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Report



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RURASU Project

WP7.2 Study of Cost-Benefits for Rural DASUs

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Summary

The first task, implemented in the first 6 months of the Rurasu project, was to develop a specification for evaluating the cost-benefit ratio of Design Advice and Support units (DASUs). This was the D7.1 deliverable. It was agreed that this methodology should be followed for new DASUs and by existing DASUs unless they already had alternative evaluation procedures in place. In essence, the specification involves assessing the DASU according to criteria in three categories:

- **Quantifiable Energy, CO₂ and Cost Savings:** this can be done from a record of energy consultancies, advice and audits carried out by the DASU, together with an estimate of the cost of running the DASU. A template was suggested for recording the necessary information from the operation of the DASU.
- **Other Quantifiable Outcomes:** these include increasing public awareness (through local newsletters, media publicity etc), increasing professional awareness (workshops and seminars, training courses etc) and job creation.
- **Non-Quantifiable Outcomes:** of these, the most important outcome is considered to be that the DASU is perceived by its customers to be free, unbiased and independent. Other benefits should also be identified.

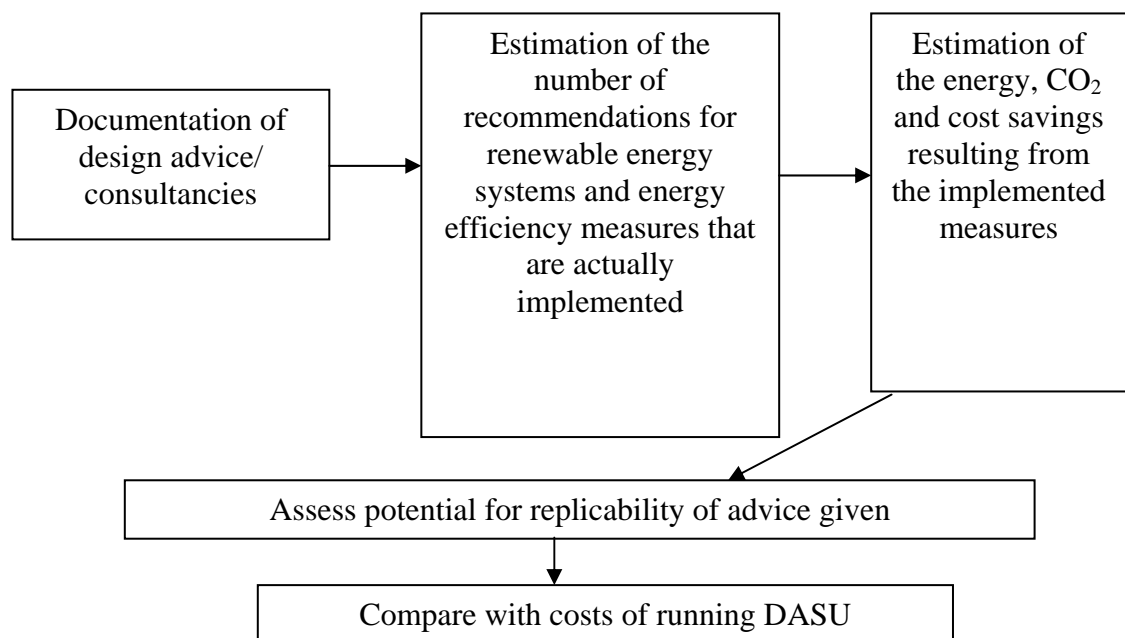
This report sets out the results of applying this methodology in detail to the Scottish rural DASU, the Energy Agency in Ayr. The full study, included as Appendix A, included an urban-based DASU (in Glasgow) to help ensure that the methodology was robust and to investigate the need for flexibility in some parts of the evaluation. Information on activities undertaken in the other Rurasu DASUs was also helpful in generalizing the procedures. Although the results of the analysis were very useful in quantifying the large energy, CO₂ and cost benefits of operational DASUs (and will be used by the Energy Agency in Ayr to help support the case for future funding), the full evaluation does require significant personnel and time resources. Nevertheless, it is believed that if the evaluation procedures are embedded when setting up DASUs in future, the resources required to undertake the cost benefit analysis should be manageable.

The results of shorter analyses undertaken by other DASUs within Rurasu are included in this report.

Methodology for Cost Benefit Analysis

A major study was carried out, focussing on the Scottish DASU, with a thorough evaluation of the costs and benefits against the criteria developed in D7.1. The study also included a shorter analysis of an urban-based DASU to provide a comparison in terms of activities and cost-benefits. The full study is included as Appendix A.

