Contents

List of Figures and Tables

1 Introduction

1.0 Background

The UK government and the European Union have targets for the wider contribution of renewable energy (RE) sources to the energy mix by 2010 and 2020. The national targets are apportioned on a regional basis, and the South East England Regional Assembly's (SEERA) 2002 strategy document entitled 'Harnessing the Elements'[1] (**Appendix A**) details the targets for the South East of England (SE) and its four sub-regions (see Tables 1:I and 1:II), yet there is in the UK at present no standard information source for regional-level data on RE installations and their combined contribution to achieving regional targets.

In parallel, there is budding interest at the political,[2] non-governmental organisation[3] and academic[4] levels in the current and potential impact of RE on the socio-economic sphere. Studies have very recently started to be carried out in the SE region to provide comprehensive statistics and better quality information in this field. Their analysis and dissemination is seen as essential for improving the public and legislative perception of renewables,[5] and for generating a better understanding of the effects of commercial and political decisions in both individual RE projects and promotional strategy. There is a need to communicate a selection of the socio-economic findings for the SE alongside 'hard' data. The SEERA document also emphasises this issue, noting that "Clear synergies exist between the development of renewable energy sources and other objectives including rural development (particularly biomass), economic development (opportunities for new markets, industries and employment) and improving the quality of built environment and urban renaissance (energy efficiency as part of high quality design)."[6]

Year/ timescale	**Installed Capacity (MW)**	**% Electricity Generation Capacity**
2010	**620**	**5.5**
2016	**895**	**8.0**
2026	**1750**	**16.0**

Table 1:I: Minimum regional targets for electricity generation from renewable sources[7]

The Government Office for the South East (GOSE), on behalf of SEERA, is funding a proposal[8] (see **Appendix B1**) by the Thames Valley renewable energy agency, TV

[1] **South East England Regional Assembly (2003)**
[2] E.g. **FES (December 1999)**,
[3] E.g. **IEA Bioenergy Task 29 (2003)**
[4] E.g. **Stavroulia, H. (2003)**
[5] See Reading Area Study 2003 & Osney Island Residential Survey 2002 in **TV Energy (2003a)**
[6] **SEERA (2003)**, p. 9, §1.12
[7] Table reproduced from **SEERA (2003)**, p. 7, §EN4

Energy, to produce such a monitoring and communication system for the region, which may become an exemplar for the rest of the country. The South East of England Development Agency (SEEDA) has secured the position of 'lead region' in England for renewable energy[9] and therefore has an interest in contributing to the initiative in the future.

Preparations for the initiative, later re-named 'South East England Renewable Energy Statistics' (SEE-Stats), started in March 2003 and the full project is due for completion in January 2004. Two TV Energy staff, including the managing director, are involved in co-ordinating the project, and have deployed this MSc student to effect its development from 6th May 2003.

Sub-region	2010 Renewable Energy Target (MW)	2016 Renewable Energy Target (MW)
Thames Valley and Surrey	140	209
East Sussex and West Sussex	57	68
Hampshire and Isle of Wight	115	122
Kent	111	154

Table 1:II: Sub-regional targets for land-based renewable energy[10]

1.1 Aims and objectives

1.1.0 Aim

The overall aim of the MSc. project was to contribute substantially towards the development of SEE-Stats, the planned statistical information system on RES generation schemes and their socio-economic impacts, in order to facilitate the monitoring of SE England's regional renewable energy targets.

1.1.1 Specific objectives

1) To collect and communicate data on regional renewable energy installations and their socio-economic benefits for the Thames Valley and Surrey sub-region, in the form of a web-based map-database-statistics system.

2) To develop the system to a skeleton stage for the entire South East of England, allowing for the subsequent addition of data for the rest of the region and the ongoing updating of the data for each sub-region.

3) To formulate and apply a consistent methodology which will ensure that the display of the statistics would be both useful and accessible for its target users, and convenient to update and extend for its hosts, whilst upholding a technical rigour and accuracy.

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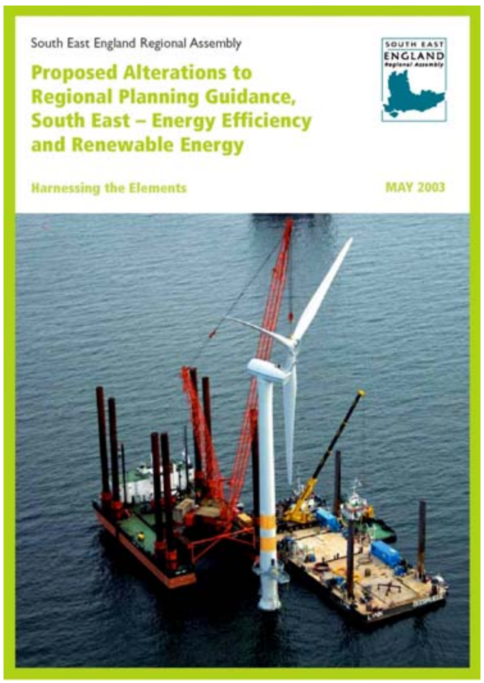
8 **Richards, K.R. (2003)**
9 **Richards, K.R. (May 2003)**, personal communication
10 Table reproduced from **SEERA (2003)**, p. 15, §EN5

4) To establish strong linkage with the UK national renewable energy statistics initiative, RESTATS[11] (and hence those of the IEA and the EU's Eurostat) and the work of IEA Bioenergy Task 29: Socio-economic aspects of bioenergy systems.[12]

5) To have a simple, offline prototype map/database/statistics system for presentation and feedback opportunities at the IEA Task 29 Bioenergy meeting[13] on 18th June and a working online version by September 2003.

Figure 1 'Harnessing the Elements', the SEERA renewable energy strategy document



1.2 Structure of report

The main body of this report falls into three sections, namely:

> **Section 2** – A review of renewable energy statistics systems similar to the SEE-Stats concept;
> **Section 3** – A detailed account of the process and method involved in arriving at the final system;
> **Section 4** – A discussion of the achievements and recommendations for improvement.

The several work areas of the SEE-Stats proposal were seen to coalesce into four key themes: the methodology to be applied to the data, the content of the database itself, the display of the data (i.e. the website), and the process of data collection. The way the main chapters is sub-divided reflects these themes.

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[11] **DTI/Eurostat/Future Energy Solutions (2002a)**
[12] **International Energy Agency/Energy Institute Hrvoje Požar (2001)**
[13] **TV Energy (2003b)**, §7

The final section summarises the main conclusions to be drawn from the study project.

2 Review of existing RE statistics systems

2.0 Review of existing RE statistics systems

2.0.0 Existing RE statistics and database systems

The sources of guidance for this project included the general briefing given in the initial 'MonSERT' proposal[14] (**Appendix B1**); ongoing advice and preferences expressed by TV Energy and the commissioning regional government bodies; suggestions and feedback from external interested sources (see **Section 3**); and original thinking in line with the principles of regional specificity, a 'bottom-up' approach and user accessibility.

In addition, it was decided to obtain input by determining current practice in terms of both content and presentation. Consequently information was gathered on the surprisingly few existing systems used to communicate renewable energy data to the public, both publications and websites, particularly those which most resemble the one being developed. Special attention was given to systems on the internet, this being the selected medium for the public face of SEE-Stats. For some aspects this research was an ongoing activity, particularly for methodological considerations which were highly dependent on continuous database decisions and receipt of new information.

The overriding observation arising from this review of English-language initiatives concerns the lower than expected frequency of map-database-statistics systems. International bodies, industry associations, pressure groups, energy agencies, and national, regional and local government have not preferred this option for publicising renewable energy information. The three approaches that SEE-Stats was developed to integrate (see again **Appendix B1**) – GIS/maps, individual project listings and overall national/regional statistics – are generally applied strictly separately. Combinations of pairs of these are however found, and those sites were given attention as being the most relevant to the project. All this appears to underline the pioneering nature of the present initiative.

The publications surveyed were as follows:

1. British Biogen 'UK Biomass Electricity Plants' website[15]

2. BWEA (British Wind Energy Association) website:

- **a. 'Operating Wind farms'**[16]
- **b. 'Wind farms of the UK – At a glance…'**[17]

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[14] **Richards, K.R. (2003)**
[15] **British Biogen (2001)**
[16] **British Wind Energy Association (2003a)**
[17] **British Wind Energy Association (2003b)**

3. RESTATS (Renewable Energy Statistics Database for the United Kingdom)[18]
4. Oberösterreichischer Energiesparverband (Upper Austria Energy Conservation Agency) website[19]
5. IEA Renewables Information Database[20]
6. EurObserv'ER 'European Barometer of Renewable Energy Sources' report[21]
7. EC DG-TREN 'The Impact of Renewables on Employment & Economic Growth' report[22]
8. Nevada AFL-CIO 'Renewable Energy Labor Calculator' initiative

2.0.1 Review of other UK regions

A brief web search for the RE strategies and resources of the governments of other English regions and UK devolved countries revealed that no significant database or statistics initiatives are yet in place in this country. Only one other appears to be planned already, namely a RE database for Scotland. A brief description of the findings is to be found in **Appendix C1**.

2.1 Review of systems – Database

2.1.0 Data

In order to gain input for SEE-Stats, attention was paid when surveying existing statistics systems to the type of data they regarded as important to publish. It is obvious how the vast majority of the systems listed fall into one of two groups: project listings or gross statistics.

The 18 data fields already included in the SEE-Stats prototype design by TV Energy before May 2003 are shown in Table 2:I. It was also intended to assess the extent of their presence in other database and statistics publications.

Project information	Technical information	Environmental & socio-economic information
Project name	Equipment supplier	Jobs created/sustained (Directly)
Owner	Technology	Jobs created/sustained (Indirectly)
Address	Current installed capacity (kW_e, kW_{th})	Financial benefits
Grid reference	Declared Net Capacity (kW_e)	Likely fossil fuel alternative
	Fuel (if applicable)	Est. annual CO_2 emissions displaced
	Operational since	Equivalent no. of homes (electricity)
	Supplying energy to (Elec.)	

[18] **DTI/Eurostat/Future Energy Solutions (2002)**
[19] **Nevada AFL-CIO (2002)**
[20] **International Energy Agency (2002a**
[21] **EurObserv'ER (2001)**
[22] **EC DG-TREN *et al* (2000)**

Supplying energy to (Heat)

Table 2:I: Original data fields as at 6th May 2003

2.1.1 Data – British Biogen 'UK Biomass Electricity Plants'

The list of data covered was limited, including only Project name, Location and county, Installed capacity (MW) and Fuel type and Fuel origin. These basic data had already been envisaged for SEE-Stats, with the last two potentially combined in the 'Fuel' field.

