste management between areas and technologies. Decision makers are looking for novel solutions to the management of residual waste, and need information on small scale energy from waste plants, the integration of recycling, anaerobic digestion and energy from waste or on novel technologies that are applicable at all scales and that allow for flexibility of the products of combustion (e.g. gasification). We have examined these issues in our gasification and small scale energy from waste reports, but further information is required on operational performance, costs and materials and energy recovery as these options develop.
- Related to the above we have recommended that the Task builds on the gasification work in the current Triennium by working with Task 33 to review gasification worldwide in the forthcoming Triennium.
- Energy from waste is a mature technology and there are many examples of grate combustion worldwide. We covered this area in our end of triennium report in 2009, where we reviewed the current technologies. However, as indicated above, the nature of its application is changing and there are new technologies that could be game changers. We recommend that work supported by the IEA Bioenergy Agreement on the integration of energy into solid waste management aims to provide transparent information on the changing application of energy in solid waste management (such as how it fits into the circular economy); and on the status of new technologies that could be game changers (such as the development stage, costs, efficiencies etc achieved by these new technologies).
- Dissemination of this information remains a problem for the Task. We recommend that more use is made of modern communication methods, but that this is co-ordinated by the ExCo Communication Group to ensure optimal use of funds. For example, greater use of webinars would help reach a wider audience.
- The Task is small and short of funds. Many of the strategic projects supported by the ExCo are not relevant to the Task as they concern virgin biomass rather than waste feedstock. We recommend, therefore, that the Task contribution to the strategic fund is decreased, or that, alternatively, the strategic fund is used to assist the Task in dissemination (such as the update of the web site, or assistance in the costs of attending the end of Triennium conference).

ATTACHMENTS AND ADDITIONAL INFORMATION

- Participation in major events is included in this report. The presentations at events are published on the web site
- Deliverables (conference papers, seminar proceedings, technical notes, newsletters, Industry Days, scientific publications, books, etc.), including website address or reference of the publication. These publications are on the Task 36 web site (www.IEAbioenergytask36.org).
- Co-ordination with other Tasks within IEA Bioenergy – information on co-ordination with other Tasks is included in this report. Reports produced as a result of this co-ordination are on the Task 37 and 32 websites and our web site links to these.
- Industry participation: We have discussed co-ordination with industry within this report. Most of this co-ordination was done through our workshops, but we also organised study tours of industrial sites.
- Budget for the triennium as at 2012 and expenditure on the different items by the end of

2015. See Appendix 2

Appendix 1 Publications and industrial participation

Publications in this Triennium

2013

- Integration of thermal energy recovery into solid waste management – published in the IEA Bioenergy Annual report, 2013.
- Summary of the Workshop on Solid Recovered fuel.
(<http://www.ieabioenergytask36.org/vbulletin/showthread.php?29-Workshop-on-SRF-Milan-20th-November-2013>)
- Proceedings of Workshop on Anaerobic Digestion of Solid Waste, Stockholm 8th May 2013 (<http://www.ieabioenergytask36.org/vbulletin/showthread.php?28-Proceedings-of-Workshop-on-Anaerobic-Digestion-of-Solid-Waste-Stockholm-8th-May-2013>)
- Health and Safety Aspects of solid biomass storage, transportation and feeding
(<http://www.ieabcc.nl/>)

2014

- Karlsruhe: IEA Task36-/ BREF AG3 Meeting, 10-12 March 2014
(<http://www.ieabioenergytask36.org/vbulletin/showthread.php?33-Karlsruhe-IEA-Task36-BREF-AG3-Meeting-10-12-March-2014>)
- Energy from waste – the next generation
(<http://www.ieabioenergytask36.org/vbulletin/showthread.php?38-Workshop-on-Energy-from-Waste-%EF%BF%BD-The-Next-Generation-29th-October-2014-Harwell-UK&p=38#post38>)
- Source separation of MSW
(<http://www.ieabioenergytask36.org/vbulletin/showthread.php?32-Source-separation-of-MSW&p=32#post32>)
- An Evaluation of arising and markets for waste derived fuels. Paper presented at the Fifth International Symposium on Energy from Biomass and Waste, Venice, November 2014