A summary of the main findings is given here. The overall methodology adopted is shown in the following figure:



The evaluation criteria used were subdivided into three categories:

- Quantifiable energy, carbon and cost savings
- Other quantifiable outcomes
- Non-quantifiable outcomes

These evaluation criteria were applied to the various DASU activities e.g. energy efficiency advice to households, business advice, and renewable initiatives.

Energy, carbon and cost savings can be obtained from an analysis of the advice and support undertaken by the advice centre. The analysis requires:

- Documentation of the advice to households, communities, small businesses, local authorities and other interest groups.

- Estimation of the number of recommendations that are actually implemented.
- Estimation of the energy, carbon and cost savings occurring from implemented recommendations.

Benefits in terms of energy savings can be presented as annual or cumulative savings - cumulative savings require assumptions on the lifetime of the installed measures and can take into account lifetime reductions.

Additionally there is also the potential for benefits from replication of the advice given.

- Neighbours and friends of householders, who implemented the recommendations for energy efficient or renewable systems, may also follow the same recommendations once they see the benefits.
- Communities who hear about successful renewable community projects may also install some renewable energy systems.
- Businesses who install measures to reduce high energy bills when they hear about other businesses that have done so after receiving an energy audit.

Ideally, there is a need to assess replication for each DASU. However, a survey undertaken in 2002 by New Perspectives showed that 33% of all respondents had told others outside their own household how to save energy, so this figure could be used in the absence of other information. Documentation of energy advice can be obtained by, for example:

- Number of phone logs
- Number of energy survey reports sent out
- Number of home visits
- Number of presentations and exhibitions + average number of attendees

Energy efficiency measures and renewable energy systems that are installed by customers with the help of a grant or loan scheme provided by the advice centre should be recorded.

For estimating the number of implemented recommendations made by the DASU, the following procedure can be adopted:

Step 1

Determine number of implemented energy efficiency measures and renewable energy systems, from:

- Grant and loan schemes for energy efficiency measures
- Loan schemes for businesses
- Grant schemes for renewable energy systems

Step 2

Estimate likelihood of uptake using a phone-based survey (using a questionnaire template) with a subset of advised customers:

- Recommended energy efficiency measures
- Recommended behavioural changes

Feedback forms issued to all advised clients could also be used - however, the experience of energy advice centres is that the response rate using feedback forms is poor.

$$\text{Energy Savings} = N * \sum_{i=1}^n (x_i * a_i)$$

Energy savings can be estimated from the following equation:
where N is number of customers advised, X_i is the estimated percentage of customers acting on a certain advice 'i' (installing certain measures 'i') and A_i is average energy savings associated with following the advice 'i' (installation of measure 'i'). Similar equations can be used for cost and CO₂ savings.

Savings can be estimated by the following two methods:

- **Method I - Detailed analysis:** This uses a different estimated percentage 'x' of customers acting on a certain advice 'i' dependent on the way the customer received energy advice.
- **Method II - Simplified analysis:** This uses a uniform percentage 'x' of customers acting on a certain advice 'i' estimated across all advised customers

Method 1 should give a qualitative better result. However, it will be rather time consuming. Both methods were compared in the study.

For estimating savings, a range of tools can be used – the choice will depend on the expertise of those carrying out the analysis and the availability. In the evaluation of the Scottish DASU, the following were used:

- EEC spreadsheet 2005-2008 – produced by Ofgem in UK to estimate annual energy and carbon savings associated with common energy efficiency measures (including a “comfort discount” of 30%)
- University of Strathclyde’s Energy Rating Tool (SERT) - calculates the annual energy use, running cost and CO₂ emissions for an individual dwelling or a number of dwellings for a package of energy efficiency measures (used for analysing South Ayrshire housing stock) – requires more detailed building information.
- University of Strathclyde’s Small Scale Renewable Energy Rating Tool - estimates the energy and CO₂ savings for different renewable energy systems depending on their size, location and other significant factors.
- Savings estimated for following behavioural advice (extracted from New Perspective’s research on ‘Savings from Behavioural Advice’)
- UK Department of Trade and Industry fuel price projections

Benefits in the form of energy, carbon and cost savings are estimated in terms of annual savings. Additionally, lifetime (cumulative) carbon savings are calculated for comparison with possible lifetime carbon savings identified using the Energy Saving Trust (EST) evaluation procedure. It is assumed that the annual savings are achieved constantly over the whole lifetime of each measure. A lifetime discount is not included. The cost-effectiveness of the DASU work is simply defined as the amount of money saved over the lifetime of the induced improvements compared with the costs associated with all DASU projects and activities.

