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АНГЛИЙСКИЙ ЯЗЫК

Учебно-методическое пособие для студентов факультета «Промышленная теплоэнергетика»

Санкт-Петербург
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МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РОССИЙСКОЙ ФЕДЕРАЦИИ

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ БЮДЖЕТНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ПРОФЕССИОНАЛЬНОГО ОБРАЗОВАНИЯ

«Санкт-Петербургский государственный технологический университет растительных полимеров»

Е.В.СЕМЧУК

Английский язык

Учебно-методическое пособие
для студентов факультета

«Промышленная теплоэнергетика»

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ПРЕДИСЛОВИЕ

Пособие составлено в соответствии с требованиями программы по иностранным языкам для технических вузов. Цель пособия развитие навыков чтения научной и технической литературы по специальности и некоторых навыков устной речи в пределах тем, предусмотренных программой.

Текстовый материал предназначен для развития навыков ознакомительного и изучающего чтения, а также для развития навыков устной речи и перевода. Приложенные, по необходимости, словарный минимум и транскрипция активизируют языковые навыки, помогают определить главное содержание, запоминание основных лексических единиц.

VOCABULARY

1) reclaim [rɪ'kleɪm] v осваивать

2) reliance [rɪ'laɪən(t)s] n доверие, надежда

3) renewable [rɪ'njuːəbl] adj возобновляемый

4) unfavourable [feɪv(ə)rəbl] adj неблагоприятный, неподходящий

5) constrain {kən'streɪn] v сдерживать

6) acreage ['eɪk(ə)rɪʤ] n площадь в акрах

7) dedicate [dedɪkeɪt] v посвящать

8) repercussion(riːpə'kʌʃ(ə)n] n отражение, последствие, влияние

9) rural ['ruər(ə)l] adj сельский

10) community [kə'mjuːnətɪ] n община, общность

11) vie { vaɪə   ] prep через

12) unprofitable [ʌn'prɔfɪtəbl] adj невыгодный, бесполезный

13) cope [kəup   ] v справляться

14) surplus ['sɜːpləs]

15) overcome [ˌəuvə'kʌm] v преодолеть

16) encounter [ɪn'kauntə] v наталкиваться

17) obstacle ['ɔbstəkl   ] n препятствие, помеха

18) steep [stiːp] adj чрезмерный, невероятный

19) consortium [kən'sɔːtɪəm] n соглашение

20) collaboration [kəˌlæb(ə)'reɪʃ(ə)n] n сотрудничество

21) dissemination [dɪˌsemɪ'neɪʃ(ə)n] n распространение

22) outcome ['autkʌm] n результат

23) mining [maɪnɪŋɪn] n горная промышленность

24) entire [ɪn'taɪə] adj полный, целый, весь

25) duration [djuə'reɪʃ(ə)n] n продолжительность, длительность

Problems addressed

Increasing reliance on renewable energy is an important priority of the European Union, since it can reduce the dependence on imports and prevent future imbalances in the energy market. What is more, increasing productivity in the agricultural sector and unfavourable market conditions, such as overproduction, constrain land use and acreage dedicated to plant cultivation. This decline in traditional agricultural activities creates a surplus of land and labour and has repercussions in our rural communities. We would like to promote a more rational use of low quality agricultural land and present energy forest planting as a viable alternative to unprofitable agricultural activities. We intend to offer would be entrepreneurs guidance and help them cope with major investment risks.

Barriers to overcome

Energy production from biomass is not always a popular proposition. We often encounter obstacles such as weak infrastructure, steep production costs, lack of history and public support, or just pure and plain conservatism. Although biomass planting has a far greater potential in Hungary then other types of alternative energy sources, it is often completely ignored by policy makers and professional organizations. To help overcome these barriers we would like to inform stakeholders of the potential benefits of biomass planting and the verdict of our experts.

Project structure

The consortium carrying out this project consists of five members from four different countries, two educational and research institutions and three SMEs. The project is fully funded and was made possible by a grant from the budget of the European Union's 5^{th} Framework Programme. The 18^{th} month long collaboration

officially started in December 2002 and the firs preparatory stage has been completed in May 2003.

The execution is divided into six blocks, called work packages, each of which is either focused on a specific field of research or related to project management. Each work package has a strict deadline and an organization that is responsible for its execution.

Work packages 1 and 2 are dedicated to project management and dissemination. Scientific work will start in work package 3 (land classification) with the characterization of potential planting sites. Work package 4 (energy forest plantation) deals with the optimal selection of biomass types. Work package 5 (socio-economic outcomes) will discuss the effects of biomass planting. Since work package 6 (the re-cultivation of open cut mining sites) is very important in some parts, it will run for almost the entire duration of the project.

Expected impact and exploitation

We hope that biomass will gain more acceptance and popularity, and that the risks and start-up costs involved could be reduced significantly.

Our research will help stakeholders to consider planting energy crops as a real alternative by supplying them with hard data. By influencing the public opinion we will certainly to a better climate for future initiatives.

Progress to date

The project was launched in December 2002 and four and half months later we can report progress on two fronts.

At our start-up meeting we agreed to focus on three reference areas, one in Poland, one in Hungary and one in Czech Republic. So far we have reviewed the Hungarian literature with a special emphasis on little known pioneering experiments, carried out by timber companies and engineers in the past. In the case of Poland, we have characterized the most common biomass types.

As regards software development, we have defined the essentials required of the proposed database and the corresponding land classification methodology. Our earliest results will be made public in our firs newsletter coming out in mid-May.

LARGE SCALE DEMONSTRATION OF ENERGY CROPS FOR COMBUSTION IN A POWER PLANT

VOCABULARY

1) encouragement [in'kʌrɪʤmənt] n одобрение,поощрение

2) penetration [penɪ'treɪʃ(ə)n] n пропитка

3) restrict [rɪ'strɪkt] n ограничивать

4) impact ['ɪmpækt] n столкновение

5) eliminate [ɪ'lɪmɪneɪt v исключить

6) purification [pjuərɪfɪ'keɪʃ(ə)n] n очистка

Challenges

Nowadays, there is no real data about the large scale utilization of the energy crops. They only solution is to take references of other types of biomass (for example, straw) but take into account that the straw is a secondary product of a food crop. Instead of a crop cultivation for the generation of energy.

The lack of reliable data about investment costs, running costs, etc. is a significant barrier for the large scale introduction of energy crops. Increasing the knowledge in this area means increasing the confidence in these kinds of renewable energy sources and decreasing its market uncertainty.

Therefore, it can be said that this project will contribute to reduce the investment costs through the decrease of the financial risk associated with such investmen.

Project structure

This is the first European demonstration project carrying out industrial scale tests jointly on the cultivation, harvesting, logistic and combustion of an energy crop. 15000 tons of Brassica Carinata and 720 tons of Triticale are grown to be used specifically in an exiting biomass 25 MWe combustion power plant located in

Spain, and devoted 100 % to the generation and sale of bioelectricity to the grid.

The project is developed in six work packages:

WP1: Demonstration of field performance.

WP2: Harvest and logistic. This task consists of biomass collection, handing, packing, storage and transport to the combustion plant.

WP3: Economical assessment.

WP4: Energy balance and environmental impact.

WP5: Combustion tests.

WP 6: Dissemination.

Expected impact and exploitation

This project evaluates, in an integrated scheme, the profitability of both Brassica Carinata and Triticale for power production by reproducing and evaluating the whole supply and energy generation chain on a real scale. Major scientific and technological prospects are the ‘decrease of uncertainty’ degree related to biomass energy and the possibility of ‘promoting future R&D’ and ‘demonstration projects’ on the identified improvement points.