2015

- The Growth of Advanced Conversion Technologies for the Treatment of Waste in the UK
(<http://www.ieabioenergytask36.org/vbulletin/showthread.php?39-Report-on-The-Growth-of-Advanced-Conversion-Technologies-for-the-Treatment-of-Waste-i&p=39#post39>)
- Factors influencing EfW
(<http://www.ieabioenergytask36.org/vbulletin/showthread.php?41-IEA-Bioenergy-Task-Meeting-Bordeaux-2-4-June-2015&p=41#post41>)
- Factors Influencing the development of Small scale EfW – paper presented at ISWA Annual Congress, Antwerp, September 2015 Small scale Energy from waste report – to be added to Web Site
- An Assessment of the Export of Municipal Solid Waste from the UK as Refuse Derived Fuel using a Mass Balance Technique – to be added to Web Site.
- Papers presented as part of the IEA Bioenergy End of Triennium Conference.
(<http://ieabioenergy2015.org/>)

Industrial participation in Task.

Name of Body	Industry (association) / International body	Area of focus	Type of collaboration* (existing or planned)
International Solid Waste Association (ISWA)	Waste Management association	Transition to circular economy, waste-to-energy role in circular economy, revision of the WtE BREF	Meeting between task 36 and the Working group on energy recovery. The chair of that working group has also participated at the triennium conference as well as at workshop held on advanced thermal treatments.
SIVOM des Canton du pays de Born	Waste management consortia/association of municipalities	Waste-to Energy /small scale W-t-E	Technical visit in association with the Task meeting spring 2015
Tiru	W-t-E operation active in UK and France	Waste-to Energy /small scale W-t-E	Technical visit in association with the Task meeting spring 2015
Europlasma	Supplier of technology for gasification, vitrification	gasification of waste together with vitrification of ashes/hazardous waste	Technical visit in association with the Task meeting spring 2015
Umweltbundesamt	German EPA	Technologies for gasification/pyrolysis of waste as a background for revision of BREF	Gave a presentation on the task meeting in Berlin, autumn 2015
The National Environmental Agency of Singapore		Waste management in a circular economy	Invited to be present in a task meeting during 2016
Skövde värmeverk	Swedish owner/operator of W-t-E and district heating	Small scale WtE	Participated as a case study in a task report on Small Scale EfW
Viridor	UK owner/operator of WtE facility	Small scale WtE	Participated as a case study in a task report on Small Scale EfW
European recovered fuels organisation - ERFO	Association for SRF-producers	SRF/RDF	Task 36 made a presentation in one of their meetings

Appendix 2 Budget for 2013-15 triennium.

2015 audited accounts are attached as a separate document.

FUNDS IN (GBP):		2015	2014	2013
	Opening Balance on 1st January	-11,570.27	-10,447.98	355.05
	Funds received from IEA Bioenergy Secretary within year	64,104.41	49,535.04	55,004.58
	Other income - Additional task funding	0.00	0.00	12,982.87
	Total Funds available in year	52,534.14	39,087.06	68,342.50
FUNDS OUT (GBP):				
	Salaries in year	38,758.12	41,551.62	51,586.43
	Support Services	14.99	109.91	59.74
	Materials/Supplies	0.00	0.00	0.00
	Travel	9,240.05	8,048.85	10,166.76
	Subcontracts/Consultants	2,909.00	923.70	16,977.55
	Other	0.00	23.25	0.00
	Total Funds Out in year	50,922.16	50,657.33	78,790.48
CLOSING BALANCE CARRIED FORWARD TO FOLLOWING YEAR (GBP)		1,611.98	-11,570.27	-10,447.98
	(USD)	<i>2434.09</i>	<i>-18,194.25</i>	<i>-17,030.21</i>

- As on 31st December 2015 the Task was in credit: \$2,434 USD.
- However in 2016 there has already been committed expenditure (where the transactions will be recognised in the 2016 audit of the accounts):
 - \$12,000 for SP Technical Research - Topic report on small scale Energy from Waste – yet to be invoiced.
 - \$3,000 Ricardo Energy & Environment - staff time on 2013-15 triennium work programme.
 - \$2,000 for Ricerca sul Sistema Energetico (RSE) – Data gathering on Italian small scale EfW– invoiced in Jan 2016.
 - \$1,400 for audit of 2015 accounts – invoiced in April 2016.
 - \$1,400 for Vismundi - High level review of the mass balance of RDF production from MSW – invoiced in April 2016.
- The estimated arrears of \$17,366 will be carried into the next 3 year work programme and will hopefully be recovered through enrolment of an additional task member (work is in progress to secure UK funding) but if unsuccessful there is a risk the remit of the task might have to be moderated accordingly.