Other quantifiable benefits fall into the following categories:

- Increasing householder awareness – exhibitions, presentations, school visits, newsletters, newspaper articles, TV, radio, website statistics

- Increasing business awareness – presentations, energy surveys, training courses
- Increasing local authority awareness – meetings, workshops
- Job creation

Regarding job creation, the jobs created due to renewable energy systems deployment and energy efficiency refurbishments are practically difficult to estimate. An assessment method was used based on the 4th HECA Progress Report of North Ayrshire Council (which is itself based on a case study on direct and indirect job creation published by the UK Energy Saving Trust in 1997). **It is estimated that one job is directly created for every £40,000 of investment, and another indirect job for every £70,000.** (Investment is defined as expenditure for installation of energy efficiency measures and renewable energy technologies – it only includes recorded installations undertaken with help of grant or loan schemes provided by the energy advice centre). Regarding other non-quantifiable benefits, one of the most important of these is that the DASU is perceived by its users to be **free, unbiased and independent.**

Other possible benefits include:

- General public and professional awareness of the importance of sustainable energy use and supply
- The promotion of best practice throughout the region
- Abatement of fuel poverty
- Increased awareness of new legislations amongst professionals
- Development of local climate change strategies and action plans

Some of these benefits result from the work of all energy advice centres and cannot be identified individually. However, they are worth recording.

Application of Cost Benefit Analysis to Scottish DASU

The report in Appendix A covers the above methodology in detail, together with its application to the Scottish DASU for the financial year 2005-6, using the following records provided by the Energy Agency:

- Records on customers who installed energy efficiency measures with the help of a local grants scheme.
- Records on installations of renewable systems by households and communities with the help of a SCHRI grant.
- Records on the total number of customers advised (including the form in which energy advice was received).
- Records on all performed activities (presentations, information forums, school visits, press releases etc.).

A simple questionnaire was designed and used in a phone survey to capture information about

- the customer property
- the uptake of recommendations
- planned improvements
- helpfulness of the advice given

The survey consisted of 20 interviews with people who had received energy advice in a variety of ways. Estimations were made for 3 main groups of advised customers who had received advice (as previous UK surveys have shown that the rate of uptakes depends on the form in which energy advice is received).

The 3 groups were:

- **Group A:** Customers who received a home energy report or a home visit
- **Group B:** Customers who phoned the energy agency
- **Group C:** Customers who received advice at presentations and information stands

Annual savings from installed measures were estimated as in the following table:

	Number of installations	Annual energy savings (MWh/a)	Annual carbon savings (tC/a)	Annual cost savings (£/a)
Virgin loft insulation	189	1391	90.2	33437
Top-up loft insulation	46	104	6.6	2200
Cavity wall insulation	219	935	52.3	19055
Water tank insulation	16	10	0.6	247
Condensing boiler	146	400	20.8	8018
Total	616	2840	170.5	62957

Estimated uptake rates in % for different recommendations are given in the following table:

	Group A	Group B	Group C	Average across all 3 groups
Installation of				
Loft insulation (top-up)	8.3	6.6	1.8	4.5
Loft insulation (virgin)	3.4	1	1	1
Cavity wall insulation	6.6	3.4	3.6	4.5
Condensing boiler	3.4	6.6	1.8	3
Low energy light bulbs	33	33	73	55
Energy efficient appliances	1	1	9	5
Heating control	1	1	4.5	2.5
Draught proofing	9	1	1	2.5
Following advice on				
Cooking/appliances	1	1	27	15
Heating/hot water	33	33	18	25
Lighting	17	66	36	35
Others	17	1	9	10

Annual savings based on customer survey outcomes were estimated as:

	Annual energy savings (MWh/a)	Annual carbon savings (tC/a)	Annual cost savings (£/a)
All installations			
Scenario I	6067	330	145712
Scenario II	5198	288	135379
All behavioural changes			
Scenario I	3756	260	153213
Scenario II	3446	240	139746
Total			
Scenario I	9832	590	298925
Scenario II	8644	528	275125

In the previous table, the scenarios were as follows:

Scenario I: Benefits are calculated for each main group of customers advised using the differing uptake rates.