On the one hand, a significant saving in the cost of energy is expected at the end of the project, which could be approximately 10 %, beginning with the cost of energy produced with straw (0,08euro per kWh). In the long term, there will be a clear improvement potential in all the economic areas mentioned above, thanks to the exploitation of the improvement points that are going to be identified in the project.

On the other hand, the exploitation plan includes the encouragement of biomass penetration in Southern Europe, for example the creation of biomass plants in the Mediterranean area. As a first step, the aim of the project is to develop an effective supply chain of new Mediterranean energy crops up to the production plant, taking into account not only the farmers but also the final electric or heat utility and all the intermediate actors. The restricting factors for developing the energy crops on a large scale will also be identified and measured.

Concerning the environmental impact, the project also addresses the large scale generation of electricity with reduced CO_2 emissions from biomass. In particular, the project will produce 15720 tons of coal, thus avoiding the emission of about

20 000 tons of CO_2 , 321 tons of SO_2 and 48 tons of NO_2. The effect will be similar to the purification effect of 970 000 trees.

VOCABULARY

1) fertiliser ['fɜːtɪlaɪzə] n удобрение

2) digestion [daɪ'ʤesʧ(ə)n] n усвоение

3) slaught ['slɔːtə] n бойня

4) leather ['leðə n кожа

5) density [den(t)sɪtɪ   ] n плотность

6.) remove [rɪ'muːv] v удалять, устранять

7) soluble ['sɔljəbl] adj растворимый

8) split [splɪt] n расщепление

9) dilution [daɪ'luːʃ(ə)n   ] v затоплять

10) deplete [dɪ'pliːt   ] v истощать,исчкрпывать

11) decontamination [diːk(ə)ntæmɪ'neɪʃn   ] n обеззараживание

12) grid [grɪd   ] n сетка высокого напряжения, решетка

13) residue [rezɪdjuː] n осадок,остаток

14) external [[ɪk'stɜːn(ə)l   ] adj наружный

Challenges

The project’s approach is based on the state of the art of the following disciplines: organic waste composting and digestion, biogas up-cleaning, reduction of organic waste contaminants, and environmental contamination through liquid manure fertilizing. Energy production from organic wastes, based on biological

methods, can only be achieved by generation of biogas via the digestion progress.

We want to achieve maximum energy yield from the digestion process by means of an innovative digestion technology and optimized process control of wastes from slaughterhouses and the leather industry.

Fuel cells (FC) have been developed mainly with natural gas as the fuel. The introduction of biogas into the natural gas grid requires the removal of inert components in order to improve energy density and to meet existing standards. The main parameters that may require removal in an upgrading system are H2S, water, CO2 and halogenated and silicon containing compounds. Closing the gap between 50 ppm (state of the art) and 10 ppm H2S (required by the FC) will be achieved by an especially reliable biotrickling filter, as well as technologies to remove siloxanes,CO2 and CH compounds.

Today, reduction of organic waste contaminants can only be achieved either by mixing the material with non-contaminated additives (wood), or by the addition of complexing agents andseparation of the soluble metal complexes. The Komptech-Farwick's B.S.F.C. process (Biowaste Separation Fermentation Composting) is able to reduce heavy metals and salt contamination in organic wastes exclusively by dry mass splitting to produce an up-cleaned compost without dilution methods. The aim is to optimise depletion of heavy metals and salt in the raw material for composting by improving the separation process performed through a mass-separator.

Furthermore, an economically acceptable method to reduce N and P contamination in the liquid digested residues have to be developed. The new technology will smooth the way for the construction of small, autonomous plants which are highly adapted to local situations.

Expected impact and exploration

ENERDEC will help to create a set of technologies for use in the fields of renewable energy, biotechnology, agro-industry and environmental protection. These technologies will help to strengthen the competitiveness of the SMEs involved by expanding their competence and experience in the waste-treatment and energy-production sectors, as well as contributing to the sustainable care of the environmental by recycling waste into the product cycle.

As a technological impact, the digestion process will be combined with the improved composting technology to establish a new B.S.F.C. technology of solid organic waste treatment systems on the market and to restructure exiting plans.

A concept for decontamination of liquid digested residues, which must be both economically and ecologically attractive, with raise the acceptance of such technologies. Another main impact should be the application of a biological biogas purification system to pass the up-cleaned biogas into the natural gas grid.

Progress to date

After half a year, work on the project is progressing according to schedule.In the digestion part of the project, different part of organic wastes, such as kitchen waste, slaughterhouse waste and pulper waste, were pre-processed under different conditions and tested for their digestion behaviour, their potential for biogas formation, and the composition of liquid degested residues. The slaughterhouse wastes were investigated in more detail: after separation into five fractions, each was processed in continuous lab-scale digestion units as a basis for specific loading calculations.

For the methodological development of a purification treatment for the digested residues, two different reactor types – a sequencing batch reactor (SBR) and a fluidized bed reactor (FBR) – were installed at laboratory scale and operated using centrifuged digested residue to maintain the process parameters. Nitrification was observed to be quite good, as was dinitrification, but the latter process depends on the availability of carbon which might be insufficient. Currently, tests are running with the addition of an external carbon source. COD could be degraded from an initial 10g/l to concentrations below 1g/l. Centrifugation experiments on digested residues on a technical scale provided the necessary amount of digested liquid for these investigations. Arrangements for experiments on the reduction of heavy metals and salt content in the solid products of the B.S.F.C. process have now been finalized – a survey of the process was performed by detailed monitoring of the method. A suitable filter arrangement was planned for the biogas upgrading tasks. As a first step, a laboratory-scale biotrickling filter is actually being constructed in order to optimize H2S removal.

THE PYROARC WASTE TO ENERGY PROCESS UTILISING GASIFICATION,PLASMA AND VITRIFICATION TECHNOLOGY

VOCABULARY

1) incineration [ɪnˌsɪn(ə)'reɪʃ(ə)n] n сжигание

2) decompose [ˌdiːkəm'pəuz] n распад, разложение
3) tar [tɑː] n деготь, жидкая смола

4) shaft [ʃɑːft] n вал,ось

5) quencher ['kwenʧə] n тушитель

6) solid [sɔlɪd] adj твердый

7) consecutive [kən'sekjutɪv] adj последовательный

8) slag [slæg] n шлак

9) recovery [rɪ'kʌv(ə)rɪ] n восстановление

10) zinc [zɪŋk]n цинк

11) sensible heat ['sen(t)sɪbl] adj ощутимое тепло

Objectives

The objective is to build and demonstrate a commercial operating PyroArc plant south of Trondheim in Norway. The capacity of the plant is 10 500 tonnes of waste per year and it will be possible to treat all sorts of waste, except radioactive. The plant will recover the energy from the combustible part of the non-combustible part. The energy will be recovered as hot water and electric power. The hot water will be utilized in the local grid and the electric power will be used partly internally, the rest being exported on the local net. Slag can be sold as a construction material while the metal can be sold to foundries for the production of simple foundry products, for example counter-weights on trucks. The plant will generate very little, residue (for example ash)which has to be put in landfill.

Challenges

Owing to increased public awareness for the environment and new regulations, there is a rising market for gasification processes.

Many attempts have been made to achieve the great benefits of waste gasification. Most of the available, commercial gasification processes for waste today are combusting the produced gas directly after the gasification to prevent tar causing operational problems in the system downstream. The results are processes that are more or less equal to traditional incineration processes.

Heading needed here

The two stage PyroArc process is decomposing all the tar components formed in the gasifier by an integrated plasma generator into a decomposition reactor immediately after the gasifier.With this,all the advantages of using a gasification process are being achieved. It is producing a clean fuel gas, recovering the sensible heat, decomposing all toxic and harmful components, recovering energy and material efficiently and no, or very limited, amounts of waste is being produced that has to be put in landfill.