2.1.2 Data – BWEA website

2.1.2a BWEA 'Operating Wind farms' database

This database, recording all (at the time of writing) 82 UK grid-connected wind generation schemes, was highly extensive in terms of the range of the data provided. The data fields comprised Month and year online, Wind farm name, Location, Manufacturer, Rating (kW), Number of turbines, Project capacity (MW), Annual homes equivalent supplied, Operator name, Contract type (NFFO etc.), °Latitude and °longitude. With only one exception (contract type e.g. Non-Fossil Fuel Obligation, Northern Ireland NFFO, Scottish Renewables Obligation, Renewables Obligation Certificate), these correspond closely to the existing SEE-Stats installation and technical data. The choice of longitude and latitude over Ordnance Survey (OS) grid reference is another minor difference between the two. No. of turbines potentially corresponds to the SEE-Stats 'Technology' field.

Further highly detailed project-specific data is provided for 4 selected projects: Turbine and Rating (kW), No. of turbines, Installed Capacity (MW), Precise location, County, Owner name, Operator name, Developer name, Construction started month/year, Month/year commissioned, Electricity output p.a. (GWh), No. of homes equivalent, CO_2 displacement p.a. (tonnes), SO_2 displacement p.a. (tonnes), NO_X displacement p.a. (tonnes), Electricity supplied to (e.g. national grid), Renewables Order, Energy payback period (), History (month/year planning consent obtained), Visitor centre (yes/no), Information board (yes/no), Site access (yes/no), Parking (yes/no, location), Recommended viewing point, Hub height (m), Rotor diameter (m), No. of blades, RPM, Weight of turbine (tonnes), Land use/type (e.g. industrial, agricultural), Site altitude (m above sea level), Average wind speed (ms^{-1}), Site density (m between turbines), Special features (e.g. first UK semi-offshore, viewing platform). Most of these details are not seen in the original SEE-Stats suggestions. As with the database, there is no explicit information on economics (e.g. costs, jobs).

2.1.2b BWEA 'Wind farms of the UK – At a glance…' statistics

This useful summary of national wind projects statistics complements the previous database and is of interest in its additional provision of certain socio-environmental data fields. The information given is No. of projects, No. of turbines, Installed capacity (MW), Annual energy generation (TWh), Homes equivalent supplied, Annual CO_2 reductions (t), Annual SO_2 reductions (t), Annual NO_X reductions (t). The last two correspond directly to two of the original SEE-Stats social and environmental data fields. As before, there is no economic element.

2.1.3 Data – RESTATS

RESTATS, being a statistics publication system, does not publish its database. As the website explains, "Due to the confidential nature of the data only aggregated results are made available".[23] However, the following minimum data fields are inferred from the statistics published in RESTATS: Project name & contact details, Electrical generating capacity (MW), Thermal generating capacity (MW), Electrical Declared Net Capacity (MW), NFFO etc. contract type, Annual electrical energy output (toe and GWh), Annual thermal energy output (toe and GWh), Country of location, Region of location, Renewable energy type. As expected, these data fields correspond closely to many of the suggested SEE-Stats installation and technical details. There is no socio-economic or environmental element.

2.1.4 Data – O Ö Energiesparverband website

The statistical information on this website is derived from the regional agency's records of Collector area (solar thermal m^2), Estimated annual energy output (solar thermal estimated kWh), Installed capacity (PV: kW_p, Woodchip & pellet central heating/Biomass district heating/Geothermal district heating installed capacity: kW), No. turbines (wind), Turbine rating (wind), Date of commissioning (month/year).

2.1.5 Data – IEA Renewables Information Database[24]

This is a database of renewable energy statistics by country and world region, as opposed to a database of projects. Historical data was given for 1990–2001 and estimated for 2002. The data fields for each country behind the aggregated information it provides are as follows.

2.1.5a Energy supply, GDP and Population

Total primary energy supply (Mtoe), Primary supply from renewable sources (Mtoe), GDP (1995 US$bil), Population (millions), Total annual electricity output (TWh), Annual electricity output from renewable sources (TWh).

2.1.5b 'Gross electricity and heat generation from renewable sources'

For All renewables, Hydro and Geothermal separately: Annual electrical output from electric-only plants (All renewables, Hydro, Pumped storage; GWh), Annual electrical output from CHP plants (All renewables, GWh), Annual heat output from heat-only plants (All renewables, Geothermal; TJ).

2.1.5c 'Net generating capacity of renewable and waste products'

Net capacity (Hydro, Pumped storage, geothermal, Solar PV, Solar thermal, Tide/wave, wind, Industrial waste (non-renewable), Municipal waste, solid biomass, Gas from solid biomass, Non-specified renewables; MW), Accumulated solar panel area (Solar PV, Solar thermal; 1000 m^2).

2.1.5d Primary energy supply, Transformation and Final consumption of renewable products

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[23] **DTI/Eurostat/Future Energy Solutions (2002b)**
[24] **IEA (2002a)**

(Geothermal, Solar thermal, Industrial waste, Renewable municipal waste, Non-renewable municipal waste; TJ)

The selection of these statistics confirms the importance of economic information, installed capacity and energy output figures. It could provide ideas for the presentation of the SE England regional statistics.

2.1.6 Data – EurObserv'ER 'European Barometer of Renewable Energy Sources'

Another statistics vehicle, as opposed to a database, the data provided here by country are Installed electrical capacity (Wind, Hydro, Geothermal, Solar PV grid-connected, PV off-grid; historical: two of 1998–2001, projected: two of 2003, 2005 & 2010; MW or MW_p), White Paper objectives for installed capacity (Wind, Biofuels, Hydro, Geothermal, Solar PV, Solar thermal, Biogas, Energy from wood; 2003 & 2010 or 2005 & 2010), Annual production (Ethanol, Biodiesel, Biogas, Energy from wood; 1992–2000; tonnes or toe), Potential new capacity (Hydro; MW), Installed thermal energy capacity (Geothermal; 1997, 2000; MW_{th}) Annual thermal energy production (Geothermal; 1997, 2000; GWh), Collector area (Solar thermal; historical 1999 & 2000, projected: 2003 & 2010; m^2), Gross renewable energy consumption (Various technologies; historical 1995 & 2000, White Paper projection 2010; Mtoe), Renewable energy electricity output (Various technologies; historical 1995 & 2000, White Paper projection 2010; TWh). Again, these are interesting for the regional statistics aspect of SEE-Stats, and confirm that installed capacity and annual output are key data. Collector area is seen again for active solar thermal energy, and biofuels production is included.

2.1.7 Data – EC DG-TREN 'The Impact of Renewables on Employment & Economic Growth'

This report on the EU-wide economic potential of renewables predicts Capacity (GW), Energy output (TWh), Total final energy demand (TWh), Impact on employment (Various renewables technologies; New net jobs relative to 1995), Direct/indirect/subsidy impacts on employment (Major industrial sectors; New jobs relative to 1995). The report underlines the potential of renewables for job creation and the importance of measuring direct and indirect jobs dependent on RE.

2.1.8 Data – Nevada AFL-CIO 'Renewable Energy Labor Calculator'

Strictly this RE jobs calculator belongs to the methodology, but the user data inputs are: Total energy retail sales (MWh), RPS requirement (% of retail sales), RPS generation requirement (MWh/yr), Proportions of mix of RE technologies (Wind, PV, Biomass co-firing, geothermal; %), Capacity factors of RE technologies (-), Proportion of co-firing (%), Time per full-time employment FTE (h), Annual retail sales growth rate (%). The calculator outputs are Manufacturing jobs (FTE), Installation jobs (FTE), Operation and maintenance jobs (FTE), Cost offset (from unemployment; Cost saved $/FTE, No. jobs FTE, Total value of jobs $, Total cost offset $/kWh). These highly specialised data are not foreseen for the initial phase of SEE-Stats, but it is interesting to note the large-scale economic potential of renewables in this US proposed jobs calculator.

2.2 Review of systems – Methodology

2.2.0 Methodologies

The determination of the relevant methodology used from statistical publications and websites was not normally possible due to non-disclosure by their authors. This was predictable given the usual practice of publishing only user-friendly information (especially internet-based information), and retaining the background assumptions and calculations within the organisation. Notable exceptions included the BWEA website,[25] which explains the assumptions used in its calculations of energy output and greenhouse gas emissions. Its reasons for doing so are firstly in the interest of public education which is clearly one of the primary aims of that site, and also for a second, undeclared reason that their emissions calculation is based on such an unorthodox – and not widely accepted – method that the process behind the resulting figures rightly demands elucidation.

The other exceptions are the IEA Renewables Information Database and RESTATS (the UK Renewable Energy Statistics database run for the DTI). For the former, the information is limited to definitions and has less relevance to this project. For the latter, this was due not to general publication of its methodology but rather to the close co-operation existing between its management and the SEE-Stats management, and the conscious project objective of linking the two systems so far as practicality and appropriateness allow. To this end meetings were held on 18th March (see **Appendix B2** for notes from the meeting by Dr Richards of TV Energy: the MSc project was not yet involved) and 29th July, 2003 with the RESTATS co-ordinator Dr Steve Dagnall of Future Energy Solutions (FES, formerly ETSU), who run the initiative for the Department of Trade and Industry.

Finally there is also the renewable energy jobs calculator from the Nevada's trade union association AFL-CIO, which however, as mentioned before, is based on very large-scale renewable generation in the US and as such is unsuited to the current situation in SE England.

2.2.1 Methodologies – British Biogen 'UK Biomass Electricity Plants'

No methodology is mentioned because the data provided is straightforward enough not to require it.

2.2.2 Methodologies – BWEA website[26]

Annual electricity output generated is calculated from the installed power rated using a 30% capacity factor as follows:

Output MWh = rating kW × 0.3 × 8760h ÷ 1000

Tonnes of CO_2 displaced by the output of wind turbines is found by multiplying output by the following emissions factors:

[25] **BWEA (2003c)**
[26] **BWEA (2003c)**

860 gCO_2/kWh ; 10 gCO_2/kWh ; 3 gNO_X/kWh .
This CO_2 factor is very interesting, as BWEA explain their use of a high emissions factor by claiming that wind power replaces not the low-emission, nuclear and gas powered electricity 'base load', but exclusively the highly polluting coal plants which are the most flexible plant type. This practice is not met elsewhere in the field of emissions displacement calculation and was treated with scepticism, since it is out of step with conventional practice (for example the official Action Energy emissions factors[27]) and is of dubious validity (since it is never so easy to say precisely which generation technology replaces which).

2.2.3 Methodologies – RESTATS[28, 29]

2.2.3a Declared Net Capacity

This is described by RESTATS as the "nominal maximum capability of a generating set to supply electricity to consumers"[30] and is defined by:

DNC kW = (name plate capacity × B) – in-house load

Name plate capacity is the rated capacity, e.g. kW peak or turbine rating, in-house load is the operational electricity demand of the generator itself, and B is a factor equivalent to capacity factor which RESTATS assigns to the various RE technologies as per Table 2:II:

B	RESOURCE
0.43	Wind
0.17	Solar
0.33	Tidal/Wave
1.00	All Others

Table 2:II RESTATS B factors for calculating output[31]

DNC is used for intermittent renewable sources instead of rated capacity when compiling installed capacity figures, to obtain a degree of comparability with 'non-intermittent' energy sources such as biomass power plants.

