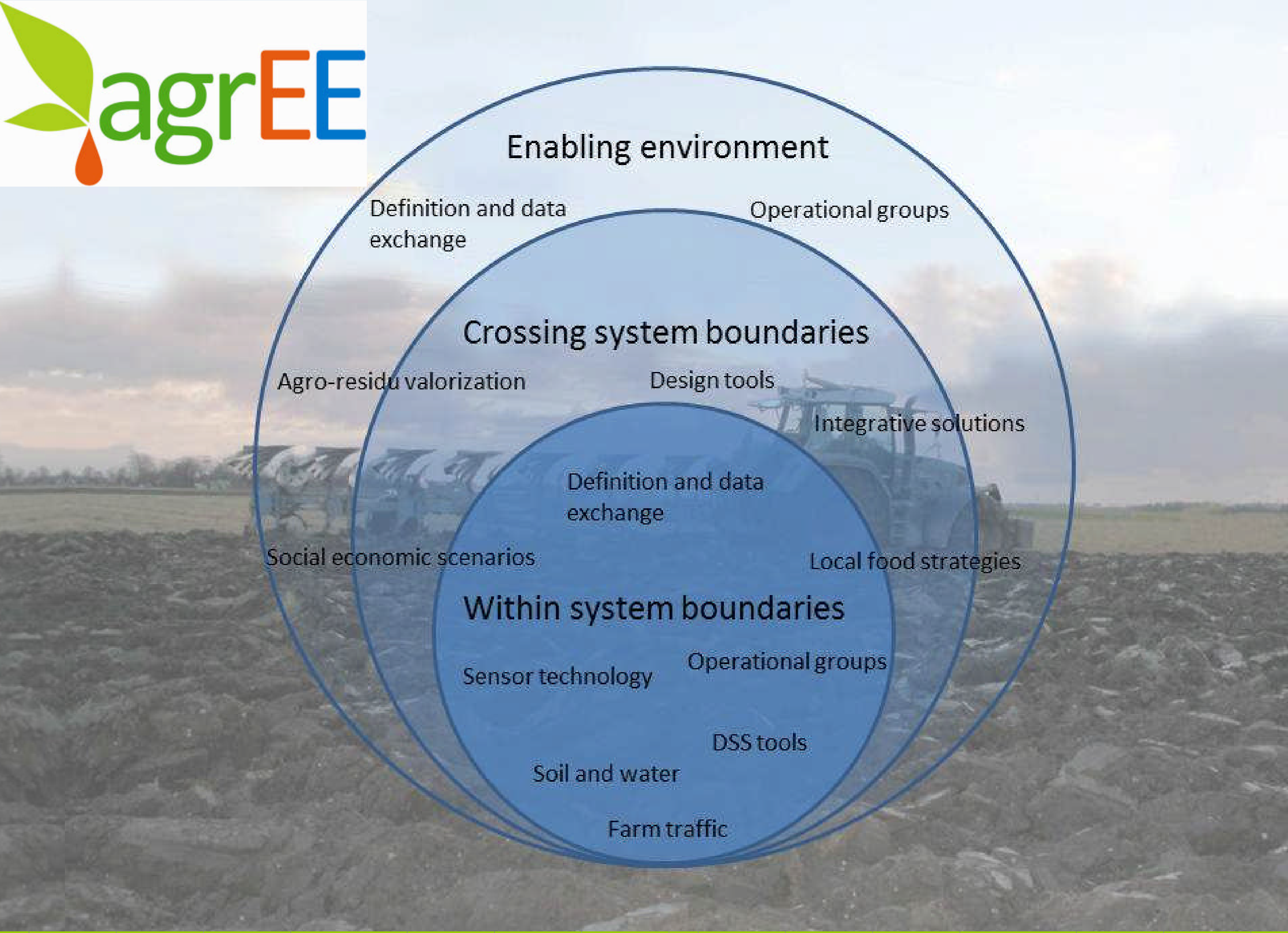

D4.5 Agenda for Transnational Co-operation on energy efficiency in agriculture

This project is funded by the European Union

The sole responsibility of this publication lies with the authors. The European Union is not responsible for any use that may be made of the information contained therein.

D4.5. Agenda for Transnational Co-operation on energy efficiency in agriculture

This project was funded by the FP7 Program of the EU under Grant Agreement Number 289139

Project Deliverable 4.5

Chris de Visser & Herman Schoorlemmer	Wageningen UR
Janusz Gołaszewski, Ewelina Olba-Zięty, Mariusz Stolarski, Zbigniew Brodziński, Ryszard Myhan	University of Warmia and Mazury in Olsztyn, Poland
Fatima Baptista, Luis L. Silva, Dina Murcho, Miguel de Castro Neto	University of Evora
Andreas Meyer-Aurich	Leibniz-Institute for Agricultural Engineering Potsdam-Bornim
Demetres Briassoulis, Panos Panagakis, Athanasios Balafoutis	Agricultural University of Athens
Claudia Lutsyuk	Fachagentur Nachwachsende Rohstoffe e.V.
Tommy Dalgaard	Aarhus University
Hannu J. Mikkola	University of Helsinki

Contents

List of Tables

List of Figures

Executive Summary

This report describes the stakeholder process set up by the AGREE project, to produce an Agenda for Transnational Cooperation in R&D on the topic of energy efficiency in agriculture. In six of the partner countries, represting a wide variety of agro-climatic conditions, stakeholders from across the value chain and representing the enabling environment, came together to discuss and identify opportunities and bottlenecks for an energy efficient agriculture for the future. The resulting lists were analysed and clustered to produce nine potential topics for energy efficiency R&D in EU agriculture. In a transnational meeting with representatives from each of the participating countries, as well as from the External Advisory Board, R&D themes were identified and prioritised to produce a list of eleven R&D areas:

1. *Sensor technology*
2. *Agro-residue valorisation*
3. *Operational groups (energy efficiency networks)*
4. *Integrative solutions*
5. *Socio-economic scenarios research*
6. *Definitions and data exchange*
7. *Decision Support System (DSS) tools for farmers*
8. *Design tools*
9. *Local food strategies*
10. *Soil and water management*
11. *Farm machinery*

In this report the above mentioned areas are explained and described and finally suggestions for the potential embedding of each of the items is discussed. The suggestions are summarized in the table below.

Table 1: Suggestions for absorption of the R&D areas of the ATC

R&D area	platform
Sensor technology	ICT-AGRI ERA-NET, ManuFuture-AET (Factories of the Future PPP)
Agro-residue valorisation	ERA-NET Bioenergy, ERA-IB2 and BRIDGE PPP
Operational groups (energy efficiency networks)	European Innovation Partnership of Agricultural Sustainability and Productivity
Integrative solutions	SCAR/KBBE CWG
Socio-economic scenarios research	SCAR/KBBE CWG
Definition and data exchange	SCAR/KBBE CWG
Decision Support System (DSS) tools for farmers	ICT-AGRI ERA-NET, ManuFuture-AET (Factories of the Future PPP)
Design tools	SCAR/KBBE CWG
Local food strategies	European Network on Rural Development, RURAGRI ERA-NET

Soil and water management	European Innovation Partnership of Agricultural Sustainability and Productivity
Farm machinery	ICT-AGRI ERA-NET, ManuFuture-AET (Factories of the Future PPP)

1. Introduction

1.1 Statistics and energy use in agriculture

In all economic sectors of society energy use and efficiency needs to be addressed for two obvious reasons: cost management and the environmental objective to mitigate greenhouse gas emissions. However, except for greenhouse crop production in northern Europe, energy efficiency in agriculture has not yet received the appropriate level of attention [1]. The main reason for this is that the published statistics on final energy consumption indicate that agriculture and forestry use only 2% of the total final energy consumption, while other sectors like industry (26%), transport (33%), households (25%) and services (13%) use considerably more. However, the AGREE project argues that primary energy consumption would be a more appropriate variable for measuring energy use in agriculture and that the statistics should also include the embedded energy, so direct and indirect energy consumption should be evaluated. In this way, the amount of energy consumption for which a sector is responsible from its position in the value chain, would be better described and be a better starting point when considering the demand for energy consumption and the need to improve efficiency in any given sector.