The PyroArc Process

The process comprises a feed system, a melting shaft gasifier, a plasma generator system, a decomposition reactor, a gas quencher, an energy-recovery system and a dust collection and gas cleaning system.

Solid waste materials are charged into the shaft gasifier through a lock hopper system. The organic components are converted into a partly oxidized syngas, while the remaining inorganic species melt. The syngas consists mainly of carbon monoxide, hydrogen, carbon dioxide, water and nitrogen but is also associated with a rather high content of tar-forming components (complex HC) and chlorinated hydrocarbons. Depending on the moisture of the feed, the temperature of the syngas will be around 400-700 C when it leaves the gasifier. In the consecutive plasma generator system and decomposition reactor, the gas decomposes completely due to the high temperature (3000-5000 C) of the plasma jet and its strong dynamic impact on the syngas which provides a homogeneous temperature of more than 1 100 C to all fraction of the syngas. Liquid waste will be fed directly into the plasma generator system. The most important feature of the PyroArc process is that all the waste material that leaves the process has been exposed to sufficiently high temperatures for the decomposition of toxic elements. The products are a fuel gas, a leach resistant slag, molten metal and small amounts of secondary dust that may be subjected to the recovery of zinc.

About 65 % of the energy content of the waste is available as heat of combustion in the fuel gas, and almost 30 % as sensible heat.

The uniqueness of the process is the plasma generator system and the way it is used to decompose the syngas into a harmless fuel gas without any contents of tar. The main features of the plasma generator system are:

1) a complete decomposition of the highly toxic halogenated organic compounds,

2) the higher heating value of the produced fuel gas, and

3) the decomposition of any tar components.

TOWARDS MAXIMISING ENERGY FROM WASTE RECOVERY

VOCABULARY

1) superheater ['s(j)uːpəˌhiːtə] n пароперегреватель

2) reheater - подогреватель

3) permit [pɜːmɪt] v разрешать, позволять

4) economizer [ɪ'kɔnəmaɪzə] n подогреватель, экономайзер

5) outlet - выход

6) facility [fə'sɪlətɪ] n устройство

7) disseminate [[dɪ'semɪneɪt] v распространять, рассеивать

8) gross - валовой, масса, в общем, в целом

Challenges

The city of Amsterdam will extend its existing waste incineration plant will two new lines, the HR-AV1, high-energy recovery waste incineration. One of the main objectives of the hew plant design is to raise the steam parameters to reach considerably higher efficiency in electricity generation than is common in exiting waste-incineration processes.

A number of interdependent measures are being taken in order to deal with raised steam parameters and to avoid corrosion of boiler tubes. The boiler is designed for high steam parameters and is based on innovative elements to allow this highly conditioned steam to be generated. Three innovative installation parts will be at the heat of the demonstrated design:

1) The superheater temperature will rise from 400 C to 440 C. Higher steam parameters cause unavoidable massive corrosion on the superheaters, if conventional materials and conventional boiler designs are used. In order to overcome this limitation:

- New alloys will a high corrosion resistance will be applied; and

- The incineration process, the boiler design and the flue gas flow will be thoroughly optimized to minimise corrosion attack.

2. A reheater will be used after the first turbine stage. High steam parameters permit a futher increase of process efficiency by using steam reheating which has not been applied in any other waste-to-energy plants to date.

3. A larger economizer will reduce the actual boiler outlet temperature to 180 C and thereby minimize flue gas losses. Besides that, a second and third economizer in the flue gas treatment

Facility will provide extra energy recovery

A main limitation to process efficiency is the flue gas temperature at the boiler outlet. This temperature is normally in the range of 200 to 240 C, and the remaining energy contents of the flue gases are not used.The high efficiency boiler will utilize the energy of the flue gases down to a temperature of 180 C. Energy recovery with the second and third economizer is possible due to the special patented heat exchanger with an economically acceptable lifetime.

A number of other measures will accompany these main features. They represent advanced techniques and will further contribute to the improvement of heat transfer in the boiler or otherwise improve the performance. The balanced combination of all the measures must quarantee undisturbed functioning at the level being pursued.

Project structure

The project is structured in four stages:

1) Design:

2) Tendering, construction and installation:

3) Commissioning; and

4) Monitoring, evaluation and dissemination.

At the moment the second stage of the project is ongoing. The tendering and contracting procedure for the main parts of the installation is in preparation.

Afval Energie Bedrijf, part of the administration of the city of Amsterdam, which is also the principal contactor for the FPS project, will coordinate the project. Furthermore, there are two assistant contractors mainly responsible for the global design of the high –energy concept and for the evaluation programme.

Expected impact and exploration

The present project can act as a pilot for a new generation of waste-to-energy plants in Europe and far beyond. It will bring the efficiency of electricity generation in waste incineration processes to a new level and will form the basis for further development. The effects on the CO2 reduction potential will be substantial.

On the European scale – with 220 million tonnes per year of household waste and household-like municipal waste – the potential with over 34 % gross efficiency production of approximately 25 000 Mwe which is roughly twice the installed capacity in the Netherlands.

MIXED BIOFUEL 38 MWe POWER PLANT

VOCABULARY

1) purchaser [pз:ʧəsə] покупатель

2) turnkey ['tɜːnkiː] n контракт на возведение
3) eligible ['elɪʤəbl] adj подходящий

4) vigorous ['vɪg(ə)rəs] adj мощный, сильный

5) disrupt [dɪs'rʌpt] v разрывать, разрушать

6) miscanthus биолог. трава

7) tendering - предложение

Objectives

The mixed bio-fuel 38 MWe power plant project started on 1 January 2000 with FLS Milj (DK) as the project coordinator, and Energy Power Resources Ltd. (UK) as a partner.

The main objective of this project is to design, build, own and operate a mixed bio-fuel 38 MWe power plant in the UK. The plant's major sub-systems comprise the biomass handling, firing system, supercritical boiler, flue-gas cleaning system, and turbine island.

The firing system, consisting of feeding equipment, firing grate and furnace, had to be upgraded to accommodate biomass consisting primarily of miscanthus (with wood chips or straw as a substitute), poultry litter, and sludge. The eligible work packages for this project are:

W1 Miscanthus Establishment and Logistics

W2 Upgraded Biomass Firing System.

Expected benefits

The major benefit of this project to the EU will be a yearly electrical output of some 256,500 MWe of CO2-neutral green energy while burning miscanthus for the first time in UK, and at high electrical efficiency of 35 %. If this plant burnt coal it would generate 338,000 tonnes of CO2 per year.

Progress to date

9 ha of miscanthus has been established. It was planted at the beginning of May 2000 at a rate of approximately 3 rhizomes/m. Plant growth has been monitored and conditions assessed approximately once a month. All plants look healthy and vigorous with no evidence of disease. A series of events and open days were undertaken to encourage farmers and growers to participate in a 500 ha demonstration trail. These events were successful and a number of potential host farmers have been identified. Several potential miscanthus growers have successfully applied for DEFRA-Energy Crops Scheme establishment grants. Additional growers have been identified and plan was to establish 500 ha June 2003.

During 2000, Anglian Straw Ltd. Successfully demonstrated the harvesting of miscanthus from trail plots using mower conditioner by producing high-density Hesston bales.

Design and engineering of the Corby plant

The design and engineering of the Corby plant was divided into the following main sections: Fuel supply, reception and storage; boiler; flue-gas treatment system; steam turbine plant and cooling system; water supply treatment and storage, ash handling and storage, generator, and control and instrumentation.