2.2.3b Energy output

Energy generated is calculated for the various resources as follows and converted to units of tonnes of oil equivalent (toe):

Active solar thermal hot water[32] – Assumed average $4m^2$ area; assumed energy output 1.2 MWh/y (new systems), 0.9 MWh/y (old systems); estimated number of systems.

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[27] **Action Energy (2003)**,
[28] **DTI/Eurostat/Future Energy Solutions (2002c)**
[29] **Future Energy Solutions (2000)**
[30] **DTI/Eurostat/FES (2002c)**
[31] Table reproduced from **DTI/Eurostat/FES (2002c)**
[32] **FES (2000)**, p. 3

Solar PV[33] – Estimated from records of installation numbers, individual output and the likely annual growth rate. No detail is given on calculation of outputs from peak power rating.

Wind[34] – Effectively calculated by the formula using a DNC-linked equivalent year-round capacity factor of 25%:

Output MWh = DNC MW × 0.25 × 8760h

This effectively uses a coefficient of 0.43×0.25 = ~0.1 compared to the coefficient of 0.3 preferred by BWEA.

Wave[35] – No methodological information given (no installations).

Small hydro[36] – A capacity factor of 0.55 was used but different figures were applied for previous years, based on differential rainfall records. Effectively,

Output MWh = capacity MW × 0.55 × 8760h

Geothermal aquifers[37] – Just one project provided the figures used. Energy generated was found using a capacity factor of 50% as follows:

Output MWh = (capacity kW + heat pump contribution kW) × 0.5 × 8760h ÷ 1000

Sewage sludge anaerobic digestion[38] – Thermal and electrical output (MWh) was obtained directly.

Wood combustion (domestic)[39] – Based on an estimate of mass of wet wood fuel used and assumptions on moisture content (50%), energy content (19 GJ/dry tonne).

Wood combustion (industrial)[40] – Thermal output (MWh) figures were used where available; otherwise effectively used

Output MWh = boiler rating kW × capacity factor × 8760h ÷ 1000

If the capacity factor is unknown, RESTATS uses ~91%. For sites not returning generation data (36%), the data from other generators was scaled up to account for them.

There are further resources covered by RESTATS which do not feature in the immediate scope of SEE-Stats. The above methodology is of some interest for SEE-Stats, although there is a large degree of on the one hand direct obtainment of energy output figures for schemes and on the other broad estimates for smaller schemes. These were not foreseen to be the chief avenues for SEE-Stats, due to a lack of monitoring for the predominant smaller schemes and the bottom-up, project-based approach which discourages blanket estimates.

2.2.4 Methodologies – O Ö Energiesparverband website

No methodological considerations behind the statistics are provided.

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[33] **FES (2000)**, p. 4
[34] **FES (2000)**, pp. 5–6
[35] **FES (2000)**, p. 7
[36] **FES (2000)**, p. 8
[37] **FES (2000)**, p. 9
[38] **FES (2000)**, p. 11
[39] **FES (2000)**, p. 12
[40] **FES (2000)**, p. 13

2.2.5 Methodologies – IEA 'Renewables Information'[41]

The methodology used here is not helpful for SEE-Stats since it is applicable to large-scale data collection from industrial generators, as opposed to providing methods useful to SEE-Stats, for example for calculating energy output, emissions displaced etc.

2.2.6 Methodologies – EurObserv'ER report

No methodological considerations behind the statistics are provided.

2.2.7 Methodologies – EC DG-TREN report

No methodological considerations behind the statistics are provided.

2.2.8 Methodologies – Nevada AFL-CIO 'Renewable Energy Labour'

The methodology is probably suited to a large-scale RE industry of greater maturity than the SE of England, being based largely on high-capacity wind farms and biomass co-firing on a scale seen in certain US states but not in the SEE-Stats region. The statistical sensitivities of a nascent sector based on a handful of sites are lost in the course of the calculations of 10-year job creation and cost offsetting.

2.3 Review of systems – Website design

2.3.0 Website design survey

An outline of description and comments from a survey of the four most interesting online statistics/database presentations is given in **Appendix C2** – 'Renewable energy statistics presentation websites survey'. The chief lessons learnt for SEE-Stats were to make the graphs legible (unlike OÖ Energiesparverband) and attractive (avoid RESTATS graphics), and the map interactive (like British Biogen but not BWEA).

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[41] **International Energy Agency (2002b)** pp. 9-11

2.4 Review of systems – Data collection

2.4.0 Data collection

All gross regional and national statistics systems obtain their data from electricity generators, usually via the relevant government departmental offices who oblige generators to provide information, or, like RESTATS,[42] obtain it directly from generators (with DTI authorisation), trade associations and their own staff. The first three database/statistics systems are considered below.

2.4.1 Data collection – British Biogen 'UK Biomass Electricity Plants'

The data contained in the UK biomass electricity plants database is very limited, both in the number of projects and the number and scope of the data fields. British Biogen, a trade association, has obtained the data directly from its members. As evidenced by the outdated broken web links for most of the projects listed, this statistics webpage has not been updated since 2001.

2.4.2 Data collection – BWEA website

This most comprehensive and detailed of the 'project listings'-type sites is professionally operated by BWEA, the largest and best-funded of the national renewable energy trade associations. It is well-placed to obtain details of planned and existing projects, and it is likely that BWEA has staff assigned to collation of the data. The difficulty of obtaining data from non-commercial and administratively isolated wind projects may be shown by BWEA's conscious decision to list only grid-linked turbines.

This database is updated regularly, at least quarterly. As at September 2003, the latest site update had occurred in August 2003 and even before that redesign, the latest project listed had been installed in May 2003. The BWEA website also contains a webpage[43] listing projects expected to become operational through the calendar year. At the start of the new year this is converted to a webpage listing the past year's launched projects,[44] along with a summary of their combined impact.

2.4.3 Data collection – RESTATS

FES uses a range of contacts, survey reports and internal knowledge to obtain project information:[45]

Solar thermal – FES Solar Team; Solar Trade Association; Report - 'Review of Active Solar Technology'.

Solar PV – FES Solar Team; British Photovoltaic Association; Report - 'The Photovoltaic Industry - An Analysis of Strengths, Weaknesses, Opportunities and Threats'.

Wind – RESTATS Survey; NFFO; FES Wind Team

Wave – ETSU Technology Officer

[42] **Dagnall, S./FES (29 July 2003)**, personal communication
[43] **British Wind Energy Association (May 2003d)**
[44] **British Wind Energy Association (May 2003e)**
[45] **FES (2000)**

Hydro – RESTATS Survey (2000 Digest); FES Hydro Team
Geothermal – RESTATS Survey; FES Geothermal Team
Sewage sludge A.D. – CHAPSTAT Survey
Wood combustion (domestic) – FES Biomass Team
Wood combustion (industrial) – RESTATS Survey (2000 Digest); LRZ Survey (1996, updated in 2001); FES Project Officer.

These sources are generally not available for the purposes of SEE-Stats, but the same principle of using internal staff knowledge, established surveys and own investigation can be applied to this project and TV Energy.

According to FES, the data for large generation projects (NFFO/ROCs scale, e.g. industrial wind, biomass and hydro schemes) is updated every year.[46] For smaller RE projects the data is updated approximately only once every 3 years.[47] The organisation maintains a confidentiality agreement with the DTI and contributory companies and may not release even project names or locations.

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[46] **DTI/Eurostat/FES (2002b)**
[47] **Dagnall, S. /FES (29 July 2003)**, personal communication

3 Developing the SEE-Stats system

3.0 Developing the SEE-Stats system

3.0.0 Development of SEE-Stats

The detailed decisions on what to include in SEE-Stats (Database), how to calculate them (Methodology), how to present them (Website), how to collect them (Data Collection) and how it should proceed in future (Maintenance) were ongoing throughout the time of work on the project, only finally being completed by the end of August, 2003. At the time of writing, the SEE-Stats Main Database for the Thames Valley & Surrey (**Appendix D1**) contained 50 projects which are either operational or imminent, and there were 46 prospective installations in the Prospects Database (**Appendix D2**). The website design has evolved but remains a test website; it has been live at http://www.see-stats.org since the end of July 2003. Data collection commenced at the end of June 2003 and continued until the end of August 2003. Issues surrounding the future maintenance of the SEE-Stats site were also identified and the best approaches considered as SEE-Stats progressed.

3.0.1 People involved

It is worth recording here the key personnel and organisations involved in the development of the database-statistics system. Figure 2 illustrates the information, human resources and funding flow for SEE-Stats.

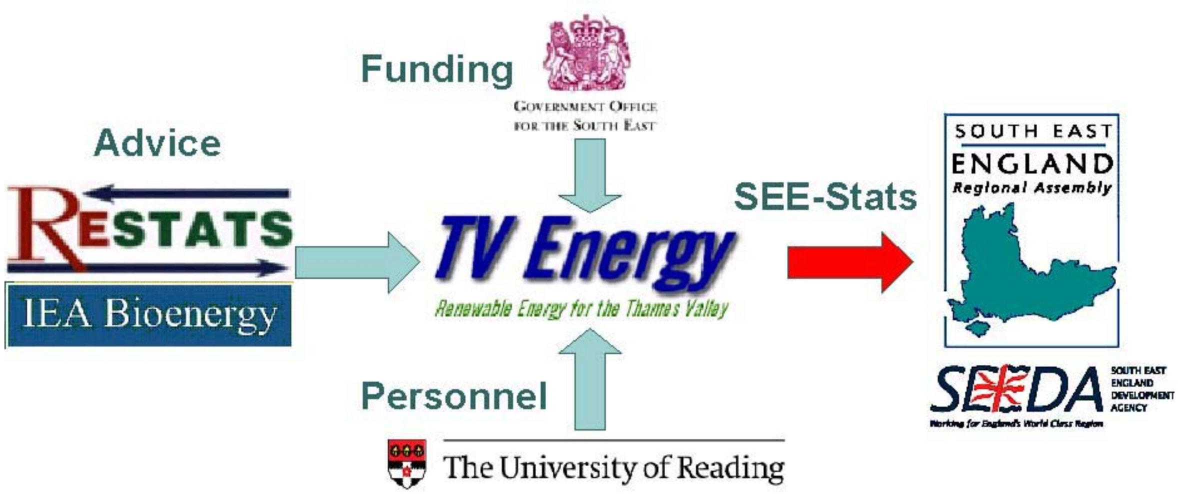

Figure 2 Simplified illustrative organisation chart for SEE-Stats

The customers were considered to be the Government Office for the South East (GOSE), the funding body; the regional assembly (SEERA), the intended users; the regional development agency (SEEDA), also interested potential users. Direct contact between the MSc project and these bodies was minimal due to their 'hands-off' approach, but a meeting was held with SEERA's Regional Analyst, Kate Morrison, to liaise with regard to linking SEE-Stats to other regional information systems.