Scenario II: Benefits are calculated for total number of customers advised using the average uptake rate estimated across the 3 groups.

The conclusion was reached that differences are not great, and therefore average uptake rates can be used.

Annual savings from community renewable energy projects were calculated as:

	Annual energy savings (MWh/a)	Annual carbon savings (tC/a)	Annual cost savings (£/a)
6kW turbine Largs	6.2	0.7	490
50kW turbine Gatehouse	111.7	13.1	8760
45kW wood pellet boiler	-	15.9	3175
17kW heat pump *	26.6	3.1	1492
Total	144.6	32.8	13917

* plus loft insulation

Annual savings from household renewable projects were calculated as:

	Annual energy savings (MWh/a)	Annual carbon savings (tC/a)	Annual cost savings (£/a)
18 Solar heating systems	15.1	1.0	303
17 GSHP systems	599.8	35.4	1484
2 Biomass systems	none	5.8	1249
2 Wind turbines	11.7	1.4	915
Total	626.6	43.6	3951

Other quantifiable outcomes were documented. For example, for increasing householder awareness the number of public presentations and information forums were recorded as shown in the following table. Similarly, details were tabulated for: number of school presentations; number of press releases, articles and adverts; number of staff training for local businesses; local authority support (meetings, information sessions ...).

	Total number of presentations	Average number of attendees
EE Presentations in day hospitals	12	12
EE Presentations to community groups	6	35
EE Exhibitions/information forums	16	81
Presentations to private landlords	2	48
Presentations on renewable energy	2	47
Renewable energy fair	1	600

Regarding employment, it was assumed (as mentioned in the previous section) that 1 job is directly created for every £40,000 of investment, plus 1 indirect job for every

£70,000. Based on the following expenditure for documented installation works of energy efficiency and renewable systems:

- £539,446 for installation of insulation and heating measures
- £318,905 for community renewable projects
- £316,360 for household renewable projects

Expenditure (£)	Direct jobs created	Indirect jobs created	Total jobs created
1,174,711	29	16	45

Costs were provided by the Energy Agency directly and by the UK Energy Saving Trust for householder renewable energy projects.

In terms of the overall analysis of the Scottish DASU, the following conclusions were drawn:

Annual Energy Saving potential (across all evaluated activities)

- energy efficiency installations: 11,484 MWh
- renewable energy projects: 771 MWh

Annual Cost Savings for customers: £355,950

- The cost savings correspond to lifetime energy savings of £6,736,266

Annual Reduction in Carbon Emissions: 775 tonnes

- The carbon savings correspond to 17,103 tonnes over the lifetime of the installed energy saving measures.

Considering the complete funding income of the Energy Agency, it could be concluded that:

For each £1 of government funding, energy savings worth £23.23 are generated

This is based on direct energy savings through energy efficiency and renewable energy advice and support.

Benefits not included in this analysis are:

- Any savings achieved through replication of the advice
- Possible savings resulting from the work with local authorities
- Any savings achieved through improving the energy consciousness of school children

- Any savings achieved through staff training presentations

Additional benefits from the operation of the DASU are a general increase in public awareness towards reducing energy demand and creation of 45 potential jobs in the region.

Spanish DASU

The procedure was followed by the Spanish DASU, as reported in Appendix B. They created a database which logged all consultancies undertaken, together with the information required to undertake the cost-benefit analysis.

In the case of the Spanish DASU, the following savings were calculated.

Type of measure:	No	INVESTMENT		SAVINGS			
		Power (kW):	Cost (€):	Final Energy (kWh/year)	Primary Energy (kWh/year)	Economics (€/year)	CO ₂ (ton/year)
Heating system replacement	1	127	74,757	12,570	32,661	1,099	8.16
Change of oil for heating	10	1,833	245,062	1,758,778	1,896,818	103,577	504.13
Solar hot water	5	-	32,726	38,473	97,211	3,284	24.20
Photovoltaic system	19	58,286	12,093,712	2,953,249	7,673,722	258,347	1,916.66
HVAC replacement	1	-	2,915	3,624	9,416	317	2.35
Lighting change	10	-	49,884	87,932	228,485	7,692	57.07
Insulation in buildings	1	-	7,955	31,188	81,041	2,728	20.24
TOTAL	47	60,246	12,507,013	4,885,816	10,019,357	377,046	2,532.81

The report in Appendix B also contains information on a customer survey and an analysis of jobs created in the first year of operation, based on the same figures as used in the Scottish DASU analysis, in the absence of alternative data. The other assumptions made were:

- The investment cost of P-V systems will not be taken into consideration.
- The rest of the investment cost is multiplied by a factor of 0.5 (i.e. assuming that only 50% of the proposed measures will be realised).