1.2 Aim and objectives

The SCAR/KBBE Collaborative Working Group on Agriculture and Energy, which is a joint effort undertaken by the Standing Committee on Agricultural Research and the KBBE-net, has identified the need to put energy efficiency in agriculture on the European agenda. This resulted in a call for a Coordination and Support Action under the 7th Framework Programme (FP7). The topic calling for a project identifying low-hanging fruits was published in the FP7 work programme 2012 . The aim should be to identify research areas that can bring short and medium term research results. Secondly, it should assess what kind of on-farm investments could contribute to energy savings at reasonable cost. This aspect is important as decisions for investment for energy efficiency compete with possible investments in other on-farm segments that promise to increase productivity or decrease operating costs. The AGREE project was set up under this call and the combined forces of seven European member states, with differing agricultural climatic zones, were selected to effectively represent the greater proportion of European agriculture.

The objectives of the AGREE project developed from the SCAR/KBBE CWG aim, are the following:

- Make an inventory of economic feasible energy efficiency measures either already taken up by the agricultural industry, or at an early stage of introduction to the agricultural industry, in different European countries under various climatic conditions.

- Based on the inventory, propose actions to promote energy efficiency in European agriculture addressing the dissemination pathways and the pitfalls to innovation.
- Initiate transnational sharing of knowledge on energy efficiency measures ready for short term introduction.
- Produce an agenda for transnational research collaboration using a participatory approach. This Agenda will target the potentials offered by several agricultural production systems, building types and designs, ventilation and other climate control processes, use of inputs, agricultural machinery design and the use of farm logistics.
- Indicate the added value of transnational R&D on energy efficiency in agriculture.
- Indicate the potential benefits of energy saving in European agriculture by providing evidence for the economic and ecological side-effects of improved energy efficiency in agriculture.
- Involve stakeholders in selected countries and present the AGREE results to funding organizations and R&D networks.

1.3 Definition of energy efficiency and the challenge for agriculture

The AGREE project has positioned energy efficiency as its prime indicator while using the following World Energy Council definition: energy efficiency improvements refer to a reduction in the energy used for a given service (heating, cooling, lighting, etc.) or level of activity. The reduction in the energy consumption is associated with technological changes, better organization and management or improved economic conditions in the sector.

This definition implies that energy use is allied with the corresponding level of agricultural -production. Thus, increasing energy use efficiency might imply an increase of energy use when the production level is stimulated to a higher extent. Or, that decreasing energy use could result in lower energy efficiency if the production level decreased even further as a result.

In the past increasing agricultural production has coincided with an increase in energy use. Koning et al (2008) [2] have shown this in their study on the evolution of agro-production systems when trying to assess the long-term global food availability. Historically, the evolution of agricultural production systems shows an increase in inputs used to

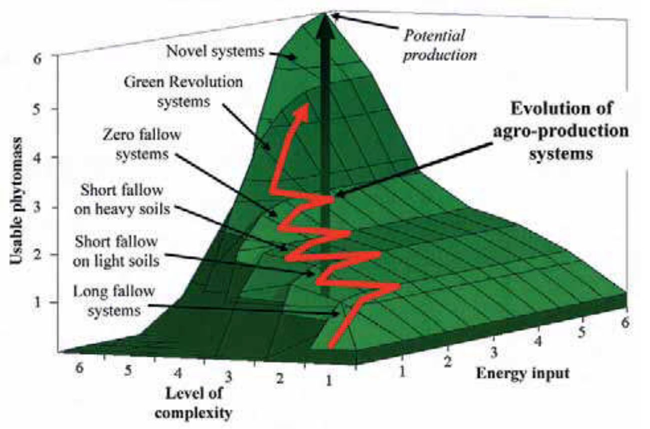

Figure 1. The evolution of agro-production and the corresponding increase of energy use (source: Koning et al, 2007, courtesy N. de Koning).

convert more of the solar energy into food and feed (Figure 1). Mechanization and the use of mineral fertilizers and pesticides are prime examples of innovations that have increased the complexity of agro-production systems and at the same time have used more energy. With the need to increase food production in view of an increasing world population and the desire for more Western style diets with a higher share of animal products, it can be expected that energy use in agriculture will rise. The question is whether this will also apply to European agriculture. Yet, increasing productivity will be important from the viewpoint of competitiveness. Therefore, the challenge is to combine increased productivity with increased energy efficiency, which could well imply a step change in the evolution of energy use in agriculture. This will not only require large improvements in existing agro-production systems but could also ask for new designs and innovations that answer to the needs of this step change. "Sustainable intensification" is a phrase often used to describe how agricultural production needs to develop to meet the increased demand for agricultural products [3].

1.4 Results of the AGREE project

The AGREE consortium has worked together in collecting information to design the operating area of energy use and efficiency improvements in agriculture and to highlight this area by showcasing it in a wide range of products and farms. This work has shown that energy efficiency varies widely between agro-climatic zones and countries but that improvements can be made quickly and easily by learning from one another, exchanging best practices and focusing on country-specific applied research. Moreover, the inventory of energy efficiency measures has resulted in a large list of nearly 500 measures ranging from operational to more strategic levels. The show cases of several production systems of selected agro-products in six European countries have revealed some of the challenges when trying to improve energy efficiency in practice like the interactions and trade-offs between energy use, farm income and greenhouse gas emissions.

Although the technical information collected and produced by the AGREE consortium revealed many opportunities to improve energy efficiency, the question remains - how do drivers and stakeholders influence decision making at the farm level to implement, postpone or ignore energy efficiency improvements?

In the different participating countries the forces in this arena were assessed and Figure 2 shows the combined result regarding the position and influence of the different stakeholders.

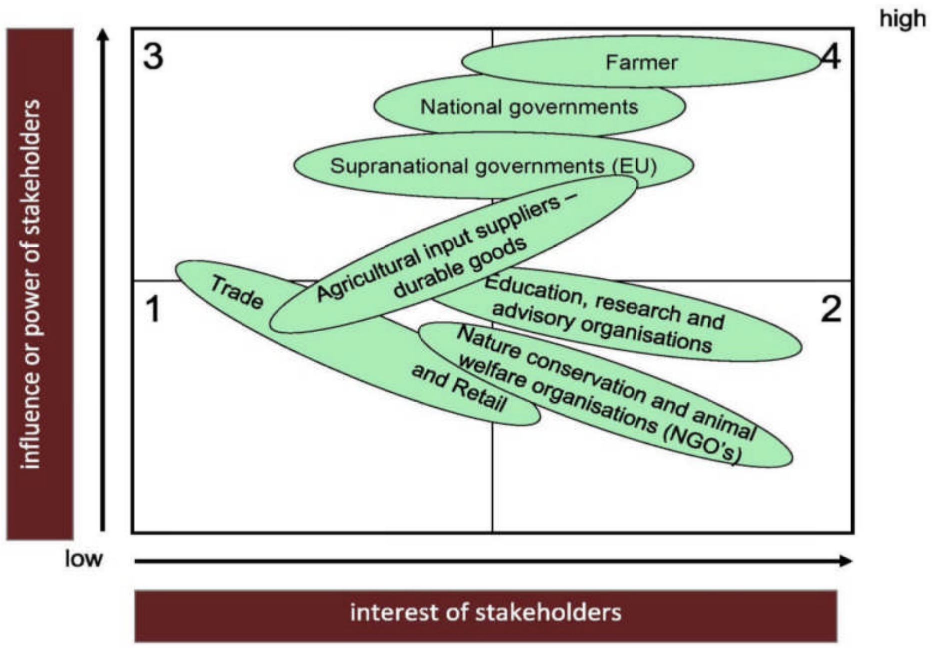

Figure 2. Stakeholder position and interest on energy efficiency in agriculture.