The design basis was for nominal plant with a capacity of 38 MWe (net) based on mixed biofuels and 10% of natural gas. Mixed biofuel of nominal and maximum composition based on input power was:

- Straw (miscanthus) nominal 58 %, max. 90 %
- Poultry litter nominal 10 %, max. 10 %
- Natural gas nominal 10 %, max. 20 %
- Wood chips max. 15 % (emergency operation, no poultry litter)

The design, including all process calculations, detailed engineering, and layouts of the Corby plant was completed by FLSm by the summer of 2001.

Progress to date

Miscanthus development has been delayed due to severe wet weather in the UK, in particular in September 2000, and foot and mouth desease which made it difficult to persuade farmers to establish new crops. In the initial project planning it was expected to use commercial waste partially (as packaging) with gate fee, but that was not possible.

Using straw as major fuel had a major negative impact on the project economics. The partners had a Non Fossil Fuel Obligation (NFFO) contract for 14 MW and were expecting to aggregate other NFFO contracts for MBF 38 MWe plant. However, since each contract requires separate power output, the aggregation was not economically attractive. Furthermore, it was found out that the grid can only accept 25 MWe so the economy of scale was disrupted, making plant economics unviable.

Even though the Corby plant will not be built, the know-how obtained in the design and engineering of this plant can in future serve as a basis for the commercial offer and project execution for MBF plant of any size.

A SOLUTION TO AGRICULTURAL WASTE PROBLEMS IN IRELAND – DEVELOPMENT OF AN INNOVATIVE BIOMASS COMBINED AND HEAT PLANT IN COUNTRY MONAGHAN

VOCABULARY

1) legislation [leʤɪ'sleɪʃ(ə)n] законодательство,закон
2) deterioration [dɪˌtɪərɪə'reɪʃ(ə)n] n повреждение
3) simultaneously [ˌsɪm(ə)l'teɪnɪəslɪ] adv одновременно
4) fossil - ископаемое
5) diversion [[daɪ'vɜːʃ(ə)n] n отклонение, обход
6) poultry [pəultrɪ] n птицеводство
7) annum лат. Год
8) care [[keə] n сердцевина
9) target ['tɑːgɪt] n цель, мишень
10) anticipate [æn'tɪsɪpeɪt] v ожидать, предвидеть

Challenges

The mushroom and poultry industries in Ireland are mainy concentrated in the border countries of Monaghan, Cavan, Armagh and Tyrone.

Waste spent mushroom compost (SMC) and poultry litter (PL) materials are disposed of locally through various methods. Land spreading is currently the main disposal route for wastes arising from these industries, but there is insufficient associated acreage to safely absorb these materials. As a result, groundwater and surface water in the county is becoming contaminated with excess nutrients, particularly phosphorous. Current and future legislation, including the EU Directive on Drinking Water Quality and the 1998 Phosphorous Regulations, will place limitations on current, unsustainable, agri-waste disposal practices within the region. Current waste management practices for SMC and PL are having a negative impact on the environment. Further expansion and current sustainability of the industries are in question due to restrictions imposed by the local authorities on land spreading and the move to reduce the amount of organic waste sent to landfill. The increase in land spreading of spent waste with associated high phosphorous concentrations has resulted in water quality deterioration in the area. Unless an alternative use for this material is found it will negatively impact on the sustained development of these industries. If these industries, which have tight profit margins, are to continue to develop in an environmentally, sustainable and economic manner then an alternative disposal method must be found to deal with the current waste problems. Interest was therefore stimulated into the research and development of cleaner, more environmentally friendly, disposal options for these materials and the promotion of a sustainable indigenous energy supply that will reduce reliance on imported fuels.

The main aims of the project are, therefore, to provide solutions to the agri-invironmental problems in County Monaghan, Ireland, whilst simultaneously generating renewable energy, If Ireland is to honour its agreement to limit its growth in emission of greenhouse gases to 13 % by 2010, then we must increase our use of energy from renewable sources immediately. An investigation into various renewable energy resources in Ireland found biomass to be a largely unexploited resource with huge potential. The project will make the first use of condensing economizer technology in a biomass CHP plant. CHP is considered an important element of the EU CO2 reduction policies and the use of biomass in CHP is an important factor in the increased usage of this environmentally friendly option. The facility will be unique in its ability to exploit a previously unutilized energy source; spent mushroom compost. Under normal operating conditions, the plant will generate an average 22,5MW of electricity using biomass-based fuels. 20MW of this will be exported to the national grid. The proposed biomass CHP power plant will generate electricity using a spreader stoker boiler or similar

technology, like the Bubbing Fluidised Bed and a conventional steam turbine generator.

The steam turbine generator will be designed for a gross generating capacity (including export power and on-site use) of 22,5MW. The thermal capacity of the biomass power plant at peak electrical capacity will be approximately 80MW. The biomass power plant will operate 24 hours per day, 8 200 hours per year and is expected to have an annual on-line availability of 92 %.

Project structure/Partnership approach

A special purpose company, RENEWtech Limited, was set up to develop the project and the project developer is a wholly owned Irish company. South Western Co-operative Services Limited, in conjunction with four other partners from three EU Countries, received partial funding from the European Commission Research Department to build and operate the plan. Numerous meetings and discussions have taken place between the parties. Public consultation meetings have been held with the local community, public bodies, Environmental Protection Agency and the planning authorities.

Expected impact and exploitation

The utilization of renewable energy in Ireland is very low with just over 3% of our energy coming from renewable – predominantly in the area of wind-power. There are currently no industrial CHP biomass developments in operation in Ireland but there is clearly a need to use renewable sources of energy if we are to sustain current rates of economic development.

The project involves the replacement of electricity from a traditional power plant fired with fossil fuels with electricity produced from a biomass fired CHP Plant. The plant will use a boiler that will be fired with SMC and PL, and will be equipped with the complete system for a third biomass, such as wood chips. The boiler will be capable of maintaining 100 % load on two out of the three fuels. Produced steam will be used in a steam turbine generator set for the production of electricity – the efficiency is increased by recovering energy from the hot and humidified drying air from the fuel dryers by means of condensing economizer

unit. This energy is used for the pre-heating of combustion air and boiler feed water. Combustion of biomass is CO2 neutral, and the plant will reduce the CO2 production by 132 Kt. Per annum.CHP is considered an important element of the EU CO2 reduction policies and the use of biomass in CHP is an important factor in increasing the usage of this environmentally friendly option.

The diversion of poultry litter and spent mushroom compost away from landfill and land spreading and its use in the production of green electricity will result in the reduced dependence

On fossil fuels and an avoidance of 188 kt CO2 per annum to the atmosphere. This is in line with the Irish Government policy for promoting alternative energy and meeting our Kyoto

Agreements

The development of this plant represents the first power plant in the world to burn a combination of poultry litter and spent mushroom compost, The development introduces a new, renewable energy, fuel source that was previously regarded as waste and also ‘state of the art’ technologies to convert this waste into an economical and environmentally friendly energy source.

The generation of renewable energy is being actively promoted in the EU and while there is no commercial plant currently in operation utilizing SMC as a raw material, there are a number of similar developments in operation globally that use other biomass-based fuels, including PL. The project will contribute 134GWh per annum to the EU target of 18% total gross electricity generation of the EC produced by CHP by 2010. The production of low cost energy with positive environmental benefits is the core of the Managhan Biomass Project. It will also contribute 43 ktoe to the EU target of 135 Mtoe from biomass by 2010 and will contribute 14MW to the UK target of 10GWth of biomass installations by 2003. In addition, demonstration of this project will strengthen the position of European SME’s in the world market for biomass energy products and services and open the development of biomass CHP technology in Ireland.