Co-ordination with the regional bodies was carried out by Thames Valley Energy management in the person of Dr. Keith Richards. Executive advice on the initiative came from him and technical advice from Michael Beech of TV Energy, while information and further advice on a daily or weekly basis came from other staff of the company. The work was carried out in situ at TV Energy's offices at New Greenham Park, Newbury and otherwise at the author's home workstation. A laptop computer was kindly provided by TV Energy in May 2003 for exclusive use on SEE-Stats, ensuring location-independent continuity.

The technical aspects of the website design was carried out by specialists Web on High, and close co-ordination was achieved with their staff when making alterations to content and design, since their offices are located in the same corridor as TV Energy's.

Apart from the extensive contacts made in the course of data collection, external linkages were made via Dr Dagnall of FES on methodology and members of the IEA Bioenergy Task 29 on socio-economic aspects of renewables who attended the presentation made at the group's conference. Valuable input was also received from website survey respondents; from visiting professionals who voiced questions and comments at and subsequent to the official seminar presentation of the MSc project at the University of Reading; lastly from the MSc project supervisors, Dr Anne Wheldon and Dr David Fulford.

3.0.2 Target users

Decisions such as the choice of data to include in the SEE-Stats database, and the website design (especially the statistics presentation) will be crucial to the utility and value of the site for its target users, who were estimated by the author to be as given in Table 3:I.

Primary users
Policy-makers of regional and local authorities Civil servants of regional and local authorities Regional and local bodies promoting sustainable development Regional and local bodies promoting energy & environmental issues
Secondary users
Present and potential commercial generators Present and potential domestic/business generators Researchers and students in energy, socio-economics and sustainability Teachers and students in primary and secondary education The interested general public

Table 3:I Target users of SEE-Stats

3.0.3 IEA Task 29 conference

A presentation was made at the IEA Bioenergy Task 29 – Socio-Economic Aspects of Bioenergy conference at Streatley, Berkshire 18-19/6/2003[48] to introduce the concept of SEE-Stats to an international audience. See Appendices G and H for copies of the paper and presentation.

Workshops were also held at the conference, and the results of one suggested the following potential socio-economic benefits of renewables (with a biomass bias) which could be considered for use in SEE-Stats:

Job creation and retention
Wealth retained (direct, indirect and induced)
Rural diversification and land use options
Security of energy supply
Greenhouse gas mitigation
Fuel poverty alleviation
Health
Education and training
Silvicultural benefits (site prep, etc.)
Sense of 'well being' or quality of life
Community self-sufficiency
Community cohesion
Landscape and recreation
Sustainable energy resource
Community ownership
Social acceptability
Perceptions, awareness and attitudes

Table 3:II Socio-economic impacts of renewables suggested at IEA Task 29 conference

[48] **TV Energy (2003b)**, ¶7

3.1 SEE-Stats development – Database

3.1.0 The database and its fields

Early in the process it was jointly agreed for temporary convenience to set the database up initially as an Excel spreadsheet, as opposed to using specialised database software.

As revealed previously, it had already been decided by TV Energy to have three broad categories of data, which this project then developed by re-allocating fields and re-titling as follows: Installation details, Technical information, Socio-economic and environmental data (see **Sections 3**, **4**). There were also 18 data fields in existence – refer to Table 2:I in **Section 2** – and the broad structure of the website had also been decided before the MSc involvement. Compare Table 3:III, listing the complete list data fields at the time of writing. Their development including the 12 additions are described here, for what were named fields S1 to S30; the treatment of the data *content* for the more technical data is to be found in the next section, which deals with the detailed methodology of SEE-Stats.

Installation details		**Technical information**		**Socio-economic & environmental data**	
S1	Installation number	S10	Technology type	S21	Social benefits
S2	Installation name	S11	Manufacturer & installer	S22	Jobs (Direct)
S3	Owner	S12	Fuel or feedstock	S23	Jobs (Indirect)
S4	Postal address	S13	Capacity kW_e	S24	New business startups
S5	Grid reference	S14	Capacity kW_{th}	S25	Annual financial benefits
S6	Sub-region	S15	DNC kW_e	S26	Capital cost
S7	Renewable energy	S16	Average power kW_{th}	S27	Replacing likely alternative
S8	Development status	S17	Annual output MW_eh	S28	Annual tCO2 displaced
S9	Operational since	S18	Annual output $MW_{th}h$	S29	Homes (Electricity)
		S19	Energy to (Electricity)	S30	Homes (Heating)
		S20	Energy to (Thermal)		

Table 3:III: Final data fields as at 12th September 2003

3.1.1 Data fields – S1 Installation number

This field was added to the head of the installation details section by the MSc involvement in May in order to obtain greater ease of reference and ordering, not so much in the early stages but for when the number of installations becomes less manageable in the future.

3.1.2 Data fields – S2 Installation name

This field, being essential, was not altered apart from being renamed to avoid casual confusion of the word ‘project’ in the sense of generation scheme with ‘project’ in the sense of the MSc project.

3.1.3 Data fields – S3 Owner

The owner, or the developer for planned or prospective installation, is another field which was considered essential when gathering data and for database users to be aware of who to contact about their scheme.

3.1.4 Data fields – S4 Address

It was seen for data collection purposes and public information that it was important that this field be retained.

3.1.5 Data fields – S5 Grid reference

The Ordnance Survey convention was retained, as this was seen as preferable to the longitude and latitude system used by BWEA. It is more precise for UK pinpointing and more practical, since all Ordnance Survey maps and map-books such as the ones used at TV Energy, apply the system. It is rightly situated just after the address, since they both relate to site location.

3.1.6 Data fields – S6 Sub-region

The sub-region in which the schemes are located was added (alongside the other location information) by the MSc project in May. It was considered important to record this information when it became clear that the region is divided into four administrative sub-regions: Thames Valley and Surrey, Kent, East & West Sussex and Hampshire and the Isle of Wight. The RE targets are divided correspondingly. In addition, the MSc objective was to collect data for the first sub-region only, and so it was important to categorise installations correctly from the very beginning to save time.

3.1.7 Data fields – S7 Renewable energy category

Since the strategy document suggests dividing the regional and sub-regional RE targets by renewable energy source type, reflecting the projected local resource potentials, it was considered necessary from May onwards for the MSc project to categorise projects accordingly.

3.1.8 Data fields – S8 Development status

This field was added early in May when it became apparent that not only was it a useful piece of information for public users of the website; it would indeed be essential in order to project future regional and sub-regional developments, in terms of aggregated installed capacity, energy output and other statistics likely to be useful to the strategic planners.

3.1.9 Data fields – S9 Operational since

The year of commissioning was moved by the MSc project in June from the technical information section to the installation details section, since it was considered to reflect the generator's history rather than its technological features.

3.1.10 Data fields – S10 Technology

This field was retained at the head of the technical information section, crucial as it is for a proper understanding and assessment of the generation scheme, for both policy planners and the wider public.

3.1.11 Data fields – S11 Manufacturer / Installer

This was expanded from the original 'Equipment supplier' field by August with the agreement of TV Energy. It was considered useful information for the purposes of generator performance comparisons. It was also potentially an incentive for installers and manufacturers to provide data on their installations, in that it provides publicity for their products.

3.1.12 Data fields – S12 Fuel or feedstock

This field was expanded in June to include the fuel equivalent for anaerobic digestion schemes, namely the digestive feedstock (e.g. sewage sludge). The field was retained and moved to its current position because it complements the technology and manufacturer/installer data to provide a relatively complete qualitative description of the installation.

3.1.13 Data fields – S13 Electrical capacity (kW_e)

The installed capacity of the generator was one of the most significant data fields, particularly in terms of the SE targets: SEERA states that "Monitoring of the installed capacity (in terms of megawatts of electricity generation capacity) will be essential to track delivery against the indicative targets of the Strategy".[49] 70% of survey respondents wanted the statistic included on the website (see **Section 3.3** – Website design). The original field was formally split by the MSc project into two in May – the one for electrical energy (kW_e) alone and the succeeding one for thermal energy (kW_{th}) – once it had rapidly been realised that the two energy forms should be rigidly separated for statistical purposes (requiring entry, for example, into separate Excel cell to create separate graphics).

3.1.14 Data fields – S14 Thermal capacity (kW_{th})

See the description for the previous field. SEERA notes that "heat generation (from biomass, solar and geothermal/ground source) and use…will also be important in offsetting fossil fuel energy generation and should be encouraged."[50]

3.1.15 Data fields – S15 Declared Net Capacity (kW_e)

It was decided to keep DNC despite its low recognition factor – only 20% of respondents to the website feedback survey indicated they wanted to see this data for the SE region (see **Section 3.3**), though the question was slightly misconceived. DNC simply represents capacity for intermittent sources (e.g. wind), equivalent to installed capacity for 'non-intermittent' sources (e.g. thermal plant).[51] Its use and calculation in the RESTATS way (see **Section 2** previously) is also in line with IEA recommended practice, and so it was decided for the sake of consistency to retain the field and use it for the regional statistics, in preference to installed capacity; it applies only to PV, wind and tidal/wave generators. There would remain the option for the future possibly to alter the

[49] **SEERA (2002)**, p. 59, §6.2
[50] **SEERA (2003)**, p.13, §1.37
[51] **Currie et al/ESRU (May 2002)**

DNC factors used in SEE-Stats to reflect regional performance. Gross installed capacity for the affected intermittent resources was nevertheless retained, due to its common and logical usage to denote the rating of an individual system.

3.1.16 Data fields – S16 Average thermal power (kW_{th})

DNC applies only to electricity generation, and so it was decided by the MSc project in August to add an 'equivalent' field for thermal generators. This would enable the provision of more information to SEE-Stats users, who may be interested in the actual power usage or performance of the heating system in practice, as opposed to its theoretical capacity. It would also help to indicate at a glance how the energy output figure was arrived at (see field S18).

3.1.17 Data fields – S17 Annual electrical energy output (MWh_e)

Along with capacity, the energy generated every year is possibly the most important item of data for any renewable energy statistics system, since it is this quantity that represents the true contribution of the renewable installation to pursuing the aims of climate change and security of supply. The MSc project consequently decided in May to introduce this field alongside the other quantitative technical data. 70% of website survey respondents agreed it should be included in the regional statistics (see **Section 3.3**), even though the SE electricity RE targets focus on installed capacity.

3.1.18 Data fields – S18 Annual thermal energy output (MWh_{th})

For similar reasons, the usable heat output of thermal systems was also added, for this output too offsets energy use from fossil fuel sources.

3.1.19 Data fields – S19 Electrical energy to…

This and the next field are potentially useful for an idea of the size of the load supplied by the system, and were retained.