Figure 2 combines many agro-production sectors under varying agro-climatic zones and reflects the rather low interest and current influence of the downstream value chain and NGO's on energy efficiency in agriculture. This coincides with the rather low share of final energy consumption by the agricultural sectors. Governments have a more focused interest in energy use and efficiency in agriculture. However, the position of national governments as given in the National Energy Efficiency Action plans (NEEAP's) illustrates that the relative contribution that agriculture could make is not expected to be substantial [1] although the greenhouse sector in the northern parts of Europe is an exception.

As a result of the current views on energy efficiency in agriculture, implementing energy efficiency will mostly be considered by farmers based on the opportunities they see to save money, especially with low investment technologies that can be easily implemented. Support could come from governments and to a lesser extent from the supply chain.

When energy efficiency in agriculture has a more pronounced position on the European agenda, the likely result will not only be that more effort is put into R&D but also that the downstream value chain will have an increased influence fuelled by societal demands through NGO's.

2. Methodology

This Agenda for Transnational Co-operation was the result of a thorough and intensive interaction between the AGREE partners and the stakeholders that have an influence on development and implementation of energy efficiency measures in European agriculture. In six countries (Poland, Finland, Greece, Portugal, Germany and The Netherlands) stakeholder meetings were organized. Stakeholders and representatives from within the whole value chain (suppliers to and buyers from farmers), farming and the enabling environment (governments, NGO's, researchers) were invited to join in. The actual participation can be viewed in Annex 1. Government representatives, farmers, knowledge institutes, service providers and suppliers to agriculture too part in the discussions, but downstream companies and NGO's were not represented to a satisfying extent which is in accordance with Figure 2.

Figure 3. At work in Athens.

All meetings followed the same format (Annex 2), which was developed previously by all the partners. This format was designed to yield a prioritized list of opportunities and bottlenecks for an energy efficient agriculture for the future in each of the six countries. The partners were trained to guide such a meeting. In each meeting the opportunities and bottlenecks were prioritized. The six priority lists were analyzed and clustered to result in a list of eight Clustered Priorities from which energy efficiency measures could be developed. One non-partner representative from each stakeholder meeting was invited to a transnational meeting which took place in Athens (Figure 3). For this meeting, also a representative of the External Advisory Board of AGREE was invited. The format of the meeting was developed by all the project partners and implemented as a group of 20 people (AGREE partners, country representatives and EAB representative). This group discussed the Clustered Priorities in detail to yield a vision for 2040, relevant R&D themes and arguments for transnational co-operation. In a marketplace setting the results of the Clustered Priority were discussed in order to add relevant items. Finally, the R&D themes were prioritized by the participants of the meeting. The results where then clustered into 11 R&D Areas that will make up the Agenda for Transnational Co-operation on energy efficiency in agriculture (see Figure 4).

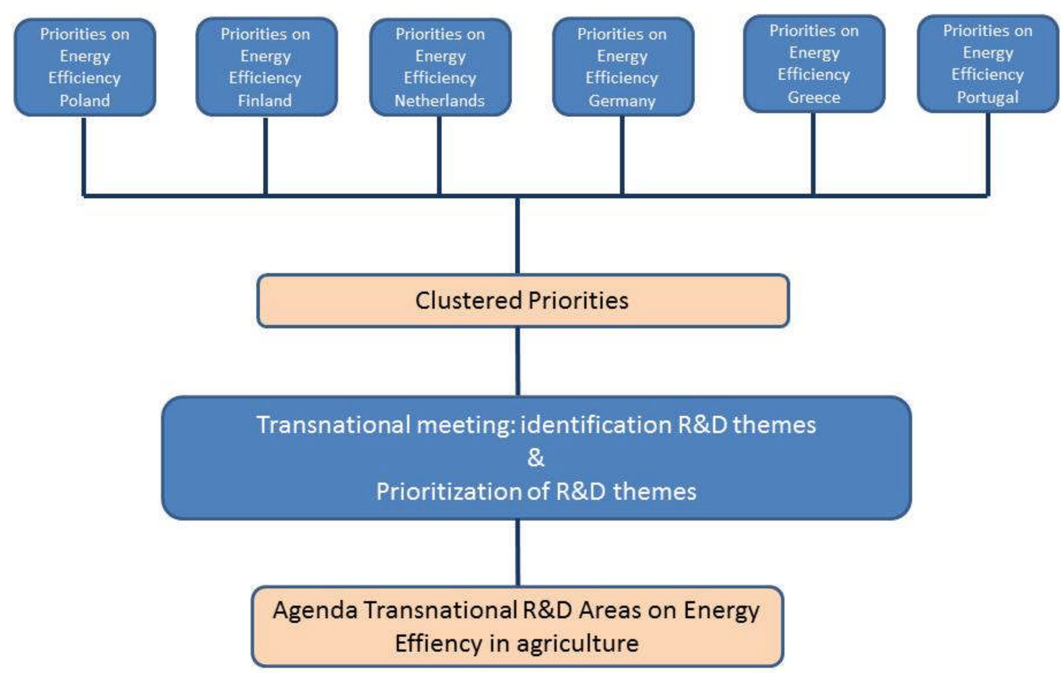

Figure 4. Process to develop the Agenda for Transnational Cooperation.

3. Results of national stakeholder meetings

2.1 Bottlenecks and opportunities embedded in institutions and structures

In the first 3 months of 2013 in Portugal, Greece, Germany, Poland, Finland and The Netherlands national stakeholder meetings (NSM) were held. An important aspect of these meetings was a plenary brainstorm based on two questions:

- what are the most significant opportunities to realize an energy efficient agriculture and

- what are the most significant bottlenecks that hinder an energy efficient agriculture.

This resulted in a list of 25 bottlenecks and 25 opportunities per country. The results were clustered and participants were asked to prioritize the most important ones from this list. Afterwards the results of all 6 NSM's were categorized and illustrated in a synthesis report. In this report the national prioritized opportunities and bottlenecks (82 in total) were categorized based on structural and cultural features of the innovation system framework according to Klein Woolthuis, R.J.A., V. Gilsing & M. Lankhuizen, (2005) [4]. These results, presented in Table 2, emphasize that the mentioned bottlenecks and opportunities will not arise in isolation but are embedded in institutions and structures, like the knowledge infrastructure, the physical or virtual infrastructure, legislation, norms and values, interaction (is there a shared vision?) and market incentives. These institutions and structures are crucial for the behavior of the different stakeholders in the system and the likely extent of success of the proposed actions.

Table 2. Results of the 6 national stakeholder meetings categorized according the Innovation System Framework

Aspect	Number of issues
Knowledge infrastructure	26
Physical infrastructure	13
Legislation and regulation	11
Values, norms and symbols	7
Interaction	16
Market structure	9

2.2 Synthesis of results from national stakeholder meetings

Based on discussions within the project team, the mentioned bottlenecks and opportunities were reduced to nine Clustered Priorities. These topics would be elaborated further during the transnational stakeholder meeting. Table 3 shows these top nine priorities as a result of the synthesis.

Table 3. Potential topics for the R&D agenda based on the national stakeholder meetings

Potential topics for the R&D agenda	**Description**

Data & monitoring	If progress is needed on energy efficiency it is important to have reliable data and uniform definitions underlying this parameter. This makes communication more efficient and can support decisions to be made in governing the process.
Vision & awareness	Improvement of energy efficiency starts with awareness of the current status and the importance of the issue for society and the sector itself. A vision that inspires and guides processes is important to set things in motion.
Co-innovation	For R&D knowledge to be effective it is important to understand how new knowledge is implemented and what the enabling environment for this looks like. Is knowledge something that is simply transferred from scientists and researchers to the value chain or is intensive interaction between researchers, farmers and companies a prerequisite? This topic refers to the process of innovation (in practice).
Technology advances	Technological advances can be made in machinery, equipment, building construction, ICT etc. that can technically make processes more efficient.
Alternative use, recovery and Reduction of waste	More and more it is accepted that resources should be re-used, recycled and reclaimed in order to increase the end-use efficiency. For nutrients in particular and for waste streams in general, re-using, recycling and reclaiming are important in agriculture. If better use is made of biomass, more products can be made and energy to drive the process can be used more efficiently.
Efficient use of natural resources	Natural resources are scarce in most countries. Some of them, like soils or water, can have reduced, or even be of poor, quality. It is important to preserve and use them properly, because further deterioration will also affect the efficiency of other inputs, including energy
Integrated system design	Energy efficiency can be realized either by optimizing processes at company or farm level or by considering the design of the whole value chain. Sometimes other integrated system designs show huge potential saving potential that outweigh individual views.
Farm and rural area economics	Implementing energy efficiency measures require investments to be made. These investments can have long pay-back periods and can be difficult on farms with generally low margins. If incentives to implement these measures are low, even with measures that require small investments and have quick pay-back periods, the chances are that implementation will not take place.
Policy Support	Supporting policy decisions with up-to-date information and analysis regarding the prevailing topics on energy use and efficiency is needed