Progress to date

The total timeframe for the project has been determined at 40 months and includes all aspects of the development. From identification and quantification of potential fuel resources; assessing potential site suitability from economic, social

and environmental perspectives: applying for planning permission and obtaining an Integrated Pollution Control (IPC) licence from the Irish Environmental Protection Agency (APA); plant construction, commissioning and operation. A planning application, including a detailed Environmental Impact Assessment, has been submitted for the development of the project. Upon receipt of planning permission, detailed work on the project engineering will continue and it is anticipated that this will take place towards the end of 2003. The construction period for the project is 18 months and it is therefore anticipated that an operational demonstration plant will be available in 2005.

CLEAN ENERGY FROM REFUSE DERIVED FUEL

VOCABULARY

1) shredder ['ʃredə] n измельчитель, дробилка
2) fraction - доля
3) sewage ['s(j)uːɪʤ] n сточные воды,нечистоты
4) sludge [slʌʤ]] n густая грязь, осадок
5) refuse - v отвергать
6) derive - v получать, извлекать
7) tight [taɪt] adj плотный, крепкий
8) calorific - adj тепловой
9) pellet ['pelɪt] n гранула, шарик, зерно
10) bind [baɪnd] n соединение
11) reduce - v сокращать, уменьшать
10) odourless ['əudələs] adv без запаха
13) leachable - adj выщелачиваемый
14) emit - v излучать, выделять
15) implements - n оборудование, устройство
16) emerge [ɪ'mɜːʤ] v появляться, выходить

Challenges

Despite increased efforts in the EU member states to reduce the amount of wastes (or trials to recycle it), the question for an economical and ecological solution for hard-to-treat wastes, like light-shredder fractions from car recycling,

industrial wastes, sewage sludge or even municipal solid wastes, is still there. The problem gets pressing with newer, ecologically welcomed regulations that forbid the questionable landfill of untreated wastes in the EU member states over the next years (Council directive 1999/31/EC on the landfill of waste).

The production of clean energy from non-recyclable organic wastes by thermal treatment is a solution to this problem, substituting fossil fuels. Classic thermal treatment plants are huge, centralized industrial systems with the objective to mineralize. Enormous efforts are taken into account to hold to the very tight limits for emissions that are regulated in the EU member states (Council directive

2000/76/EC on the incineration and co-incineration of waste). The waste-to-energy conversion efficiency is low because the plants are designed to incinerate wastes with low calorific values and most of the effort goes in the expensive flue gas treatment which provides an ‘end of the pipe’ solution.

The high amounts of chlorine in some wastes are of special importance as these are the cause of corrosion of the plant material and a source for increased emissions of dioxins. This project provides an ecological and economical solution by secondary fuel pellet from hard to treat organic wastes and inorganic additives like lime, alumina and an acidic mineral catalyst, which bind harmful substances during the production and use of the fuel.

The result is a reduction in effort for the flue gas treatment. The designed secondary fuel pellets will be odourless, sterile, storable, transportable, unleachable, inexpensive, compact and have a high calorific value even on changing refuse fractions.

Using combined heat and power generators (CHP), energy can be yielded after combustion or pyrolysis of the pellets. Due to the binding capabilities of the inorganic additives that is achieved by a specialised pelletising method, the amount of halogenides, sulphur, tars and heavy metals that are emmitted when combusted or pyrilysed, and unleachable and can be used as construction material.

The problem of changing refuse qualities will be solved by using intelligent process control technology which will permit the production of a high quality secondary fuel with constant binding capabilities and a high calorific value.

Expected impact and exploitation

After the successful implementation of the ASMICAF prototype process, a pilot plant is planned to start the exploitation of the results. The expected environmental impact will be that an economical way to produce clean energy from hard-to-treat

organic wastes will be available, which conserves fossil fuels and treats the wastes prior to use as a construction material. The plant will be economically feasible, even on a small scale, which will reduce the transport of the wastes to the plant for utilization and ease the location of a heat sink for the thermal energy of the used cogeneration system.

A recent study from Frost and Sullivan estimates a demand of 166 large scale thermal treatment plants which would be commissioned between 2003 and 2009 across the European countries. They expect a diversification in the waste treatment industry with great market potentials for newer technologies, realized by small and medium sized enterprises (SME) in a market that is currently dominated by large companies. This emerging market is envisaged and a successful exploitation will give new opportunities for the European SME contractors if the project and can give new employment possibilities.

PRODUCTION OF BIO-OIL VIA CATALYTIC BIOMASS PYROLYSIS

VOCABULARY

1)pyrolysis [pʌɪˈrɒlɪsɪs] n пиролиз
2) crack - v трещать, скрипеть
3) appropriate - adj подходящий
4) enforce [ɪn'fɔːs] v принуждать
5) substitute - n подставляемое выражение
6) relevant - adj важный
7) adhesive [əd'hiːsɪv] adj связывающий, липкий
8) regard - n внимание
9) liquid ['lɪkwɪd] adj жидкий
10) zeolitic научн. Цеолитовый

Biomass flash pyrolysis (BFP) is very promising thermochemical process for the production of liquid products (up to 80 %wt on biomass). However, large-scale applications are still under careful consideration because of the high upgrading costs required for BFP liquids. In this project the possibility for the production of

stable liquid bio-fuels from biomass flash pyrolysis in a single stage catalytic process is being investigated. This is achieved through mild cracking reactions taking place in the presence of appropriate catalysts within the pyrolysis process and prior bio-oil condensation, without the use of external hydrogen.

Project structure

The initial phase of the project includes fundamental studies for the development and bench scale evaluation of the appropriate new catalysts. In a second phase the most promising catalysts are scaled up and evaluated in pilot scale in three reactor technologies. Finally the bio-oil is tested in diesel engines while phenols separated from bio-oil are tested as wood adhesive. The experiments performed provide the basis for kinetic and reactor modeling studies along with technoeconomical studies of the integrated technology.

Upon the successful development of a catalytic biomass pyrolysis process, the interest and application of pyrolysis oils will be increased. This will have a positive impact on the environmental since the use of this renewable bio-fuel will help Europe to meet the target of the Kyoto Protocol, that is to reduce the greenhouse gas emissions by 8 % up to 2010 (300 tn CO2 reduction/tn of biomass). Moreover, the project will enforce the biomass role in the European energy balance. By developing a promising technology, the cost and risks of fossil fuel imports will be eliminated and the project will help to contribute to the EU goal of increasing the share of renewable energy sources to 12 % in the European energy market by the year 2010. The project will also have a positive impact on the development of a new market for the non-fuel applications of bio-oil (substitution of petrochemicals with biochemicals) with a much hier added value. Taking into account all these applications of bio-oil, the contribution to the rural economy will be important and new employment opportunities will be created in Europe. Regarding the exploitation of the project results, it concerns the development of new processes (BTG, CREPI), new catalysts (GRACE, SINTEF) and bio-adhesives (ARI). A further scaling up of the catalytic biomass pyrolysis process is foreseen and this could be the subject of a future EU demonstration project.

Progress to date

The project has completed its first year and the main work was mainly developed to the synthesis and evaluation of new, innovative, catalytic materials

(based on mesoporous MCM-41 and zeolitic ZSM-5) for biomass catalytic pyrolysis using three different biomass feeds. Both types of catalysts were evaluated in a bench scale reactor. The results (see figures above) showed that the type of catalysts can completely after the composition of the bio-oil received from biomass pyrolysis. From this evaluation the best ZSM-5 and MCM-41 catalysis regarding the bui-liquid quality were identified and proposed for scale up studies in the three pilot plants.