3.1.20 Data fields – S20 Thermal energy to…

See the description of the previous field.

3.1.21 Data fields – S21 Social benefits

This field was added in June at the behest of TV Energy. As a key component of SEE-Stats according to the project objectives, it was later decided by the MSc project to promote to the head of the Socio-economic and Environmental Data section.

3.1.22 Data fields – S22 Jobs (Direct)

The number of jobs created and sustained directly by each installation was an important socio-economic parameter, especially given the intended end users, the regional assembly and development agency.

3.1.23 Data fields – S23 Jobs (Indirect)

Jobs may also be created or sustained by the commissioning of a new RE installation, for example the growers and transporters of energy crops for biomass CHP station. Since sustaining rural employment is a current ongoing political issue, the attraction of underlining the significant actual and potential contribution of renewables to the effort is obvious.

3.1.24 Data fields – S24 New business start-ups

The number of new companies founded as part and parcel of renewable energy projects (as for employment, both direct and indirect) is a fourth socio-economic data field, and was added at the request of TV Energy.

3.1.25 Data fields – S25 Annual financial benefits

Some renewable energy installations may have a high capital cost, but if this is put to one side, all RE sources can nevertheless provide a financial benefit in comparison to the previous situation. For some, the payback period is so short that they even start making money after only a couple of years. It is interesting for the purposes of RE promotion to look at the financial savings and/or incomes from the installations of SEE-Stats.

3.1.26 Data fields – S26 Capital cost

Ignoring the capital cost of a scheme in the calculation of its financial benefits, it is only fair to include this separately.

3.1.27 Data fields – S27 Replacing energy source

It is useful to know exactly which fossil fuel energy source is being replaced, either historically (for operational RE installations) or theoretically (for planned schemes). It is upon this basis that the value of the next field is calculated, and so must first be mentioned to explain the rationale behind the calculation.

3.1.28 Data fields – S28 Annual tonnes CO_2 displaced

This is the key environmental data and is mandatory for such a database, as seen for example in the BWEA website. It really covers just CO_2, rather than all greenhouse gases and represents the mass emitted by the fossil fuel generation capacity likely to have supplied the same amount of energy in the absence of the renewable installation. It was decided not to include the SO_2 or NO_X emissions as well, since these pollutants were not the focus of the environmental driving forces behind SEE-Stats (climate change) and their inclusion could possibly confuse policy-makers and the public.

3.1.29 Data fields – S29 No. of homes equivalent (Electricity)

This and the next field are attractive for indicating the magnitude of an installation's contribution to meeting the local energy demand. For many small-scale installations the values are not immediately impressive, but the aggregated figures in the form of the regional and sub-regional statistics do have a potential impact, if only to act as a negative driver to urge policies to stimulate a greater up-take of RE technologies in the region.

3.1.30 Data fields – S30 No. of homes equivalent (Heating)

See the notes on the previous field.

3.2 SEE-Stats development – Methodology

3.2.0 Methodology

The methodology for the entries in the chosen data fields was considered the heart of the MSc project. It is crucial that the principles of technical rigour, uniformity, and as far as possible a combination of informative value and simplicity, are observed in such systems. This is because of the range of knowledge and understanding of the intended users and the aim to be the credible regional information source.

The methodology was a product of convention and originality as appropriate, to achieve the linkage with IEA/RESTATS whilst regionalising and improving where possible, and developing new approaches for data not present in those initiatives. The quantitative General Methodology for SEE-Stats is summarised in **Appendix E1**, while a record of the main quantitative calculations was made for each installation with capacity data, and this document can be viewed in **Appendix E2**.

3.2.1 Methodology – S1 Installation number

Installations were initially added at the foot of the main database as awareness of them arose. They were gradually re-located in order of data completeness over the work period as information was gathered, according approximately to the following rubric:

Installation no.	Project status	Data obtained
Lowest (top of screen)	Operational	All data fields
	Planned	All data fields
↓	Operational	Name, Location, Capacity
	Planned	Name, Location, Capacity
	Operational	Name, Location
Highest (foot of screen)	Planned	Name, Location

Table 3:IV Rubric for ordering projects within main Installation database

3.2.2 Methodology – S2 Installation name

It was decided by August to reform the naming system and to keep this most basic of data was as concise as possible while still informative. A typical project name is therefore composed of the name of the owner, building and/or location followed by an abbreviation of the technology type. Whereas one project, for example, may originally have been known as University of Reading Engineering Building BIPV array, it would have been altered to Reading University PV. The information contained therein is sufficient to distinguish it from other schemes but is sufficiently brief for entry in the cells of the database and rapidly grasped by website users.

3.2.3 Methodology – S3 Owner

From the start of the MSc involvement, the owner's (or developer's) title, first and last names were used, e.g. Mr David Brown, for domestic systems. For commercial systems the proprietary company's name was entered, e.g. Martin R. Fry & Associates; for schools the local education authority, e.g. Oxfordshire CC. Where confidentiality was expressly requested, e.g. by those not prepared to have their surname listed on the web, initially the relevant details were clearly marked in red font, along with the contact details which were being recorded in the same data field. In August it was decided, in order to ensure a clear division of data accessibility levels, to delete confidential contact details from the database and restrict them to a separate worksheet in the same Excel document, entitled Contact & Response Records (see **Section 3.4** – Data Collection).

3.2.4 Methodology – S4 Address

It was decided early in the MSc project to use the simple postal address of the actual generation site, including postcode and county. For isolated installations such as many hydro and wind turbines, the names of the nearest landmark (e.g. weir, meadow), settlement and county were deemed to suffice.

3.2.5 Methodology – S5 Grid reference

The full OS reference was retained, locating the generation site by means of the two-letter area code followed by 6 digits for the Eastings (a two-digit 10km gridline number, plus a one-digit estimate to the nearest km) and Northings (system as for Eastings).

3.2.6 Methodology – S6 Sub-region

The sub-region for the generator location was easily identified from the county named in its postal address.

3.2.7 Methodology – S7 Renewable energy category

It was important to consider which technologies would be included in SEE-Stats. The SEERA electricity targets were an obvious guide but they neglected thermal energy generation and biofuels. It was decided in line with convention (with the exception) to limit SEE-Stats to fixed-site renewable sources, in other words excluding use of biofuels. These would introduce a complexity to data collection and the calculation of capacities, outputs, emissions displaced etc. which would be excessively demanding for the present project. Although SEERA mentions that "the development and use of liquid biofuels in transport, although not quantified in the targets, will also be important in offsetting fossil fuel energy generation and should be encouraged",[52] there was no call for it from anyone providing feedback or advice on SEE-Stats. However, there is obviously room for future expansion into this area if required.

Likewise, passive solar thermal features were excluded from SEE-Stats due to the difficulties associated with classifying architectural features. Passive solar would stretch too far the definition of an 'energy generation installation', whereas at least in the UK, active solar heating systems are demonstrably generating thermal energy in a way which is parallel to alternative systems powered by fossil fuels.

Following the RESTATS division of hydro power into large and small, only small hydro would be included in SEE-Stats, i.e. hydro-electric schemes with less than $5MW_e$ installed capacity. This was decided for reasons related to the unacceptable environmental impact of larger schemes. In practice this decision is unlikely to have any

[52] **SEERA (2003)**, p. 13, §1.37

effect in the SE of England, whose geography dictates that the maximum head height available on the region's watercourses is likely to be too low to provide power to the level of this theoretical upper boundary.

Unlike RESTATS, the present initiative excludes energy generated from municipal solid waste, which is by UK convention counted as a valid 'renewable' source only when contributing less than 15% of the fuel or feedstock.

Since May the 6 categories in were in use for SEE-Stats:

RE category	***Notes***
Biomass	*Both thermal and electric*
Bio & sewage gas	*Mainly anaerobic digestion of sewage sludge*
Hydro	*Small hydro only (under $5MW_e$ capacity)*
Solar	*Both PV and active solar thermal; not portable PV*
Wind	-
Other	*Mainly ground source heat pumps*

Table 3:V Working SEE-Stats RE categories as at June 2003

However, by August it was decided by the MSc project, after consulting TV Energy, to deploy instead the following 8 categories, which also cover technologies applicable to other parts of the SE but not the Thames valley & Surrey sub-region, and take account of the necessary division between electric and thermal energy generation:

RE category	***Notes***
Biomass	*Electric output only*
Bio and sewage gas	*Electric output only*
Hydro	*Small hydro only*
Onshore wind	-
Offshore wind	*Not applicable to Thames V.*
Solar PV	-
Tidal and wave	*Not applicable to Thames V.*
Thermal	*Heat from biomass/ biogas CHP, active solar heating, biomass domestic heating, ground source heat pumps*

Table 3:VI Final SEE-Stats RE categories as at September 2003

Thermal-only generating schemes are set apart because are no official targets for these. For CHP and other sites with multiple technologies, all applicable categories were recorded. The co-generated thermal output of CHP was obviously neglected for target purposes.

3.2.8 Methodology – S8 Development status

The appropriate categories underwent much discussion, focussing on the boundaries between them and the need to cater for all the possible situations which may arise. Originally simply Operational, Under Development and Planned, it was decided in June at the request of TV Energy to increase the information provided on schemes in the development and planning stages. This would firstly allow greater statistical sensitivity when projecting statistics for future installations; secondly, it would have the additional advantage of increasing awareness amongst regional and sub-regional policy-makers of the important issues surrounding the historically mixed relationship between renewables schemes and planning application success. The middle category was therefore replaced by three new ones: Awaiting Planning Permission, Planning Permission Granted and Under Construction. It was realised in August that for projects not requiring planning consent, that a new Priority Prospect category could serve to fill the intermediate stage.

3.2.9 Methodology – S9 Operational since

Initially just the year was recorded, but latterly it was noticed that most installations could be pinpointed to a particular month. It was therefore decided by the MSc project that more information at very little expense (in terms of research time and database/website space), rather than less, was worth having.

3.2.10 Methodology – S10 Technology type

Again, a compromise between brevity and utility of the information to be provided was sought. A convention was developed to give very brief details of the energy conversion technology, such as '1× 850kW turbine', 'Biomass combustion boiler', 'Anaerobic digestion – Gas turbines – CHP' etc.

3.2.11 Methodology – S11 Manufacturer/Installer

First the main equipment manufacturer's name and then that of the installer or supplying company were entered, if known. If self-installed, this phrase was entered instead. As with all other data fields, if either item of data was unavailable then a hyphen was used to indicate such. For multi-equipment systems with more than one manufacturer, only the maker of the principal system component was given, e.g. for a PV array this means the module manufacturer and not the inverter. Although, as in the example given, the inverter is an important part of a PV system and contributes to its performance, the quality of many or all of the other components of the installation (e.g. the cabling) could also be argued by the same token to warrant the inclusion of the names of their makers, which would be an intolerably large set of data. The boundary has to be set to pinpoint the key data and save space.