4. Results from the Transnational Stakeholder Meeting

3.1 Central questions

The transnational stakeholder meeting was organized in Athens in June 2013. After a plenary introduction, the nine Clustered Priorities of Table 3 were discussed in small groups in breakout sessions. For organizational reasons the nine Priorities were reduced to eight by merging the Priority of Policy Support, that pays attention to up-to-date data for policy decisions, with the Data & Monitoring priority. During two breakout sessions 4 subgroups discussed the eight Priorities with the central questions:

- What R&D themes are relevant and related to this topic? The suggestions can be related to fundamental research, applied research and development and valorization.
- Why will international co-operation on this topic within Europe be profitable?

The following paragraphs describe the results for each question as a result of the group discussions.

3.2 Proposed and prioritized R&D issues

Table 4 presents the different results achieved in the meeting. Under R&D themes are presented the general topics retrieved from the break-out groups' discussions. After a plenary presentation and discussion of all the results of the break-out groups all 20 participants were asked to prioritize six R&D questions from the complete list with six stickers. The last column of Table 4 gives the number of votes that participants linked to the Theme.

Table 4. Proposed and prioritized R&D-themes as result of the transnational stakeholder meeting in Athens, June 2013

Priority	Number	R&D Theme	Number of votes
Vision & awareness	V.1	Socio-economic scenarios research	4
	V.2	Involve government and private sector in prioritization of research	3
	V.3	Social acceptability of new technology	2
	V.4	Alternatives solutions for utilizing new energy resources	0
	V.5	How to improve public awareness	1
	V.6	Transfer of know-how and results from research	1
Open innovation network	I.1	Platform for communication and social media: linking supply and demand for both farmers, industry and society	6
	I.2	Systemic approaches: addressing whole value chain / cycles	2
	I.3	Field experimentation approaches related to energy efficiency agenda	2
	I.4	Testing key agricultural factors in new context of energy efficiency demand	0
	I.5	Subject oriented data warehouses	0
	I.6	Launch an EU crowd sourcing agriculture and energy efficiency research project (including NGO's)	0
	I.7	How to overcome bureaucracy: blocking new developments	1

Data & monitoring	D.1	Better technology for data acquisition and collection + guarantee compatibility of data	2
	D.2	Improved applied modeling: transfer research data and knowledge to practical tools	9
	D.3	Transnational standardized procedure of benchmarking (database definition)	10
Technology advances	T.1	R&D on bio-based materials	3
	T.2	Smart systems: sensor technology : Wireless Sensor Networks in livestock systems, irrigation, storage and greenhouses.	13
	T.3	Autonomous machines / ergonomics / user interfaces / safety	2
	T.4	Traffic ability and weather info: can soil be cultivated?	1
	T.5	Socio-economic impacts of technology advances	1
	T.6	Appropriate technology transfer	1
	T.7	Robotics	0
	T.8	Climate change: measurement of GHG emissions	0
	T.9	Labor productivity and demographic adoption (effects on rural employment)	0
	T.10	Anaerobic digestion systems	1
	T.11	Irrigation and soil management technology	2
System design	S.1	New systems : how to make it less expensive (decrease pay-back time and decrease initial capital demand)	3
	S.2	Economic, energy and resource efficient systems: integrative solution	8
	S.3	More holistic approach needed --> effect on farm level	3
	S.4	Policy is more directed at addressing single bottlenecks than integrative solutions	0
	S.5	Taking care of trade-offs	0
	S.6	Re-use of non-consumed resources	0
	S.7	How to design sustainable systems, develop tools and rethink current systems	5
	S.8	Approaches to implement new systems: risk sharing	0
	S.9	Technology research to support new production systems	0
	S.10	Management of logistics for new systems	0
	S.11	Local production value chains	0
	S.12	Origin of the produce	0
Rural and farm economics	E.1	Waste management	0
	E.2	Local strategies and local consumption	5
	E.3	Cost of new technology	0
	E.4	Improve data availability of energy use by operations and products --> local products	0
	E.5	GMO: new plants in local environments	0
	E.6	Conflicting interests: farmers, local communities and rural stakeholders	0
Alternative use, recovery and reduction of waste	W.1	Integration of waste streams in energy production (farm and regional) + processing	10
	W.2	Optimization models	1
	W.3	Novel approaches to nutrient recovery	2
	W.4	Social awareness, education on food use efficiency (need of circular economy)	0
	W.5	Protein and other added value by-products	4
	W.6	System design waste valorization	0
Efficient Resource use	R.1	Benchmarking organic and conventional farming	0
	R.2	Re-use, recycle and renewable materials: how to manage and	0

		how to procure	
	R.3	Data analysis & sensors	6
	R.4	Cost analysis of precision farming	1
	R.5	New system boundaries for precision farming (vertical farming, controlled farming)	1
	R.6	Preservation and improvement of soil and water quality	2
	R.7	Dissemination and exploitation of research results	3

High scores (8 votes and up) were given to: improved applied modeling (D2), standardized procedures (D3), sensor technology (T2), integrative solutions (S2) and use of waste streams (W1).

3.3 Motives for transnational co-operation

During the break-out sessions the participants discussed why European co-operation on the topics mentioned in Table 3 would be profitable or useful. The plenary presentations showed overlap between the results of the break-out groups. Several suggestions showed international (European) incentives to stimulate energy efficiency. Below is the list of the answers given.

- Common vision and awareness will increase the exchange across Europe of data and results;
- Value chains in the agriculture & food sector are transnationally oriented and there is often involvement of multinational players. This means that system designs require transnational co-operation;
- There is common EU legislation on food labeling. That can be an incentive for cooperation on labeling with an indication of energy use;
- Part of the resources used are regulated on an European level;
- Learning from one another: exchanging best practices, case studies and technological solutions;
- Technology can have multiple implementation areas and product chains;
- Make full use of expertise from across Europe and avoid duplication of efforts and missed results;
- Farmers mobility across Europe is easier if European R&D results are given consistently;
- Researchers in some areas becoming aware of potential future problems and can broadcast that awareness transnationally;
- Environmental issues like GHG and water quality are problems on an international level;
- Increasing nutrient use efficiency (nutrients are an important source of indirect energy use) requires international co-operation
- Solving the energy use efficiency problem together will increase the international competiveness of European farmers.

5. The R&D agenda

In the list presented in Table 3 the topics voted for were assessed for affiliation in order to reach a usable clustering that could present an R&D agenda. In Table 4 the clustering results are given. These results are the R&D agenda items (or: R&D Areas) that can be used to increase energy efficiency in agriculture.