The pilot plant testing of biomass catalytic pyrolysis is in progress and up-to-date preliminary tests were carried out in a fuel bed and in a circulating fluid bed reactor. Modelling studies, taking into account decomposition kinetics and the relevant transport phenomena, were also performed based on literature data and data provided from the partners. Regarding the extraction of useful chemicals from bio-oil, an effective separation procedure was developed based on the washing of bio-oil with dichloromethane (DCM) and small amounts of acetone. A liquid-liquid extraction scheme was applied in order to separate and analyse the oil components into different groups on the basis of their polarity: neutrals, phenols, acids and bases. Finally the specifications of bio-oil, which are required to run it in diesel engines, were established and it was found that the fuel acidity and the high temperature stability are the most important properties. Moreover, the use of bio-oil as a substitute for petroleum phenol, for the production of Phenol-Formaldehyde (PF) synthetic resins (which are commonly applied in wood panel manufacture), was tested using a non-catalytic bio-oil. It was found that even this liquid could be used at substitution levels up to 30 %. Catalytically produced bio-oil is going to be tested in diesel engines and in PF production in the next phase of the project.

A NEW COMPETITIVE LIQUID BIOFUEL FOR HEATING

VOCABULARY

1) competitive - adj конкурентноспособный
2) issue [ɪʃu] n выпуск
3) crucial ['kru:ʃ(ə)l] adj ключевой, решающий
4) vertificate - n документ
5) verify v проверять, контролировать
6) assess [ə'ses]] v оценивать

7) estimate - v оценивать

Challenges

The development work faces many challenges. Improving the economical competitiveness of the bioenergy chain and its components is one of the key factors involved in penetrating into the heating fuel market. The main competitors in the market are chips, pellets and light fuel oil. Fulfilling the specifications and needs required by users demands a clear visin of the future needs of the market.

There are certain things to be done concerning the fuel itself. The first condition is that the fuel quality needs to be high. To date there has been no long-term experience with pyrolysis oil at the pilot and industrial scale due to a lack of

sufficient quantities of suitable quality fuel. There are also questions to be solved concerning the fuel's stability, acidity, and healthy/safety issues.
It is crucial that the emissions are reduced to the minimum.

Project structure

A stage-wise approach for R&D work is being adopted. In general terms, the project includes pyrolysis oil production (large quantities), ling-term utilization tests, determination of fuel specifications, oil quality improvement, and verification of the whole concept from biomass to pyrolysis oil use.

Stage 1

First, the issues common to potential applications (replacing heavy and light fuel oil in boilers) are addressed and the entire utilization chain is verified with the technically least demanding alternative. The common issues include fuel harvesting, conversion, storage, transportation and use.

The first stage is to verify a continuous pilot-scale production of pyrolysis oil, followed by industrial scale use in a boiler. Individual topics in the chain cannot be optimized separately but, due to interaction between stages, the chain has to be considered as a whole.

Stage 2

For replacement of heavy fuel oil in large boilers and light fuel oil in intermediate and small boilers, specifications for pyrolysis oil will be defined. Feedback from utilization tests will be used.

Utilisation tests include long-term combustion tests of biofuel from laboratory scale to industrial scale. The aim is to generate fundamental pyrolysis oil combustion data to help develop higher quality fuels with less emissions, easy ignition and high stability.

Stage 3

While the pyrolisis and use is being implemented and developed, work on oil quality improvement can be started in a PDU (Process Development Unit) and at laboratory scale. Pyrolysis oil quality is improved to increase potential user applications from medium to small boilers, CHP and eventually to power production.

Use if emulsions and hot vapour filration are seen as a means of reducing cost and lowering emissions in utilization. Data and freedback received from combustion tests will be used in this work.

Stage 4

The complete pyrolysis oil utilization chain will be assessed on a technical and economical basis. Two country specific case studies (Finland and Italy) will be prepared, illustrating two applications for pyrolysis oil.

Detailed cost and performance analysis will be carried out, including estimates of emissions. Cases have been selected to represent different applications in order to expand pyrolysis oil utilisation.

The objective of this task is to provide concrete information about the exploitation possibilities and market application of the proposed technologies. Experimental results from other work done in the project will provide a basis for analysis along with other published data available.

Expected impact and exploitation

The pyrolysis process is able to produce high yields of liquid product which can be shipped, stored and utilized more economically than solid fuels on the small to medium-sized scale. Another significant advantage is that pyrolysis oil provides an opportunity to bring renewable energy into cites. It is simple and easy to use, and emissions are low (CO_2-neutral). Also, the technical and economical attractiveness of transportation promotes any future use. Pyrolysis oil is a high efficiency renewable liquid energy which can even be transported over long distances.

VOCABULARY

1) modify - v видоизменять, корректировать

2) viscosity [vɪs'kɔsətɪ] n вязкость

3) feasible ['fiːzəbl] adj реальный, выполнимый

4) furnace - n печь

5) ignition - n воспламенение

6) drawback - n препятствие, недостаток

7) sawdust - n опилки

8) bark - n кора

Problem addressed

Liquids produced by pyrolysis from biomass are estimated to be the lowest cost liquid bio-fuel. A high efficiency (65%) process has been projected for industrial scale production. However, the larger units that have been operating in Europe

have not yet been able to reach the expected efficiency. This is due to the fact that during scale up of these systems, solutions have been used that have not been employed on the laboratory scale work. This project is aimed at an improved operation of the pyrolysis pilot plant, owned and operated by ENEL, with an increase of the efficiency.The PL currently available for industrial scale utilization tests all have unfavourable fuel properties, which hamper their use.

Fuel properties which need most further improvements are: homogeneity, stability, reactivity, viscosity, solid content, particle size of solids. A numberof improvements have been suggested, e.g.hot vapour filtration (HVF), solvent addition and chemical upgrading in order to improve the value of PL as fuel.

However HVF is not currently available for large scale application, the addition of solvents increases cost and chemical upgrading has been shown to be expensive, if feasible at all. Removal of solids from PL remains as one of the critical problems. If solids can be removed, several other properties affecting fuel quality will also be improved. Forestera example, it has been shown that removal of solids improves stability.

Differences have been detected in combustion behavior of pyrolysis liquid from different biomasses in both small laboratory scale work and industrial furnaces.

Much of the different combustion behavior of PL compared to mineral oils has been explained through ordinary liquid fuel properties, e.g. viscosity (injection spray formation), water content (ignition) or solids content of PL (unburned particulates).

However, other phenomena are also included as pyrolysis oils from similar biomasses produced in different processes (PL with same physical characteristics) may behave in a different way in combustion. Although several biomasses have been proposed as feeds, and tested in laboratory scale pyrolysis units, there is very little information concerning the suitability of these liquids for use. Only pyrolysis oils from bark-free wood have been combusted in boilers and engines. However, bark-free wood fuels are probably too expensive for industrial energy applications.

Pyrolysis oil use

Handling, storage, and health and safety issues have been developed to assist in future demonstrations. A manual for sampling (both laboratory and demonstration level) and fuel oil analysis of PL has been published by VTT.

Use of PL in medium size boilers designed for light fuel oil LFO) appears

promising because of the relatively high cost of LFO. However, this application is technically more demanding than replacing HFO.

Expected impact and exploitation

Demonstration of the entire utilization chain ‘biomass to heat’ through pyrolysis on an industrial scale may have a strong impact on the penetration of biomass in the energy market. Indeed one of the major drawbacks of the biomass is its relatively low energy density, which make its transportation over long distances unfeasible for economic reasons. This is particularly true for those biomasses like sawdust and bark that are often available at large distances from sites where there is an energy demand: pyrolysis makes the energy associated to those biomasses transportable. In this perspective, an energy company is experimenting with pyrolysis and combustion of PL with the aim of supplying pyrolysis liquid to customers as an alternative fuel to the fossils.