3.2.12 Methodology – S12 Fuel or feedstock

It was relatively simple to determine the entry for this field, with a simple description such as 'Industrial woodchip' or 'Sewage sludge' considered sufficient in providing broad information on the type and origin of the input. For most technology types a stroke was entered here instead, to indicate that their energy source was self-explanatory (e.g. running water for hydro, solar irradiation for PV etc.).

3.2.13 Methodology – S13 Capacity (kW_e)

Since the various technologies, in using different generation processes have various non-uniform quantities corresponding to the parameter called 'capacity', a guide to the quantities employed in SEE-Stats is shown in Table 3:VII. The choice of definitions was made on the basis of received practice for each technology. For generation schemes with an 'in-house' electrical load (i.e. energy used in process), the capacity figure included this component. In each case the units were kW_e.

Renewable energy	Capacity definition used
Bio & sewage gas CHP	Full-load rated electrical capacity
Biomass CHP	Full-load rated electrical capacity
Hydro	Total rated turbine capacity
Solar PV	Rated peak
Wind	Total rated turbine capacity

Table 3:VII Definitions of electrical capacity used for each technology

3.2.14 Methodology – S14 Capacity (kW_{th})

Similarly to the previous field, Table 3:VIII gives a guide to the definitions of installed thermal capacity for generators of heat. Units are again kW_{th}. If necessary the BTU/h rating was converted using factors of 1.05506 kJ/BTU[53] and 3600 kJ/kWh.

$$\text{rating BTU/h} \times 1.05596 \text{ kJ/BTU} \div 3600 \text{ kJ/kWh} = \text{rating kW}_{th}$$

The most difficult calculation of capacity was for solar thermal systems, which in fact has little meaning in kW terms due to the high day-to-day and year-to-year variability of both the incoming solar irradiance and the load, e.g. domestic hot water usage. It was ultimately decided in late August to recommend the application in future of a definition called the theoretical peak delivered power based on certain parameters of the system (for more detail, see **Section 4** – Discussion and recommendations).

Renewable energy	Capacity definition used
Bio & sewage gas CHP	Full-load rated thermal capacity
Biomass CHP	Full-load rated thermal capacity
Domestic biomass heating	Full-load rated thermal capacity
Solar thermal	Peak delivered power
Ground source heat pumps	Full-load rated thermal capacity

Table 3:VIII Definitions of thermal capacity used for each technology

[53] **Action Energy (2003a)**

3.2.15 Methodology – S15 Declared Net Capacity (kW_e)

$$\text{DNC } kW_e = (\text{rated capacity } kW_e \times B) - \text{in-house load } kW_e$$

DNC applies to wind, solar PV and tidal/wave power, and the coefficients used to reduce rated capacity to DNC were the B factors of RESTATS (see Table 2:II): 0.17, 0.43 and 0.33. Hydro and CHP from anaerobic digestion or biomass, all have a B factor of 1. In most cases, the in-house load was zero or else not given: where necessary the phrase '(+ in-house load)' was written by the capacity value.

3.2.16 Methodology – S16 Average thermal power (kW_{th})

If unknown, this data was calculated as follows:

$$\text{Average power } kW_{th} = \text{full-load rated capacity } kW_{th} \times \text{capacity factor},$$

where the capacity factor used was the year-long full load equivalent utilisation (i.e.the proportion of year the heater runs at its top rating). If unknown, the factor used was the SEE-Stats regional average, which is the mean value of the capacity factors for all installations of the same type (domestic biomass stove; domestic biomass boiler; industrial biomass CHP; industrial bio & sewage gas digestion CHP; solar hot water system) for which this data was available. For planned generators, the predicted capacity factors from the relevant studies were found if available.

3.2.17 Methodology – S17 Annual electrical energy output (MWh_e)

It was decided to use MWh instead of kWh for the sake of consistency with the RE targets, and the greater manageability of the aggregated statistics. The first port of call was the owner (or operator) for actual recorded output data, as primary records were the only possible guarantors of accuracy and regional specificity.

If actual output was unavailable, the year-long average operating power was used:

$$\text{Energy output MWh} = \text{average operating power } kW_e \times 8760\text{h} \div 1000$$

8760 is the number of hours in a year. If year-long average power was unavailable, it was decided to estimate it using the rated capacity and what is called here the capacity factor reflecting the equivalent proportion of the year over which the system generated at its rated capacity:

$$\text{Energy output MWh} = \text{rated capacity } kW_e \times \text{capacity factor} \times 8760\text{h} \div 1000$$

For the intermittent sources wind, PV and tidal/wave power, rated capacity and capacity factor were used, in line with BWEA practice, instead of DNC and a load factor as RESTATS does: this bypasses the systematic error which would arise from using the national B factors. For all technologies, where the capacity factor was not known, as before the mean regional value of this data from all other projects of the same technology type was used. The exceptions were projects of an obviously small-scale, demonstration status, e.g. the Reading RISC installations whose wind and solar outputs were not comparable to those for schemes of a more serious nature.

3.2.18 Methodology – S18 Annual thermal energy output (MWh_{th})

As before, first-hand output data was first sought. If output data was unavailable for a biomass heating system but its annual fuel consumption and efficiency was known, then the following formula was used:

Energy output MWh= (fuel CV 12,810MJ/t ÷3.6MJ/kWh) × efficiency × fuel use dry t/yr

If the system efficiency (usable heat output ÷ primary energy input) was not known then a regional average of known efficiencies was used instead. If fuel use was unknown, then if available, average power was used as for electrical output (above):

$$\text{Energy output MWh} = \text{average operating power } kW_{th} \times 8760h \div 1000$$

Again, if the average operating power was not known then the following formula was employed:

$$\text{Energy output MWh} = \text{rated capacity } kW_{th} \times \text{capacity factor} \times 8760h \div 1000$$

3.2.19 Methodology – S19 Electrical energy to

A very brief description of the load supplied was entered, e.g. '80% national grid, 20% house'.

3.2.20 Methodology – S20 Thermal energy to

Methodology was as for the previous data field.

3.2.21 Methodology – S21 Social benefits

After discussion with Deborah Stoer, TV Energy's sociology expert, consultation of the IEA Task 29 workshop suggestions, and experience in the form of the data coming in, the four main applicable social benefits to be entered for SE installations were found to form the following shortlist:

- Educational & training uses, e.g. use in school science projects
- Research uses, e.g. monitoring performance
- Reducing fuel poverty, e.g. reducing costs
- Improving personal/local health, e.g. replacing oil burner fumes by a low-emission wood pellet stove

3.2.22 Methodology – S22 Jobs (Direct)

The number of directly dependent jobs was defined as the number of full-time equivalent jobs involved in energy generation activities which would disappear if the RE installation was closed.

3.2.23 Methodology – S23 Jobs (Indirect)

The number of indirectly dependent jobs was defined as the number of full-time equivalent jobs *not* involved in energy generation activities which would disappear if the RE installation was closed.

3.2.24 Methodology – S24 New business start-ups

The number of new businesses set up as a result of a RE project was divided over the number of installations having a separate entry in the database, e.g. Thameswey Energy

Ltd owns three installations and each one therefore has 0.33 business start-ups associated with it. The business could be indirectly connected, e.g. a short rotation coppice grower's start-up, so long as the associated installations are the sole stimulants for its establishment.

3.2.25 Methodology – S25 Annual financial benefits

If the installation is replacing a previous fossil fuel generator (including grid electricity) then the difference in annual energy costs is used as the financial benefit. Initially, if the owner's data did not include operation and maintenance costs, these were assumed to be approximately equivalent before and after replacement. If the RE installation is feeding the grid rather than displacing a specific generator, then the simple difference between the new ongoing costs and income is used. If the new RE generator is more expensive or the costs are unknown then, as usual, a dash is used to indicate the absence of this data.

3.2.26 Methodology – S26 Capital cost

The format for capital cost was to exclude VAT (on the advice of TV Energy) but to include installation and/or suppliers' extras.

3.2.27 Methodology – S27 Replacing energy source

A simple generic phrase such as 'Natural gas boiler' or 'Electricity from grid' was considered appropriate. Since this field covers hypothetical situations then the more detail provided, the more potentially inaccurate the description would become. Where more than one fossil fuel was cited, an estimate of their respective proportions of the energy output was obtained or made.

3.2.28 Methodology – S28 Annual tonnes CO_2 displaced

The most recent emissions factors for fossil fuel delivered energy published by Action Energy[54] were used. These were converted to convenient units as follows:

Electricity grid mix	0.52 tCO_2/MWh
Natural gas	0.19 tCO_2/MWh
Heating oil	0.27 tCO_2/MWh
Coal	0.32 tCO_2/MWh

For biomass, to cover fuel transportation emissions, the following factor, derived from the authoritative Standard Assessment Procedure document 2001,[55] was used:

Biomass, Wood, Biogas (landfill): $7kgCO_2/GJ \times 3.6GJ/MWh \times 0.0001t/kg = 0.0252\ tCO_2/MWh$

The appropriate emissions factor for the likely fuel alternative is multiplied by annual energy output of the installation, then divided by the likely efficiency of the fossil fuel generator to find the emissions displaced annually in tonnes CO_2. For biomass the same then has to be done using the biomass emissions factor (and the efficiency of the biomass system) to find the emissions per year by the RE installation, which is then subtracted from the initial value of emissions displaced to give the net reduction. In practice the regional average efficiency for domestic biomass boilers was taken from a local

[54] **Action Energy (2003b)**, p. 22
[55] **BRE *et al* (2001)**, p. 34, Table 15

feasibility study.[56] This figure of 68% efficiency was confirmed by an expert[57] linked to the report to be a sound conservative estimate for seasonal average boiler performance, which can reach 80%

The grid electricity factor obviously did not require division by any efficiency value, and takes account of grid losses. For the latter reason it is not directly comparable to the immediate output from a RE scheme supplying to a grid, which would also experience losses. However, it is not possible to quantify the order of these losses and it was therefore decided to neglect them, which should be noted on any public SEE-Stats methodology page. For CHP the thermal output (usually considered as replacing natural gas) and electric output (usually considered as replacing grid electricity) were treated separately and the final totals added.

3.2.29 Methodology – S29 No. homes equivalent (Electricity)

The average annual UK household consumption of electricity was calculated from first principles instead of using other bodies' figures, which generally range between 3 and 5 MWh/year/household. The most recent total UK domestic electrical energy consumption per year value (8.4 Mtoe[58] in 2000) was converted to kWh (11,630kWh/Mtoe[59]) and divided by the most recent figure for the number of households in the country (21,660,475[60] in 2001) to give 4.51 MWh/home/year. This was rounded to 4.5 and divided into the electrical output of each installation to find the average number of homes it supplies.

3.2.30 Methodology – S30 No. homes equivalent (Heating)

An identical approach was taken for thermal energy consumption, the relevant total household usage in 2000 being 38.5Mtoe and the final per-house demand was about 20.67 MWh/home/year. A figure of 20 was used for convenience and taking account of the relative imprecision of the consumption statistics, and where applicable divided into each installation's usable heat output.