The different R&D Areas can be explained as follows:

1. ***Sensor technology***: Sensors can be helpful in closely monitoring the status on the farm of crops, soils, production systems and livestock and so can contribute to energy efficient farming. While more than a decade of innovative research on sensors for "Precision Farming" has provided good solutions for sensing important information from agricultural systems R&D is needed to develop sensors that can be wirelessly connected to databases and analyses software to support decision making. Combining different information types in smart decision support tools is still lacking. This decision making can then lead to the application of the right measure at the right time and place. It became clear from the meeting in Athens that compatibility of data is important to ensure effective communication between soft- and hardware components. The sensors can monitor conditions of direct value such as yield, or of indirect value, such as whether a machine is functioning
2. ***Agro-residue valorisation***: agro residues can be used to produce a wide range of products including bio-energy (from chemical action on biomass directly or via fermentation or other biological process), fibers, biopolymers and other bio-based materials, nutrients, proteins and molecules for chemical processes. This can be achieved by some form of biorefinery with the aim to ultimately produce the highest possible economic added value. By doing this, products in other value chains can be partly replaced resulting in an overall decrease of greenhouse gas emissions. This GHG emission reduction can be attributed to the agricultural product value chain where the residues originate from, thus increasing the energy efficiency of this value chain. In those cases where the agricultural residues contain high levels of moisture, the refinery is best located close to the site where the residue is produced allowing nutrients to remain within the area. Comprehensive waste valorization requires not only that new technologies are developed in a future biobased economy, but also that changes or adaptations to the agro production systems are involved and, although this may make it complex, it is a potentially highly rewarding transition. Anaerobic digestion systems are well known and can play an essential role in bio-refinery processes of agro residues to valorize low value organic material that is left over in these processes. However, experiences in Germany showed that incentive structures for inducing the use of agricultural residues have to be created with care without creating unintended side-effects.

3. ***Operational groups (energy efficiency networks)***: research results and best practices should be transferred effectively between researchers, value chain companies and farmers to make sure energy efficiency measures and related information, are implemented satisfactorily. These operational groups can be seen as demand driven partnerships around a solid innovation in energy efficiency. They work on focused solutions and could also be used to prioritize R&D. These functionalities come close to those of the current European Innovation Partnership initiative. Putting operational groups on the agenda of the energy efficiency ambition of the agricultural sectors, reflects the conclusion of AGREE that there are many energy efficiency measures already available and ready for use even though some could use research advances to optimize their benefits and make them useful for specific applications for a particular group of farmers with certain conditions and constraints.
4. ***Integrative solutions***: the transnational meeting concluded that energy efficiency measures should be developed and implemented in an integrative manner, meaning that economic, energy and environmental (resource efficiency) aspects should be considered at the same time while respecting their mutual interactions and trade-offs. This also requires that integrated value chain approaches should avoid gains in one part of the value chain offsetting losses in another part of the chain. This is not so much a separate R&D item but a call for a holistic approach to R&D applied to energy efficiency. This is well supported by the findings of AGREE on trade-offs for individual energy efficiency measures.
5. ***Socio-economic scenarios research***: in order to improve energy efficiency in agriculture a common vision and ambition based on different future scenarios would be significant in creating awareness and the correct socio-economic incentives to support the desired developments. These developments require existing and new technologies to be developed in a manner that is socially acceptable and economically feasible. An obvious example is robotics applied to harvesting where there is a major potential to directly replace labourers currently used for harvesting. This loss of work for labourers must be considered against the economics, crop quality and increased competiveness aspects. It could be useful to study the use of risk perception and risk sharing models to smoothen the implementation of new developments. Possible conflicts of interests should be identified beforehand to avoid implementation failing and incentives could be determined that would stimulate a positive change of behavior. Concluding, this agenda point is about targeting R&D to ensure a more effective implementation of technologies that contribute to energy efficiency.
6. ***Definition and data exchange***: if energy efficiency in agriculture is to be improved, monitoring the progress of the improvement is important. As AGREE has shown, the current statistics on energy use in agriculture do not include all of the primary energy embedded in the different agro

products and are therefore not useful for successful monitoring of the progress of energy efficiency in the sector. This needs a European benchmarking tool and/or procedures with standardized data definitions and collection methods. This tool should link with current databases like ECO-invent and BIOGRACE and with existing statistical datasets but should take regional differences across Europe into account.

7. ***Decision Support System (DSS) tools for farmers***: the stakeholders greatly supported the development of applied models and expert systems to support farmers' decisions on a variety of measures that influence energy efficiency. It was stressed that these DSS tools should be user friendly and formed and adapted for the decision processes of farmers. Current IT technologies enable such tools and this also links with item 1 of sensor technology. Together these two items, for example, will make valuable use of current and innovative Wireless Sensor Networks, Big Data handling methodologies and databases and cloud based analytical modelling to support farmers, or their immediate advisers, in decision making.
8. ***System design tools***: it was concluded that to improve energy efficiency, progress is needed both within current system boundaries and beyond these boundaries to optimize current production systems. The latter requires rethinking of current systems and redesigning value chains such that by reshaping them they could be made more energy efficient overall. To this end current value chains need to be analyzed on energy use overall, and the results are to be used in System Design Tools to come up with redesigns with a more overall energy efficiency of end products. One could think of nutrient recycling technologies, valorization of side-streams or logistic improvements etc.
9. ***Local food strategies***: this agenda item links up with the current world wide attention for local value chains as opposed to global value chains. As such, this item needs a rethink and developments beyond the current system boundaries. It can be expected that to a certain extent local and smart value chains will be more energy efficient. Investigations should be made into which value chains and local food strategies contribute most to increasing energy efficiency of end products and which food strategies perhaps rely too much on global markets to improve energy efficiency. One has to realize that local food strategies are primarily designed to serve other advantages or drivers than energy efficiency so an integrative approach is recommended. In the end, a particular local food value chain could support or endanger energy efficiency, and both situations deserve proper attention.
10. ***Soil and water management***: soil of adequate quality and ample availability of good quality water are essential for agricultural production. Both aspects determine yield levels to a great extent and determine the amount of energy used per unit of product. Items to be addressed are irrigation schemes, inclusion of nitrogen fixating crops, energy efficient soil

tillage systems and good geometry of fields to ensure efficient trafficking of farm machinery etc. This illustrates the interaction between optimization of the production process in general and specific energy.

11. ***Farm machinery***: a large part of the direct energy in agriculture, especially arable agriculture and feed for intensive livestock, is associated with diesel use by machinery. Obviously, increased efficiency in diesel consumption by these machines or alternative fuels (biodiesel, pure plant oil, green gas, electricity) adds to increased energy efficiency in agriculture although there are indications that requiring cleaner exhaust emissions can limit improvements to fuel efficiency. Already, for larger commercial farmers, auto-steer technology fitted to tractors is considered to be so obvious an economic and time saver that it is rapidly gaining popularity. This technology, by allowing very accurate matching of machine passes and quicker turns, can readily save 5-10% of all inputs; labour, fuel, seed, fertilisers and pesticides. It also enables the shrewder farmers to move to controlled traffic farming and save further fuel by avoiding excessive, random, trafficking of the soil and so avoids the need to cultivate soil compacted by that machinery. This also allows an improved yield as plants can make better use of nutrients and water in the more friable soil. Although robotic, autonomous guided vehicles, are not yet commercially available for arable use they are being developed and most researchers expect significant fuel savings from lighter slower machines that work longer hours with a better array of sensors that allow more precise, plant specific, operations. An example is that better targeted pesticides, using weed detection sensors, can potentially save over 95% of herbicide using "dot-matrix-printer" type application of minute amounts of herbicide solely to the leaves of the weeds, not to the whole crop. Robotics applied to Voluntary Milking Systems for dairy cows have been commercially available for several years and show an increase of 10% or so in milk yield as cows choose to get milked more than twice a day. Extra sensors on the unit can detect milk quality, oestrus and other aspects that enable higher quality milk to be sold and the cows to be more productive over time so improving the energy efficiency of the feed given to the cattle as output is increased.

Table 5. Clustering of R&D themes identified in the transnational stakeholder meeting.