VOCABULARY

1) auxiliary [ɔːg'zılı(ə)rı]] adj вспомогательный

2) comprise - v включать, заключать, обобщать

3) erect - adj прямой, вертикальный

4) silos - n силос, бункер, зернохранилище

5) baghouse - тканевый фильтр, рукавный пылеуловитель

6) validation - n утверждение, обоснование

7) cutter - режущий инструмент

8) hammering - n ковка, стук

Challenges

Straw gasification technology, including gas cooling and cleaning, was further developed in this project by Energy E2 and Foster Wheeler Energia Oy during 1999-2001. The high alkalinity and chlorine content of straw requires removal of these harmful components from the gas before it is burned in the integrated boiler. Three pilot-scale trials were executed on straw gasification in a 3 MWth CFB gasifier. Furthermore, filter ash treatment was tested and developed at pilot scale.

In addition, to the pilot-scale testing, process validation and design study covered gasification of 100 % straw and a fuel mix of straw and wood.

In the design study a full-scale straw gasification plant of 100 MWth and its integration with an existing large CHP plant was investigated. The practical solutions of all unit operations were developed. The budget for a complete plant was calculated and consequently the overall project economy was assessed.

Project structure

Partners

Energy E2 is a major energy producer in Denmark. ENERGI E2 owns and operates seven central power stations and ten local CHP plants in eastern Denmark and has a share in seven hydropower plants in Sweden. The total production capacity amounts to 4100 MW electricity and 2.900 MJ/s heat. Besides producing energy, ENERGI E2 is trading electicity on the international power exchanges and sells energy to large outfits.

Energy E2 is the market leader in the field of straw-based power production.

Foster Wheeler Energia Oy (FWEOY) is a Finnish based operating company of the Foster Wheeler Corporation. Foster Wheeler Energia Oy’s products are power plants, steam generators, gasifiers and auxiliary equipment for the utility and industrial markets. The company is famous for its energy production systems, based on circulation fluidized bed technology (CFB). Services also include engineering, manufacturing, erection services, power plant repairs and modernization.

Foster Wheeler Energia Oy is the leading fluidized bed technology supplier in the world, with long experience in biomass combustion and gasification.

Project

As a first phase, a test programme comprising four separate test series for straw gasification in a 3 MWth atmospheric CFB gasifier with gas cleaning, was carried out by Foster Wheeler Energia Oy and ENERGI E2. The project also included development of the straw feeders, based on the ideas of, and carried out by TK-Energy from Denmark. The test series consisted of three gasification trials on straw and one on the burning of filter ash in a CFB combustor. Secondly, in parallel with the testing programme, a design study was conducted with a view to creating a decision basis for erecting a 100 MWth demonstration plant.

The plant designed in the study is a complete plant covering: straw storage, conveying and preparation facilities; feeding system for straw; feeding system for wood chips; CFB gasifier; silos and feeding systems for make-up materials; inert gas system; syngas cooler; baghouse for syngas cleaning; ash handling systems; syngas burners in existing PC boiler; instrumentation and control; and powering.

Expected impact and exploitation

The results of the process validation and design study could be the technical and economical basis for a decision to build a demonstration plant and, furthermore, to commercialise gasification and co-combustion technology based on the utilization of straw as a fuel in the gasifier. Since straw is a major biomass resource in large parts of Europe, this project can help to increase the share of renewable energy in the energy system, and to improve economy and employment in the agricultural sector.Results

Pilot-scale tests

Four test series were conducted: running in of test pilot plant with straw pellets; tests with loosely cut straw and a specially designed cutter; tests with loosely cut straw; long-term testing with gas cleaning, etc.; burning of filter ashes in a low-temperature CFB.

During the three gasification trials, more than 220 tonnes of pelletised and loose straw were gasified during over 400 operational hours. Detailed test reports have

been prepared for all test periods. The following conclusions can be drawn from the pilot test programme: loose straw gasification is technically feasible; in spite of high alkaline fuel, smooth, stable operation could be achieved; wood and straw may be gasified together and trouble-free operation can be reached;

Carbon conversion was in the range of 95-97%; gas cooler could be kept clean both by soot blowing and by spring hammering; 3 M's filter operated well without blinding by tars, and it also removed also alkalis and chlorides quantitavely at 350-370 C from the synthesis gas; PAH were formed in the gasification conditions but dioxins and furans were not; and the optimal gasification conditions were validated in the project.

The actual gasification process with gas cleaning had already proved technically feasible during testing.

PYROLYSIS OIL TOXICITY

VOCABULARY

1) inhalation [ˌɪnhə'leɪʃ(ə)n] n вдыхание

2) ingestion n всасывание (воздуха, газа, жидкости) двигателями

3) expose [ɪk'spəuz] v выставлять на показ

4) cone - коническое сопло

5) ablative ['æblətɪv] отделяемый,удаляемый, абляционный

6) comport - v согласовываться (with) с (чем-либо)

7) dissemination - n распространение, разбрасывание

8) elaborate [ɪ'læb(ə)rɪt] adj тщательно продуманный

9) enhance - v усиливать, увеличивать, повышать

10) awareness [ə'weənəs] n осведомленность

11) benign [bɪ'naɪn] adj добрый, благоприятный

Challenges

Pyrolysis is one of the three main thermochemical routes to convert biomass into useful primary energy products. Fast pyrolysis has benefited from an active research programme since the 1980's in order to obtain bio-oils, which can be used in engines for the generation of electricity or after refining in transport. Today, several demonstration plants are operating in Europe and North America where significant quantities of bio-oils are produced for research and development purposes and several commercial plants are at an advanced stage of planning. Thus for a commercial development, the question of safety procedures for human health and environment preservation is raised.

In the project, the relationship between process parameters on the one hand and chemical composition and toxicity for human health and environment on the other will be investigated, so as to recommend the operating conditions to produce bio-oils with the lowest impacts. Then the optimized compositions of bio-oils will be submitted to the mandatory tests required by the EU legal authority, the objective being the definition of secure handling and storage procedures, in order to control the risks related to the product for the population and the environment.

The effects of different ways of exposure (inhalation, injection or skin contact) will be quantified, as well as the effects of long term exposures/ The impacts on the environment will also be evaluated by biodegradability, chemical oxygen demand (COD), biochemical oxygen demand (BOD) and the effects on bio-organisms. A

MSDS safety procedure and guidelines for bio-oils use and transport will be published in order to allow oil producers to legally market and transport on the European market.

Bio-oils production and procurement

Oil composition strongly depends on feedstock, pyrolysis technology and process condition. Therefore, bio-oils will be produced from different reactors (fluid bed, rotating cone, circulating fluid bed, ablative pyrolysis, vacuum pyrolysis), and under different conditions and temperatures (450 to 600*C) in order to relate those parameters to oil composition, toxicological characteristics and biodegradability.

Bio-oils analysis and screening tests

It will concern the chemical and physical analyses of the oils, the determination of concentration ranges in each chemical family and the characterization of the oils versus operating conditions/ These analyses will be completed with toxicological screening tests for a first evaluation of bio-oils toxicity and biodegradability.

Recommendations for safety procedures and dissemination of the results

This will include the redaction of MSDS safety procedure and guidelines for the use of bio-oils and transport preparation as well as the elaboration of recommendations on the best operating conditions to be used to obtain friendly products/ The dissemination will be done through the pyrolysis European network “PyNe”.

Project structure

The structure of the consortium is defined to ensure dissemination and utilisation of the results, as producers and users are involved in the project through the pyrolysis European network “PyNe”. During the different meetings of the steering committee they will be asked to give feedback on their own experience, give their opinions on the tests performed and participate in the definition of the safety procedures to be applied. This will enhance awareness among the producers and end-users, and the procedures defined will be directly applicable on industrial sites.

Expected results

An appropriate assessment of the risk involved, and the definition of the best practice for the production of the most benign bio-oil in terms of health and the environment, will contribute to reduce the production costs and make pyrolysis bio-oil more competitive. In addition, the knowledge of the parameters potentially responsible for toxicity will limit production losses. The MSDS safety procedure will allow a free exchange of the bio-oil throughout Europe and the world. The results will be widely published on the existing PyNe's website, as well in the newsletter.