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[56] **Econergy (2003)**, p. 13
[57] **Rippengale, R./Econergy (11 September 2003)**, personal communication
[58] **DTI (July 2002)**, (Chart 3.1, p. 23)
[59] **Action Energy (2003)**
[60] **Office of National Statistics (2003)**

3.3 SEE-Stats development – Website design

3.3.0 Website design

The MSc development of the website was limited within a framework provided by the input of TV Energy with the original design concept and most of the text content, and Web on High (WoH, the professional web designers) with their own, mainly technical and graphical contribution. The MSc role was limited to producing and operating the web feedback survey; designing the dummy statistics page; having a link-through page from the old URL to the new location added; producing half of the initial 6 installation datasheets online; producing 45 more datasheets for the future expanded website; mediating TV Energy's input and WoH's output.

The second to last activity mentioned above consisted of blending ideas and preferences from Dr Richards with some personal conceptions, particularly informed by the feedback from the survey; the last activity consisted of correcting and improving design and content aspects of the 15-page test website before an after it went live in mid-June 2003 at the provisional URL www.tvenergy.org/see-stats. There was a second period of identical interplay in the weeks before and after the transfer of the website with improvements in early August to its current and final URL, www.see-stats.org (or alternatively www.see-stats.co.uk). Consult **Appendix F1** to see documents set to WoH requesting changes.

The main principle applied by the MSc involvement to the SEE-Stats site was to combine maps, database and statistics whilst optimising the quality of the graphics, layout, navigability and other content. The graphics were required to be sufficiently numerous, interesting and colourful without straying into the realm of the distracting or garish. The layout was aimed at being aesthetically pleasing, logical and hence easy to use, and needed constant adjustment in conjunction with any graphics and text changes. The site's navigability and reliability demanded particular attention, since several programming errors and inconsistencies were turned up over the course of the process and needed fixing. The text had occasionally to be reformed to correct misprints.

3.3.1 Website – content

Screen grabs of the 12 webpages of the latest version as at September 2003 can be viewed in **Appendix F2**. Refer to the paper and slideshow presented to the IEA Bioenergy conference (**Appendix H1, H2**) for a description of the website's basic composition.

3.3.2 Website – Feedback survey

A copy of the questions asked in the feedback survey is given in **Appendix G1**. In producing these questions, the focus was divided equally between aspects of the design, to attain the user-friendless that is key to the success of any website, and the content, which is the point of SEE-Stats. Although the survey was made deliberately anonymous, it was possible to know from the limited range of people made aware of SEE-Stats and the timing of their responses that the bulk of the sources of feedback originated from the following three groups:

1. IEA Bioenergy Task 29 conference participants
2. Local authority contacts
3. Installation owners

The results are shown in graphical form in **Appendix G2**. Due to a combination of minor text entry and programming errors, the results for question 7 were not valid and have been omitted. Partly as a result of the survey results, the original homepage design (which only 44% thought had enough information) was improved by adding the 'Featured Case Study' interactive image was added, the layout re-organised and the graphic design made more attractive. In addition it was intended to add a prominent link to a Methodology page once sufficient web space is negotiated. Plans for a more fundamental redesign of the sub-regional map page, which also attracted only muted support, were drawn up (see **Section 4**).

There were also some useful comments from half the respondents, also included in the Appendix: mainly general views but also detailed suggestions for the improvement. Much of their content confirmed points which it was already planned to address, such as the visual interest of the home and sub-regional map pages, the viewing of generator locations by technology category and the use of differential symbols to mark scheme locations and distinguish various categories.

3.4 SEE-Stats development – Data collection

3.4.0 Data collection

The gathering of data on Thames Valley and Surrey renewable energy schemes for the SEE-Stats database commenced in May and proceeded until late August. By the time of writing there were 51 installations in the Main Database with relatively complete data (including name, grid reference, capacity, output, emissions displaced, no. homes equivalent); 84 in total in the Main Database (i.e. 33 more with substantial amounts of data missing); 46 prospective future installations (not priorities) in the Prospects Database.

As a precaution, the text of all covering emails and letters to external bodies or individuals, requesting information on the names of local projects or detailed installation data, was produced by the MSc project and always submitted for approval by TV Energy.

3.4.1 Finding project and contact information

The first task of the data collection process was to become aware of the sub-region's installations. The seven chief sources for the names and contact details of RE schemes were as follows, and they are listed in approximate order both of chronology (starting with those who were approached first, although most continued throughout) and of productiveness (the sources encountered last provided the fewest).

1. TV Energy Project Tracker – All projects transferred by August. Data was largely incomplete and many were no longer viable.
2. TV Energy staff – also provided data on installations from previous
3. Internet research – Particularly commercial sites, e.g. BP Solar
4. Old NFFO records
5. TV Energy Advisory Council members – These included many local authority energy, environment, housing officers. There was a disappointing response from this quarter, with some exceptions
6. Local authority planning officers – They were also approached for successful RE applications previous years. The response was negligible, and this was thought due primarily to the absence of RE schemes large enough to require planning consent.
7. Word of mouth from various sources – Including installation owners and casual contributors.

Industry associations were also contacted and their websites consulted but led to no positive results, as the few records which exist are of technologies which do not have a presence in the Thames Valley and Surrey, e.g. BWEA's wind database and British Biogen's biomass electricity plants (Slough Heat and Power is the sole representative).

3.4.2 Data collection process

The typical procedure employed went as follows:

1. Obtain name & location of project
2. Obtain owner or other information holder's name and contact details: telephone number and/or email address
3. Make initial telephone call or email data request form (see **Appendix I1**) with covering email (see **Appendix I2**)
4. If no email address, hold a telephone interview and/or fax or post the data request form
5. If no reply to email or post/fax by approximately 1 week after last contact, make a telephone reminder
6. If no success then try other means of data recovery e.g. web search, literature for Oxford Ecohouse data[61]
7. Once some data obtained, enter into database and process it to complete all fields
9. Once key data entered, move installation up the database, add the calculations to the calculations list and construct a datasheet for the website
10. Before publication on the web, obtain clearance for the data from the owner/operator by sending covering email (**Appendix I3**), copy of datasheet, copy of General Methodology and copy of calculations for the installation. Request image for datasheet if not yet provided.

The installation number, installation name, name of the appropriate TV Energy staff, contact name for the installation, email address, and telephone number were listed in a

[61] **Roaf *et al* (2003)**, pp. 213–223

spreadsheet, ‘Contact & Response Records’. The date of the first data request to the correct person responsible for that installation was recorded along with the medium (phone, face to face etc.), the date the data request email was sent (if the person had email), the date this form was returned completed,

The average response rate for requests by email only by September 2003 was 31%, while for telephone calls by the same point this figure was 63%: however, the latter sample was half the size of the former. The average successful response time as at September 2003 was 12.5 days. Emails, when responded to, had a quicker response time than phone calls.

4 Discussion & recommendations for SEE-Stats

4.0 Discussion & recommendations

The project has had success in creating the present Thames Valley and Surrey database, producing a coherent and technically justifiable methodology, and ensuring the website is on course with over 45 more installation datasheets and the new sub-regional page design (**Appendix J**) ready to add, ready pending the resolution of technical and financial issues. Only partial success has been made in collecting data for the RE installations, which is largely due to underestimating the time necessary to find contact details and obtain successful responses from the owners. There now follow recommendations for the future improvement and expansion of SEE-Stats in each of the familiar areas of work.

4.1 Discussion & recommendations – Database

4.1.0 Database

The current format and range of fields are acceptable for the initial period of the life of SEE-Stats. They may require improvements once the site has been officially launched and in use, as more users give more feedback and the priorities of the target users become sharpened or shifted. Three major alterations to be considered for the future are given here.

4.1.1 Database – Conversion to computer database

It is intended to change software formats and hold SEE-Stats on a database system (such as Microsoft Access). Developing the necessary skills for this will be worth the effort, since a real IT database, being based on a multi-level approach, offers many advantages including instantly accessing or processing a selection of data or combinations of data. The limitations of Excel-type spreadsheets are most keenly experienced in the production of the statistical graphics.

4.1.2 Database – Future GIS capability

Tying in with a future IT database format, it would be preferable to introduce aspects of the Geographical Information Systems approach and software. These is specially designed for linking geographical data records and maps and is in theory the ideal format for SEE-Stats, given the requisite expertise and software. A meeting with SEERA's Regional Analyst in May to discuss such issues pointed the way to achieving just these specialised inputs by working with the dedicated SEERA GIS-trained team. A further linkage, to the region's existing SE virtual information portal, SEE-in, has also been initiated by a link placed on the SEE-Stats homepage. Once reciprocated will place the initiative as an indispensable the developing SE information matrix.

4.1.3 Database – Historical progression of statistics

In future, given closer monitoring of generation it may be possible to collect and record the changing year-on-year energy outputs, both at the installation and then the regional statistical levels. This achievement is some way off at present due to lack of data, but in theory monitoring the historical progression of accurate output values from individual schemes would at least be feasible given the incorporation into the initiative of database technology. Adding to the database reliable figures for cost per kWh generated could also then become viable.

4.2 Discussion & recommendations – Methodology

4.2.0 Methodology

The methodology has evolved throughout the course of this project and is unlikely to be static in future. Current concerns refer in particular to the non-availability of certain key data (notably output, financial benefits, efficiencies), which arises chiefly from a lack of monitoring of domestic installations and commercial sensitivity for industrial ones. An important task of SEE-Stats in the coming months and years will be to highlight and address these difficulties. Some specific suggestions are given below.

4.2.1 Methodology – Solar thermal capacity & energy output

Due to a chronic lack of data on this type of installation, this project was not able to complete the methodology with regard to active solar heating systems. It is to be recommended for the future that a theoretical peak delivered power be based on a simplified calculation using the collector area (m^2) and overall system efficiency (thermal energy in tank ÷ solar energy input), as obtained from the manufacturer for the model in question. The irradiance used should be the SE regional average surface irradiance received (in Wm^{-2}). Due to the variability of this technology's output, it is further recommended that annual energy output be estimated on the basis of a comparison of heating bills for the twelve months preceding the installation and the 12 months after installation. All other things being equal, the year-long difference in energy use may be assumed to equate to the solar thermal contribution.

However, the feasibility of this will depend on the time available for data collection, the willingness of owners to provide the billing information, and the strategic priorities for the various technologies in SEE-Stats. It is anticipated that such detail on solar thermal will not be possible for the first stages of the initiative. TV Energy has made it clear that corresponding to SE priorities, the recording of small, low-impact thermal technologies, namely solar water heating, is to be minimised ad attention paid to larger, high profile schemes to kick-start meaningful take-off in the SE.