R&D Area	Source	Total number of votes	Total votes
Sensor technology	T.2 + D.1 + R.3	13+2+6	21
Agro-residue valorization	W.1 + E.1 + W.3 + W.5 + W.6 + R.2 + S.6 +T.1 +T.10	10+0+2+4+0+0+0+3+1	20
Operational groups: energy efficiency networks	I.1 +V.2+I.3+V.6+R.7+T.6	6+3+2+1+3	16
Integrative solutions	S.2 + S.5 + S.3 + I.2 + S.4	8+0+3+2+0	13
Socio-economic scenarios research	V.1 + S.1 + S.8+ T.5 + V.3 + E.6 + R.4 +V.5	4+3+0+1+2+0+1+1	12
Definition and data exchange	D.3 + I.5 + E.4	10+0+0	10

DSS tools for farmers	D.2 + T.4	9+1	10
Design tools	S.7 + W.2	5+1	6
Local food strategies	E.2+S.11+S.12	5+0+0	5
Soil and water management	T.11+R.6	1+2	3
Farm traffic machines	T.3	2	2
Total			117
Votes counted			120

In Table 5 the following two R&D Themes collected at the transnational meeting (both with one vote) are not included for lack of affiliation with the other themes:

- How to overcome bureaucracy?
- New system boundaries for precision farming (vertical and controlled farming)

The above listed R&D areas make up the Agenda for Transnational Cooperation for R&D on energy efficiency in agriculture (ATC). This Agenda contains areas that are partly or fully related to optimization processes within existing system boundaries. Many of the energy efficiency measures collected by the AGREE project are related to this category. These measures can be implemented on current farms and may be alternatives, or advances, to measures that are already used in present day farming practices. They do not need new arrangements between value chain partners or new policies or regulations. The measures can result in increases to energy efficiency in the short or midterm and, although the total effect may be limited, the investment cost and risk will be acceptable.

In some cases the agenda items (or R&D areas) are related to changes of system boundaries and imply redesigning production systems and value chains or having new arrangements between value chain partners or even arrangements between different value chains. Some of these promise substantial improvements but there is much uncertainty involved and an intensive R&D route will be needed followed by thorough knowledge transfer to get a satisfactory uptake of these redesigned boundaries, systems, and value chain arrangements.

In order to implement such measures, the enabling environment should be taken into account. The partners in value chains are not completely autonomous in deciding how they shape their production processes. Governments apply regulations that limit the choices within the value chain and NGO's monitor sustainability and thus have an influence on what value chains should or should not do. Also, the development of technologies and the availability of services can enhance or limit the tool box for farmers to perform farming operations.

In Table 6 the items are categorized into the three categories identified and explained above.

Table 6. Categorization of the agenda items

	Sensor technology	Agro-residue valorisation	Operational groups	Integrative solutions	Socio-economic Scenarios	Definition and data exchange	DDS tools for farmers	Design to0ls	Local food strategies	Soil and water management	Farm machines
Within system boundaries	■		■		■	■	■		■	■	■
Crossing system boundaries		■		■	■		■	■	■		
Enabling environment		■	■	■	■	■	■		■		

For instance, agro-residue valorization asks for new arrangements between value chains and thus requires crossing system boundaries. Aligned with this, changes in regulations are probably needed which is supported though by (EC) policies (bio-based and circular economy). The promise is substantial but the new arrangements and regulation changes will further increase the chance of success. When addressing this agenda item, these effects need to be accounted for. The categorization also shows that some items can have implications in more than one category and detailing the agenda item will show aspects that need appropriate attention following the relevant category.

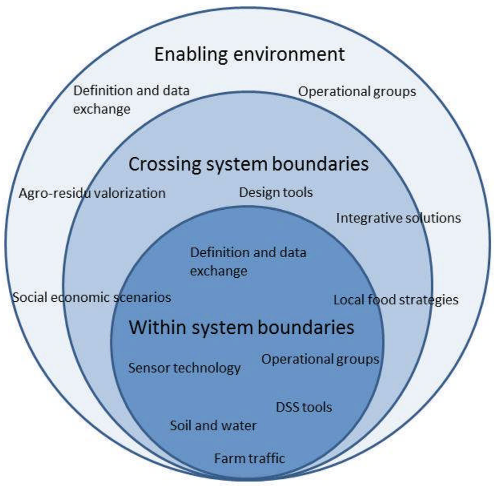

Figure 5. Visualisation of the agenda items.

Table 6 allows us to visualize all the identified R&D areas as shown in Figure 5. The category crossing system boundaries will especially ask for a longer term perspective and will also require strong interactions between stakeholders to find the right paths to follow.

6. Embedding the R&D agenda

When embedding the ATC into existing or new structures and instruments it is wise to consider the results of Table 2 and the consequences of Figure 1. This Table shows us that making agriculture more energy efficient will require a shift in systems. Considering such a shift we should note that innovating is not merely a linear process of implementing R&D results into practice but more a more interactive process where stakeholders work together giving feed-back to one another, learning from one another and creating win-win situations by bringing together unique expertise.

Embedding this agenda in to existing structures is necessary to bring energy efficiency in agriculture to the next level. This can be done on either national or regional level or at a transnational level within Europe. The reasons for transnational co-operation are given above and stress the fact that in modern research specific expertise is required to be brought together to give maximum results. The AGREE project has shown that improving energy efficiency requires integrating different and highly variable aspects of farming (deliverables 2.1 and 3.1). The backdrop to this is that energy efficiency relates not only to direct energy input but also that the indirect energy use needs to be included to get the right picture without an unacceptable risk that negative factors will reduce the resulting net effect. Therefore, we recommend an Agenda be embedded in the European context where structures for co-operation between countries and thus a wide variety of expertise are in place to profit from the critical mass available.

The Agenda and the other results of the AGREE project have shown that for improved energy efficiency in agriculture further R&D is needed, but that also many measures are already available and could be considered as “low hanging fruit” (deliverable 2.3). This latter category will need close interaction between farmers and value chain companies to exchange best practices between researchers and farmers to disseminate knowledge.

As indicated by the AGREE project (deliverable 2.4), the stakeholder arena is important but could be stronger to stimulate and facilitate increased energy efficiency. Therefore, it is advisable to build on the relationship between agriculture and the enabling environment to encourage improved energy efficiency. This is already being done in certain countries, such as the Netherlands where voluntary agreements are being made: under the “Schoon en zuinig” program many sectors have defined an aim to decrease CO_2 emissions, which for the agricultural sector is 1-2 Mton of CO_2 in 2020 [5]. Such programs are also in development in other countries. However, this is directed towards direct energy and also includes the production of renewable energy (biogas production). Nevertheless, programs like these are important to increase awareness and to speed up developments.

The Agenda produced by the joint action of the AGREE project partners and the stakeholders involved has many links to other initiatives and the individual activities under the Agenda could therefore best be offered to these initiatives for adoption. In general, Horizion2020 holds much promise for all the Agenda items to be addressed as this framework program relates to societal challenges such as a sustainable agriculture, efficient energy use, resource efficiency and climate action.

Important for the Agenda is the ICT-AGRI cross thematic ERA-NET (http://db-ictagri.eu/ict-agri/content/home.php) combining themes like environment, ICT and agriculture. The ICT-AGRI ERA-NET has developed a Strategic Research Agenda with many clear links to the energy efficiency agenda for agriculture. The most important are the themes on "Sensor technology", "DSS tools for farmers" and "Farm machinery".

EFFICIENT20 was a European funded initiative from 2010 until early 2013, to help farmers and foresters to reduce their fuel usage by 20%. This initiative encouraged fuel saving measures to bring significant cost savings to farming businesses. Close links with members of this Initiative would be valuable to build on their understanding of knowledge transfer, research and data collection on direct energy savings and energy efficiency improvements and determine how a similar initiative, perhaps with emphasis on indirect energy use as well, could be implemented (http://efficient20.eu).

The Manu*Future* European Technology Platform, through its "Agricultural Engineering and Technologies" sub-platform could play an important role in encouraging the consideration of research funding, particularly through Horizon2020, of these items. Manu*Future* has formed the Factories of the Future Public Private Partnership (PPP) which could be involved in some of the value chain processing aspects.

The item of "Agro-residue valorization" plays a role within ERA-NET Bioenergy and ERA IB2 (http://www.era-ib.net/). Furthermore, the item is very closely connected to the biobased economy and the BRIDGE PPP (http://bridge2020.eu/about/) that has recently established an agreement with the Commission and is the ideal platform to support developments under the waste valorization theme as this is an integral part of the PPP's vision. Approaching these with suitable topics for joint calls may cover some aspects of the R&D Area 2 "agro-residue valorization".

The European Innovation Partnership on Agricultural Sustainability and Productivity was recently established (http://ec.europa.eu/agriculture/eip/) and has two headline targets:

- promoting productivity and efficiency and
- the sustainability of agriculture.