PROGRESS IN COUPING BIOMASS GASIFICATION AND MCFC STACK

VOCABULARY

1) ancillary [æn'sılərı] – вспомогательный, добавочный

2) adsorption – всасывание, впитывание

3) powder – порошок

4) simulation – имитация

5) comprehensive – всесторонний

6) stack – пакет, пакетировать, штабель

7) cogeneration - комбинированное производство тепловой и элктрической энергии

8) layout – планировка, расположение

9) refurbish – подновлять, освежать

10) boundary – граница, предел

11) compatible – совместимый, сочетаемый

12) chamber – камера, отсек

13) olivine [ˈɒlɪviːn] – минерал

14) coke – кокс

15) resist - сопротивляться

Challenges

To improve the efficiency of Biomass Gasification and Fuel Cell couping.

To prove the technical feasibility of this integration by operating a pilot plant which includes:

A 500 kWth fast internally circulating fluidized bed (FICFB) gasifier for catalytic biomass steam-gasification, with ancillary units;

- A gas clean-up system for sulphur and chlorine compounds removal by adsorption on a basic powder, and ceramic candle fine particle filtration;
- A 125 kWe MCFC. To carry out accompanying research activities in selected key areas which includes;
- Cold modeling studies of the fluid-dynamic behavior of the gasifier in the presence of power load changes at the fuel cell
- Development of a comprehensive model for the gasifier, which combines overall reaction kinetics and heat transfer processes with fluidization dynamics
- Detailed simulation of the whole system and its components to develop optimal operation and control strategies
- Catalyst upgrading, characterisation and testing over a wide range of operating conditions.
  To estimate investment and operating costs.

Project structure

The Consortium is composed of universities, industries and a national research agency. The University of L’Aquila (Italy), project co-ordinator, is involved in tasks related to the engineering of the integrated pilot plant and lab tests of catalytic steam gasification. The Technical University of Vienna (Austria) studies the sistem simulation and performs gasification tests in its 100 kw facility. The University College of London (United Kingdom) is involed in CFD comprehencive modeling of the fluidized bed gasifier and cold model tests. The University of Strasburg (France) optimizes the preparation of a purposely developed Ni/olivine catalyst and provides it for at process conditions.

The companies are Ansaldo Ricerche S.r.I (Italy) and Pall – Schumacher GMbH (Germany) involed in the Hot Gas Clean-Up System (dechlorination reactor, cyclone and ceramic candle filter) and Ansaldo Fuel Cell S.p.A. (Inaly) which provides the MCFC stack and designs the fuel cell BoP. The Italian National Research Agency ENEA assembles and operates the integrated pilot plant.

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DEVELOPMENT OF AN IMPROVED ENERGY RECOVERY OF BIOGAS BY COOLING ANDREMOVAL OF HARMFUL SUBSTANCES

Progress addressed

Renewable energy is by far the largest, most sustainable, and most ecological energy potential at mankind‘s disposal. Part of this natural energy supply is the use of biomass potentials and, in particular, the use of landfill and digester gas. But when this kind of biogas is utilized for internal combustion engines, the problems caused by trace components such as halogenated hydrocarbons and organic silicon compounds have interfered with and even discouraged biogas utilization. Halogens produce acids that corrode the metallic surfaces of engines, while silicon compounds produce deposits of silica that coat spark plugs, abrade the surfaces and disrupt valve operation.

Project structure and partnership

The theoretical results of separation efficiency of trace components obtained by the feasibility check of the exploratory phase have to be followed up and cross-checked by tests and analytical investigations under real conditions on site of a landfill by using different models and types of plant components. On the basis of this results, technical and process parameters have to be defined, determined and optimised to enable the development and engineering of the prototype of a standardized gas cooling plant in module construction. The next steps will be the manufacture, the installation, the integration and the start up of the pilot plant connected to a gas engine of a landfill gas power plant. The following test runs, using the pilot plant under different working conditions, will be constantly controlled by technical and scientific staff.

At the end of the project the results will be evaluated in respect to an optimized and reliable technolody for the separation of harmful trace components from biogas, leading to the process definition and the standardization of a plant programme, ready to be offered to the market of biogas power plants.

The consortium is structured in such a way that each of the proposers participants is extremely interested in both the results and in the success of the project. On the hand, there are two manufactures and suppliers of biogas power stations, constantly confronted with problems and damage caused by harmful trace

components and very interested in the objectives and the results of the project. On the other, there is the supplier of the refrigeration plants as well as the manufacturer and supplier of all other plant components, in particular the purpose-built finned tube heart exchangers in stainless steel. The interest of both suppliers in the project is to be involved in future deliveries and to enlarge the actual programme of activities via a promising product.

Expected impact and exploitation

The exploitation of biogas is not being carried out in the same way all over Europe. The reasons for this are being created, in the main, by different legislation, plus lack of know-how and/or financial benefits. In this respect, the quality of the gas is a decisive factor as regards the operating costs. There is a considerable need for action in Europe to use the potential which already exists.

The applies in particular to the Eastern European countries where the standards of landfill sites and sewage plants and the use of biogas in general are substantially Below European Union (EU) standards. The various problem assessments and synergetic effects of all the EU-oriented partners in the consortium will result in a potential of accumulated experience and will improve the chances of realizing and exploiting the results. In this way, orientation of the project exclusively according to aspects of the national markets will be prevented, and European market opportunities are ensured.

The expected results will be disseminated by various publications and during specific conferences and workshops at the European level. Printed matter and leaflets giving information about the process, the results achieved and the plant programme will be prepared and distributed to potential clients as well as to organisations and associations concerned with waste disposal, landfills and sewage plants. Potential clients with engine problems in France, Spain, Belgium and Germany have already been informed about the project and are anxious to hear about the results. If an economical way of removing harmful traces can be found there is no doubt that this will be introduced successfully on to into the market It is the aim of all EU governments to double the share of renewable energy in EU energy consumption until 2010 up to 12 %. This can only be achieved ising processes and systems that work under economical conditions.

In addition, a Kyoto objective implies a reduction of 8 % in greenhouse gas emission for the EU between 2008 and 2012. Methane is one of the main

components of biogas and its contribution to the greenhouse effect is approximately 21 times more harmful than carbon dioxide. Therefore, the utilization and exploitation of biogas is an effective way to reach the Kyoto target. Since the intended research in the project will fulfill and improve energy recover for landfill and sewage gas, it will contribute to EU policies.

Progress to date

The specific results to date are as follows:

1) Determination of the basic technical requirements and cost-performance ratio of different ways of process design and selection of analytical methods to be applied;
2) Theoretical determination of removal efficiencies of harmful substances from biogas by cooling;
3) Functional tests and optimization of model components on site at different temperatures as regards the analytical and calculated results;
4) Promising results of the process have been analysed at a landfill gas temperature of -11*C. Reductions of 40 % and 80 % respectively have been achieved for the main siloxane compounds, octamethyltetracyclosiloxane (D4) and decamethylpentaciloxane (D5);
5) Engineering of the pilot plant taking into concideration all the results and information obtained from the preceding tasks and adjusted to the needs of the selected site; and
6) Pilot plant manufacture, functional tests at the manufacturing company, followed by test runs on site.

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Служебная записка

Прошу Вашего распоряжения отпечатать на ризографе учебно-методическое пособие по английскому языку Английский язык:учебно-методическое пособие для студентов факультета «Промышленная теплоэнергетика» автора Семчук Е.В. в количестве 300 экземпляров.

Просим выделить для преподавателей кафедры иностранных языков 10 экземпляров.