4.2.2 Methodology – Future larger scale industrial generators

Some aspects of the methodology will need closer attention when the expansion to the remainder of the SE and the expected growth in larger, commercial installations in the region. Examples include the validity of the 'financial benefits' and 'capital cost' fields, which are already considered inapplicable to industrial generators for reasons of commercial confidentiality. There may also be issues with energy output data; the experience so far suggests that larger commercial groups can be reluctant to provide this data. A way of avoiding such problems may be to adopt for example the 'Rule of Three' – to make it clear that a company's energy output data will be bundled with two others of the same order of output, making it impossible to identify an individual scheme's contribution. Another method to encourage transparency will be to give companies some benefit in turn other than the passive publicity afforded by their presence. It has been suggested,[62] for example, that a link to their website or a regular email update providing the latest information from SEE-Stats could change the potential perception that they are gaining nothing in return for their data.

4.2.3 Methodology – Statistical projections of capacity and jobs

Some consideration was given to the methodology surrounding the prediction of RE installed capacity, energy output, employment etc. in the SE. This feature, as presented in graphical form on the sub-regional statistical pages, will be the major contribution to fulfilling SEE-Stats' intended role as a strategic planning tool. It was noted that future projections can be based on either a complex algorithm involving many parameters, such as an item of economics software may provide, or on a cruder technique of simulating evolution by assuming the continuation of historical patterns. No software for modelling the growth of domestic and industrial renewable energy generation of the kind envisaged is known. Therefore projections based on short and long-term trends would have to be used.

The difficulty encountered with this approach was the lack of historical data to use, which is indeed the pioneering aim of SEE-Stats to provide. Local authority planning departments were approached for historical data on at least those RE installations requiring planning consent, but the few replies were negative, in that the frequencies were almost negligible (i.e. one or two in the past decade). It was therefore decided for the first stage of SEE-Stats that the best approach to projections would be the conditional approach. In other words, *if* (for example) two $1MW_e$ wind turbines, one small $5MW_e$ biomass CHP plant and ten $20kW_e$ PV arrays are installed each year for seven years, *then* installed capacity will grow by $7.2MW_e$ a year and the total in 2010 will be the present level plus 50.4 MW_e. A few contrasting scenarios could be hypothesised and this would focus the attention of policy-makers on the minimum requirements for installed hardware in order to achieve the region's targets.

[62] **Street, P./Black & Veatch (5 September 2003)**, personal communication

4.3 Discussion & recommendations – Website design

4.3.0 Website

The design of the website is almost complete, and the next step is to expand the content. This will mainly affect the sub-regional map page, the installation datasheets and the five statistics graphics pages for the SE and its sub-regions. Once data has been obtained for the rest of the region then these additions can be made. A decision on the ultimate design of the sub-regional (which had the lowest rating in the feedback survey) and statistics (the current design was only intended as temporary) pages will have to be made which takes into account the views of the expert survey respondents and TV Energy, not to forget the technical feasibility of the proposals. Five of these recommendations are given here.

4.3.1 Website – Changes to sub-regional page design

This was the aspect of the test website regarded with the least enthusiasm in the survey, 60% describing it a 'satisfactory but uninspiring'. As mentioned above, a design sketch has been produced suggesting the next stage of improvement to the SEE-Stats website. The chief alterations are to introduce the possibility of viewing installations on the map by the eight technology groups as well as by the five development status categories. The former would be represented on the map by the colour-coding shown, the latter as displayed by the shape of the symbols. Technology allowing, it is anticipated that all combinations would be viewed by selecting or de-selecting the appropriate icons either side of the map. These proposals are given support by 70% of survey respondents, said it would be ideal to view schemes by energy technology as well; the other 30% said it would be slightly more useful.

4.3.2 Website – Changes to regional and sub-regional statistics pages

The survey results show that of the choices given, the aggregated emissions displaced (90% approval) was the most popular statistic to include, followed by installed capacity, energy output and number of homes supplied (each approved by 75%). Employment data was wanted by only 60%; this low score may be attributable to a recognition (confirmed so far by the SEE-Stats data) that the present predominantly domestic/business-level deployment of RE sources makes the number dependent jobs fairly insignificant compared to other, more obvious benefits. However, in the impending phase of the sector's growth, employment will be a key socio-economic impact of RE as larger scale, commercial generation schemes in the of Slough Heat and Power are developed. This evolution is vital in order to meet the targets and move RE to a position where its undeniable environmental and socio-economic benefits can begin to have a significant positive impact on sustainability and quality of life in the SE.

One correspondent (see **Appendix G2**) suggested a table summarising the regional (and by implication also sub-regional) statistics alongside the graphics. This idea is to be welcomed and would be following what is BWEA's undoubtedly useful practice in their 'At a glance' data table (see **Section 1**). It is likely that an appropriate summary table on each statistics page would complement the charts, both visually and conceptually, providing both a quick reference and a sense of the context.

4.3.3 Website – Data request form

Following a suggestion by a professional attending the MSc presentation of this project in September,[63] the website is potentially an ideal data collection source. At present, visitors to the site are able to ask for more information or inform of projects via the TV Energy contact details, particularly email. If there were a form to submit the details directly from the site, it could cut down the administration time needed, while displaying the behind-scenes methods to the public and making the SEE-Stats experience even more open and interactive.

4.3.4 Website – Methodology

Similarly, it was intended from the start eventually to include a Methodology webpage, linked from every other page and particularly the homepage, to confirm that transparency and an understanding for the user's need for information both remain high on the SEE-Stats principles. The document called General Methodology (**Appendix E1**) was intended as a model for this, but requires text additions for explanatory purposes and more treatment of the qualitative methodology. A glossary or list of definitions explaining the technical terms, units etc. would also be helpful for users with less technical knowledge.

4.3.5 Website – Emphasis

In a more general vein, a perceived bias in SEE-Stats towards industrial generators, as noted by one correspondent (**Appendix G2**), is a consequence of the vital strategic drive to establish target-busting flagship schemes in the SE. It will still be important to give small-scale, domestic-level installations a stake in the website, in order to publicise and promote the broad range of RE activity. Interest for RE amongst the public will be increased by displaying what can be done closer to home. This can be started by the plan to add a second Featured Case Study exclusively for small home and business generation schemes, and the fact that most of the eventual datasheets will show small and medium-scale schemes.

4.4 Discussion & recommendations – Data collection

4.4.0 Data collection

The data for Thames Valley and Surrey installations is incomplete at the time of writing, with many contact replies pending. The least satisfactory aspect of the project has been the initial under-estimation of the time required to locate installations, identify their owners, access the appropriate information sources and obtain all the data finally. The next steps for the growth of the SEE-Stats database are outlined below.

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[63] **Foster, G./Carbon Trust (5 September 2003)**, personal communication

4.4.1 Data collection – Future avenues

More RE installation companies, manufacturers and suppliers are to be contacted regarding their past, current and future activities. The DTI 'Guide to Renewable Energy Centres in the UK'[64] is to be investigated following a suggestion after the September SEE-Stats presentation.[65] As noted above, a data request form is also to be posted on the website.

4.4.2 Data collection – Data clearance and confidentiality

As described in the collection procedure, it is important to gain authorisation for the installation datasheets to be published on the website. The data request email already makes clear that if obtained, confidential data will be held privately on the database. However, specific authorisation clearing the data as listed on the datasheet to be published must always be sought, and SEE-Stats must ensure that this principle is adhered to in order to ensure accuracy and integrity. By the same token the individual calculations used to find the installation data seen on the datasheet will be submitted to the owner, along with the explanatory general methodology which is to appear on the website. For these reasons the current databases (**Appendices D1, D2**) will be not present in the public edition because this clearance has not yet been obtained.

4.4.3 Data collection – Extension to the entire South East

Initiative partners from each of the other three sub-regions have been selected by TV Energy after a consultation with various bodies who could potentially take the role of installation data collectors for each of Kent, Sussex and Hampshire/Isle of Wight. It is intended that TV Energy retain overall control of the database, methodology and website and still coordinate the regional data collection. It is to be recommended that the personnel involved from each partner body be familiarised with the database, general methodology and website, in order to sharpen knowledge of exactly the type and level of detail of the data needed, and thereby avoid wasting time processing unnecessary information or later pursuing missing data.

Future updating – TV Energy anticipates at this stage that the SEE-Stats website be updated quarterly. It is considered that it will be possible, even with the approximate quadrupling of the number of projects due to the input from the rest of the SE. The initiative partners are unlikely to have personnel working full-time on data collection and so even in the first months of expansion, the data is likely to be of a manageable quantity. It is foreseen that advance liaising with the web designers will be crucial to ensuring punctual publication of updated information, given that they too have a tight timetable.

4.4.4 Data collection – Replication throughout the UK?

It would be feasible to transfer the SEE-Stats template to other English or UK regions. Its regional specificity makes it ideal, such as the regional averages for installation capacity factors, efficiencies and potentially also solar irradiance. Even if not adopted with precisely the same format and methodology, as the pioneering database/statistics

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[64] **Energy 21 (2002)**

[65] **Elliott, D./Open University (5 September 2003)**, personal communication

system SEE-Stats has the potential to influence other regions by stimulating their own efforts to record region's capacity and rival the progress of the SE, and secondly for its best features to be taken on board by later systems, perhaps in comparison with alternative future early regional database-statistics initiatives.

5 Conclusion

With reference to the objectives stated in this report's Introduction, the project has been largely successful. Almost complete data has been collected on 51 mainly operational RE installations in the Thames Valley and Surrey, as well as partial data on 33 planned or operational generators, and 46 purely prospective schemes. The datasheets for the first 51 are ready for communication via the online face of the map-database-statistics system, www.SEE-Stats.org. Specifically socio-economic data has a heavy emphasis in the system, accounting for a third of the fields.

The SEE-Stats system has arguably attained a skeleton stage in regional terms and is almost ready for expansion to the entire South East of England; indeed, much incoming data referring to generators in other sub-regions had to be filtered out. The exception to this readiness is the website, which due to technical funding reasons is limited to its current part experimental, part finished status pending a guaranteed regional financial backer.

It is believed that the methodology that has been formulated and applied is consistent, both internally and where possible with the external partner systems. It is also predicted that the content and presentation of the statistics will be useful and accessible provided the recommendations are consulted in the future development of SEE-Stats. The fulfilment this objective was aided by the attempted application of feedback from expert sources. and convenient to update and extend for its hosts, whilst upholding a technical rigour and accuracy.

Linkage with RESTATS has been established through the agreement of the methodology, in particular using Declared Net Capacity for intermittent energy sources, liaising closely with the RESTATS coordinator and acknowledging its 'paternal' relationship to SEE-Stats via the homepage link. The IEA Bioenergy Task 29 group contributed to the social and economic side by providing assessment of the impacts of RE in these fields, and served as a useful forum to discuss the development of SEE-Stats.

The project deliverable, in the form of the SEE-Stats website based on the database, is the most visible result of this project and it is to be hoped that readers will keep an eye on it and its future development.

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