This EIP will primarily be implemented through the post-2013 CAP and Horizon2020. The first line of implementation will involve operational groups consisting of farmers, advisors, researchers, enterprises and other stakeholders with knowledge transfer and co-operation as leading themes. This infrastructural element is well equipped for the Agenda item on "Energy Efficiency Networks". The second implementation line of the Agriculture EIP could very well host the Agenda item on "Soil and Water Management" as this item has a strong relationship to arable productivity. It is recommended that Operational Groups at a national level could interact at a cross border level (INTERREG level) through a thematic group on energy efficiency.

The Agenda item on "Local Food Strategies" has strong links with the theme of the Local Food and Short Supply Chains of the European Network on Rural Development (ENRD) which has been set up under DG Agri (http://enrd.ec.europa.eu/). The opportunities of this ENRD theme to include increasing energy efficiency in agriculture as identified by the AGREE stakeholderprocess, will be brought to the ENRD's attention. Further, the ERA-NET RURAGRI (https://www.ruragri-era.net/) could be a candidate platform to absorb this Agenda item as RURAGRI strives for improved interaction between urban and rural developments. Local food strategies can contribute greatly to this interaction.

The four remaining Agenda items:

- Integrative solutions,
- Socio-economic scenarios research,
- Definition and data exchange and
- System design tools

are more specific to energy efficiency and are not very easily linked to existing structures, programs or platforms. Therefore it is strongly suggested that the SCAR/KBBE CWG integrate these items into Horizon2020 or the Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE JPI: http://www.faccejpi.com/).

The item on definition and data exchange could be used for a Horizon2020 call but it is important that the results of such a development trajectory must be absorbed by an institution like Eurostat that could perform the benchmarking and setting up of the statistical data collection process.

The Climate-KIC public-private innovation partnership (http://www.climate-kic.org/) could be an interesting instrument to fund projects across the Agenda as long as the measures have a substantial impact on greenhouse gas emission reduction.

The European Society of Agricultural Engineers (EurAgEng) is the ideal forum to support the agricultural energy efficiency agenda in collaboration with the infrastructure as mentioned above as the Society is a network that has access to a wide variety of expertise throughout Europe (over 2000 individual members in 24 national societies in 23 European countries). As such it is a good platform to exchange information, particularly in the research and academic community but also it has good links with commercial organisations. EurAgEng has a structure of Working Groups, including one on Sustainable Energy related to Power and Machinery.

EurAgEng exists to promote the profession of Agricultural and Biosystems Engineering and the people who serve it and is particularly active in Conferences. There are two sorts of conference, those held in the odd years, Land.Technik-AgEng, are organized jointly with the German VDI Max-Eyth-Society for Agricultural Engineering (VDI-MEG). This conference is immediately before the world's leading fair on agricultural machinery, Agritechnica so of the 800 attendees, a large proportion are from major multi-national machinery manufacturers. The other style of conference, held in the even years, AgEng, is organised by various national societies, often in conjunction with other European or global associations, and attracts 500-1000 attendees. It is common to establish themes and workshops within the Conferences. The overall theme for AgEng 2014 for instance is "Engineering for Improving Resource Efficiency". EurAgEng also includes ENGAGE, a network of agricultural engineering research institutes and university departments. Several of the AGREE partners are from Institutes involved with ENGAGE while the individuals are members of EurAgEng.

7. References

[1] Synthesis of the complete assessment of all 27 Energy Efficiency Action plans as required by Directive 2006/32/EC on energy end-use efficiency and energy services. Commission staff working document. Brussels, 23.6.2009, SEC(2009)889 final, 138 p.

[2] Koning, N.B.J. et al (2008). Long-term global food availability: continued abundance or new scarcity? NJAS, 55(3): 229-292.

[3] Davies, W.; Baulcombe, D.; Crute, I.; Dunwell, J.; Gale, M.; Jones, J.; Pretty, J.; Sutherland, W.; Toulmin, C.; 2009, Reaping the Benefits: Science and the sustainable intensification of global agriculture. London : Royal Society, 86p.

[4] Klein Woolthuis, R. J. A., V. Gilsing en M. Lankhuizen (2005). A system failure framework for innovation policy design. Technovation,25 (6), pp. 609-619

[5] Nieuwe energie voor het klimaat. Werkprogramma Schoon en Zuinig. ("New energy for our climate. Work program Clean and Efficient") http://www.energie.nl/beleid/schoonenzuinig.pdf

Annex 1: participants

Participants of the national stakeholder meetings:

Portugal

Name	Organisation
João Coimbra	CAP/ANPROMIS - Farmers association
Ana Isabel Antunes	GPP – Office of Planning and Policies - Governmental
Pedro Baptista	Fundação Eugénio de Almeida - Agriculture and Food Industries
António Perdigão	Farmer
Miguel Neto	Universidade Nova de Lisboa and AgriCiência – Educational and R&D Institutions, and Consultant and Services Company.
Dina Murcho	Agriculture Engineer – Consultant
Luis Leopoldo Silva	University of Évora
Fátima Baptista	University of Évora

Greece

Name	Organisation
Georgios Kafritsas	Agronomists of the world
Michail Tsagkaropoulos	P.I. Condellis S.A.
Dimitrios Konstantopoulos	Green tech Energy
Dimitra Marda	PASEGES
Michail Smiris	PASEGES
Maria Ekonomou	Directorate of reclamation work development and mechanical equipment / Ministry of rural development and food
Thalia Anastasaki	Directorate of reclamation work development and mechanical equipment / Ministry of rural development and food
Ioulia Drosinou	Directorate of Production and development of field crops / Ministry of rural development and food
Spyros Fountas	University of Thessaly – Precision Agriculture
Theodoros Tsianos	Nemea Cooperative winery (member, ex- president)
Kostas Samantouros	Union of Agronomists scholars Greece -consultants
Ilias Balafoutis	Young Farmer’s Association Ftiotida - member
Dimitrios Dimhtrakopoulos	Greenhouse farmer
Georgiow Karampelas	Greenhouse farmer
Kostas Giannopolitis	Agrotypos S.A.

Poland

Name	Organisation
Anculewicz Urszula	Agricultural Advisory Centre for Warmia and Mazury
Bartczak Michał	Association of Consultants for Rural Development
Bieńkowski Krzysztof	Financial Brokerage
Bieńkowski Tomasz	Agricultural Production "Seed Central" Sp. z o.o.
Brodziński Zbigniew	Centre for Renewable Energy Research of the University for Warmia and Mazury
Całka - Orłowska Justyna	Agricultural Advisory Centre for Warmia and Mazury
Chyłek Eugeniusz	Ministry for Agriculture and Rural Development
Dubicki Mariusz	Centre for Renewable Energy Research of the University for Warmia and Mazury
Dunajski Lech	Service and Repair Company
Faber Antoni	Institute of Soil Science and Plant Cultivation - State Research Institute
Falkowski Jan	JAN-POL Sp. z o.o.
Głowacka-Gil Agata	Centre for Renewable Energy Research of the University for Warmia and Mazury
Gołaszewski Janusz	Centre for Renewable Energy Research of the University for Warmia and Mazury
Grabowski Bogdan	JAN-POL Sp. z o.o.
Grabowski Konrad	BIOSFERA Sp. z o.o.
Grocha Katarzyna	Baltic Energy Conservation Agency in Gdańsk
Grzybek Anna	Institute of Technology and Life Sciences
Jedynasty Zenon	Horticultural Farm "Łęgajny" Sp. z o.o.
Koniecko Andrzej	The Energy Agency of Warminsko-Mazurskie Voivodeship Sp. z o.o.
Kuczajowski Jacek	The Warmia and Mazury Agricultural Chamber
Kwiatkowski Piotr	Farmer
Laskowski Marek	ENERGA Joint-stock Company
Leonowicz Jan	Commune Office
Linkowski Piotr	Farmer
Mościcki Krzysztof	Agricultural Advisory Centre in Brwinów
Myhan Ryszard	Centre for Renewable Energy Research of the University for Warmia and Mazury
Nitkiewicz Monika	Centre for Renewable Energy Research of the University for Warmia and Mazury
Olba-Zięty Ewelina	Centre for Renewable Energy Research of the University for Warmia and Mazury
Oryl Grzegorz	Farmer
Ronkiewicz Łukasz	Farmer
Ronkiewicz Zbigniew	ABLINED Sp. z o.o.
Sekściński Waldemar	Farmer
Sochaczewski Mariusz	Farmer
Stolarski Mariusz	Centre for Renewable Energy Research of the University for Warmia and Mazury
Teodorczak Roman	Bank of BGZ Joint-Stock Company
Zaniewski Karol	Association of Consultants for Rural Development