This analysis results in an estimate of the creation of **2 direct jobs** and **3 indirect jobs**.

German and Greek DASUs

Inputs from these two well-established DASUs were included in the evaluation procedure described in this report. In particular the various quantifiable and non-quantifiable activities of the DASUs were included. They are also elaborated in detail in Deliverable 2.2 – the report on the specification of the German and Greek DASUs. In view of the fact that these DASUs already had their own evaluation procedures in place, they did not apply the procedures recommended in this report, which are intended for new DASUs.

In particular, it is worth re-emphasizing the impact that the German DASU, EZA, had on the implementation for solar thermal systems in the region it covers. From 2000 to 2004, EZA conducted more than 2,300 energy consultations referring to the utilisation of solar heat for process water and heating. For the Allgäu region, statistical figures show distinctively more implementations of thermal solar power compared to Bavarian and German averages. The results show that the utilisation of thermal solar power is higher in the Allgäu compared to the Bavarian and German average. In order to assess the success of EZA it is estimated that – without EZA – a mean utilisation of thermal solar power according to the Bavarian average would be the result. The additional investments are attributed to the intensive consultation activities and PR-work of EZA. For example, on average 57 € were spent for thermal solar power per capita in Bavaria from 2001 to 2004. Consequently, for the Allgäu, a theoretical amount to be invested of 35 Million € can be calculated from the given Bavarian average. However, the effective amount to be invested was 53 Million € within the regarded time span. Thus, EZA triggered additional investments of about 18 Million €

Also, in Germany, the number of consultations has steadily increased, as shown in Appendix C, with new figures of 3300 consultancies undertaken via the 40 consultation offices in the Allgäu region. This is indicative of the success of the rural DASU over a significant number of years.

Concerning the Greek DASU and RURASU project they have been analyzed the results of pre-consultations in accordance to the given methodology. Due to lack of information it was not possible to have absolute values of buildings energy consumption and therefore of the possible energy conservation or production.

In the case of the Greek DASU and RURASU project, the following savings were calculated.

Type of measure:	No.	Estimated initial cost (€)
Heating system replacement	3	19,000
Solar hot water	4	31,200
Installed photovoltaic system	1	3,600
Expressed of willing to install photovoltaic systems	5	30,000
Installation of heat exchanger	1	8,000
Lamp replacement	4	4,060
Additional building skin insulation	6	120,550
Low U-value fenestration	10	105,800
Low U-value glazing and / or low emissivity glazing	7	6,800
TOTAL	41	329,010

The analysis results to the creation of **5 direct** and **3 indirect** jobs. The following assumptions have been taken into account:

- The investment cost for P-V systems have not be taken into consideration.
- 1 direct job is created by £40.000 (approximately 60.000 €) and
- 1 indirect job is created by £70.000 (100.000 €)

Conclusions

From the detailed analysis carried out on the Scottish rural DASU (as well as the urban DASU included in the Appendix B report) and the shorter analyses carried out in the other DASUs, it is clear that the benefits far outweigh the costs. Therefore, large scale replication of the DASUs throughout Europe should have significant benefits in terms of energy, carbon and cost savings.

What is less clear is the financial model for creation of DASUs – national or local financial support is certainly needed to underpin the operation of the DASUs in order for the benefits to accrue to the local population; it is unlikely that significant numbers of householders would be prepared to pay for energy advice. The experience of the Scottish DASU also highlights the clear correlation between energy prices and public interest in energy efficiency and renewable energy. When prices rise drastically, as they did in the course of the Rurasu project, there is a large surge in public attendance at energy-related events; this interest appears to diminish as energy prices start to decrease again.

From the success of existing DASUs, particularly EZA in Germany, it seems to be necessary for them to engage in a large range of activities, including consultations, media work, and training courses for architects, engineers and installers. However, there is also a need for grant schemes for new and renewable energy technologies, and support, both financial and political, for the operation of the DASU. Financial support will be even more important in newer countries in the EU.

The main conclusion from this study is that DASUs offer a highly cost effective way of improving energy efficiency and increasing the uptake of low carbon technologies at a local level.

Appendices

A: Evaluation of Scottish DASU.

B: Evaluation of Spanish DASU

C: Annual Consultancies undertaken by the German DASU