Finland

name	organisation
Jukka Ahokas	University of Helsinki
Anni Alitalo	Agrifood Research Finland - MTT
Jussi Esala	Seinäjoen AMK
Aki Finér	Raisioagro Oy
Lea Gynther	Motiva Oy
Petri Hannukainen	Valtra Oy
Tapani Jokiniemi	University of Helsinki
Eerikki Kaila	TTS - Työtehoseura
Jyrki Kataja	Jyväskylän AMK
Hannu Mikkola	University of Helsinki
Seppo Mikkonen	Neste Oil Oyj
Antti Peltola	Hämeen AMK
Mari Rajaniemi	University of Helsinki
Veli-Pekka Reskola	Ministry of Agriculture and Forestry
Winfried Schäfer	Agrifood Research Finland - MTT
Taija Sinkko	Agrifood Research Finland – MTT

Germany

name	organisation
Borsdorff, Dirk	Netafim
Braun, Sabine	Landesanstalt für Entwicklung der Landwirtschaft
Prof. Dr. habil. Brunsch, Reiner	Leibniz-Institute for Agricultural Engineering Potsdam-Bornim (ATB-Potsdam)
Eckel, Henning	The Association for Technology and Structures in Agriculture (Kuratorium für Technik und Bauwesen in der Landwirtschaft, KTBL)
Dr. Hilden, Robert (Represented)	John Deere (Werke Mannheim)
Hölscher, Thomas	Federal Office of Agriculture and Food (Bundesanstalt für Landwirtschaft und Ernährung, BLE)
Jubaer, Hasan	Leibniz-Institute for Agricultural Engineering Potsdam-Bornim (ATB-Potsdam)
Kämper, Hartmut	Arbeitsgemeinschaft für Elektrizitatsanwendung
Lutsyuk, Claudia	Agency for Renewable Resources (Fachagentur Nachwachsende Rohstoffe e.V.-FNR)
Dr. Meyer-Aurich, Andreas	Leibniz-Institute for Agricultural Engineering Potsdam-Bornim (ATB-Potsdam)
Dr. Müller, Artur	Evonik Industries AG
Osterburg, Bernard	Johann Heinrich von Thünen-Institute
Dr. Saggau, Elke	Federal Office of Agriculture and Food (Bundesanstalt für Landwirtschaft und Ernährung, BLE)
Prof. Dr. Schmidt, Uwe	ZINEG /Humboldt University of Berlin (HU-Berlin)
Dr. Schüsseler, Petra	Agency for Renewable Resources (Fachagentur Nachwachsende Rohstoffe e.V.-FNR)

Dr. von Haselberg, Christiane	Leibniz-Institute for Agricultural Engineering Potsdam-Bornim (ATB-Potsdam)
Dr. Ziegler, Thomas	Leibniz-Institute for Agricultural Engineering Potsdam-Bornim (ATB-Potsdam)
Dr. Ziolkowska, Jadwiga	Leibniz-Institute for Agricultural Engineering Potsdam-Bornim (ATB-Potsdam)

The Netherlands

Name	Organisation
Martijn Buijsse	Agrifirm
Martijn Root	Ministry of Economic Affairs
Mark de Hartog	NEPLUVI
Ton van Korven	ZLTO
Peter van Marion	Powerhouse
Albert Jan Olijve	Stichting Veldleeuwerik
Marian Blom	Bionext
Hilko Ellen	Wageningen UR
Herman Schoorlemmer	Wageningen UR
Marcel van der Voort	Wageningen UR
Chris de Visser	Wageningen UR

Participants of the transnational stakeholder meeting in Athens

Name	Country	Organisation
Maria Ekonomou	Greece	Ministry of rural development and food
Demetres Briassoulis	Greece	Agricultural University of Athens
Athanasios Balafoutis	Greece	Agricultural University of Athens
Panagiotis Panagakis	Greece	Agricultural University of Athens
Fatima Baptista	Portugal	University of Evora
Luis Leopoldo Silva	Portugal	University of Evora
Miguel Neto	Portugal	Professor, Consultant and Services Company
Henning Eckel	Germany	Association for Technology and Structures in Agriculture (KTBL e.V.)
Claudia Lutsyuk	Germany	FNR
Andreas Meyer-Aurich	Germany	ATB Potsdam
Martijn Buijsse	Netherlands	Agrifirm
Herman Schoorlemmer	Netherlands	Wageningen UR
Chris de Visser	Netherlands	Wageningen UR
Bieńkowski Tomasz	Poland	Company: "Seed Central" Sp. z o.o.
Ewelina Olba-Zeity	Poland	University of Warmia and

		Mazury in Olsztyn
Janusz Golaszweski	Poland	University of Warmia and Mazury in Olsztyn
Ilpo Matila	Finland	MTK / COPA-COGECA
Hannu Mikola	Finland	University of Helsinki
David Tinker	UK	EurAgEng and External Advisory Board AGREE
Tommy Dalgaard	Denmark	Aarhus University, Department of Agroecology

Annex 2: Approach of Transnational Stakeholdermeeting

Date and Location: Tuesday, 4th of June, Athens
Participants: In total 19 participants and one facilitator. All 6 countries of AGREE participate with one or two project members and one or two participants of the national stakeholder meeting.
Goal of the meeting: Development of a solid base for a transnational R&D agenda to stimulate energy efficiency in agriculture. Results of the National Stakeholder Meetings will be important input for this transnational agenda.
Room: 18 chairs and tables in a U-form. Enough space outside the room to have parallel-discussions in 4 groups of 4-5 persons. Beamer and flip-over and pens available.
Preparations. All participants will receive the (concept) syntheses-report (deliverable 4.4) before the meeting in Athens. In this syntheses-report a proposal is given for 8 relevant topics to realize energy efficiency in agriculture.

Format of the meeting

Time	Topic of Agenda	Approach	Who	Material
From 9.30	Arrival	Doors open before start, to be sure that everyone is on time	Demetres	Café, tea available
10.00	Opening	Short explanation of goal of the meeting. Participants introduce themselves shortly and give a reaction on: European Agriculture ***is / is not*** Energy Efficient in 10 years because......	Herman	
10.25	Results of national stakeholder meetings	PPT presentation based on syntheses report. Resulting in 8 central topics. Space for informative questions (do we understand the bottleneck/opportunity. No discussion	Chris	PPT, beamer
10.50	Development of transnational R&D agenda round 1	4 groups of 4-5 persons work out parallel 4 topics of the Transnational research agenda. They write down the results on a flip-over conform following format: 1) How does this topic look like in 2040 (picture or key words) 2) What are the main R&D questions 3) What are arguments for international cooperation.	Herman 4 break-out groups	3 Flips
11.35	Development of transnational R&D agenda round 2	Idem with 4 new topics	4 new groups	3 Flips
12.20	Break			
12.35	Marketplace	Plenary: Stick the 8 flips of the 8 topics on the wall. Per topic a short presentation by one of the participants. Questions to clarify, short discussion, add new ideas	Herman, max 5 minutes per topic	
13.30	Priorities	Everyone is asked to give 6 votes to the most relevant R&D questions.	Herman	6 stickers p.p
13.45	Reflection	Plenary: What are general conclusions? What's missing? Are we satisfied?	Herman	
14.00	What's next	Short explanation about the next steps and dates to realise the transnational agenda	Chris	

14.15	Close	Last words and lunch together	Demetres