Micro CHP Field Trial - Consultation

13th September, 2006

1. Introduction

The CHP Policy Group established that the residential and domestic market for micro-CHP, while still at the research, development and demonstration stage, may in the longer term provide a very significant opportunity for CHP growth if the new technologies under development are successful.
The Group considered that a field trial of these technologies would provide the information necessary to assess the potential of this market in order to contribute to decision making for longer term commercial deployment. On the basis of the findings of the CHP Policy Group, SEI is supporting an investigation into the viability of micro-CHP in the Republic of Ireland.

2. Project Objectives

The overall aim of the field trial is to contribute towards an assessment of the potential for micro-CHP, and to identify possible barriers, risks and benefits affecting the deployment of this technology in Ireland. The objectives of the micro-CHP field trial include the following:

Micro CHP Technology Objectives

- Gain direct experience of the installation and operation of the products;
- Appreciate the operating and maintenance cost for the units;
- Assess the performance of units, using metrics such as energy savings, environmental emissions, (principally carbon savings), and operating costs.

Policy Related Objectives

- Explore appropriate licensing, connection and network protection requirements and the appropriateness of existing guidelines;
- Explore the metering and charging options and consider which could be appropriate to micro-CHP;
- Assess the results in relation to future market potential;
- Assess the trial results in relation to possible future policy options.

3. Specific Outcomes and Design of Trial

The micro-CHP units will be installed in sites which are representative of the most likely market for the technology, domestic or commercial, being trialled. The sites will be selected based on the suitability of the heating demand for the micro-CHP technology in terms of magnitude and duration. This selection will be carried out in conjunction with manufacturers/installers, but it is thought that sites with a more constant heating demand are more likely to constitute the market for micro-CHP and will therefore be preferred for the trial.

3.1. Energy Use and CO_2 Emissions

A comprehensive suite of metering and monitoring equipment will be installed to allow the performance of the units to be evaluated. Data will be monitored in 5 minute intervals and will be downloaded monthly. The monthly data sets will be subjected to rigorous scrutiny and analysis to ensure that quality data is being obtained from each site. The key data recorded at the domestic and commercial sites will include:

- Gas usage by micro-CHP (corrected for temperature and CV)
- Micro-CHP electricity use and generation
- Site electricity import and export
- Micro CHP hot water flow and temperature
- Central heating hot water flow and temperature (where buffer tank is provided)
- Gas usage by boilers (where applicable)
- Voltage, power factor
- Temperatures (internal and external)

These data will be analysed to extract key performance indicators for the micro-CHP plant as follows:

- Ratio of heat output to gas usage (thermal efficiency);
- Ratio of electricity output to gas usage (electrical efficiency);
- Performance of existing gas boiler (commercial sites);
- CO_2 emissions from micro-CHP units.

3.2. Comparison with Alternatives

This basic data will then be used to compare the gas usage and corresponding CO_2 emissions with gas usage and CO_2 emissions from alternative sources of heat and electricity; that is a boiler and imported electricity.

In the case of domestic scale micro-CHP, the standard efficiency for domestic gas boilers has proven to be a contentious issue in the UK trials.

For this reason, the Carbon Trust are currently undertaking trials of condensing gas boilers using the same monitoring methodology as is used in the micro-CHP trials to provide a standard against which to benchmark the performance of domestic micro-CHP.

3.3. Condensing Boiler Trial

The possibility of conducting a parallel trial on condensing boilers in identical houses to those hosting the micro-CHP trial will be investigated. While it cannot be expected that different houses will have identical insulation levels, occupancy patterns or comfort levels it is considered that, by carrying out the micro-CHP and condensing boiler trials in identical houses, useful data for comparison of the performance of micro-CHP with condensing boilers will be obtained.

3.4. Demand Side Management

The potential of both domestic and commercial micro-CHP as a DSM tool will be evaluated based on the output profiles obtained from the trial. The possibility of clustering the six domestic scale units in adjacent properties to allow the net import and export from all six properties to be evaluated is being investigated.

3.5. Carbon Intensity of Electricity Generation

The output of micro-CHP tends to peak at periods of peak electricity demand. The output would therefore tend to displace generation from peaking plant rather than baseload or mid merit plant. The extent to which this affects the CO_2 balance of micro-CHP will be evaluated based on the output profiles obtained from the trial.

3.6. Metering Options

The trial will build upon previous work to assess the amount of electricity exported from micro-CHP and the metering options available to compensate the micro-CHP operators (householders) according to the value of the electricity exported in a cost effective manner. This is known to be contentious across Europe.

3.7. Electrical Connection and Appropriate Guidelines

SEI will work closely in co-operation with ESB Networks and the supplier-installer to assess appropriate arrangements for connection of significant numbers of potential future installations and the impact on system operability.

3.8. Performance and Reliability

An important outcome from the trial will be an appreciation of the performance and reliability of the units compared to conventional boilers. In the longer term this will have a significant impact on market potential.

3.9. Economic and Market Appraisal

The economic viability of micro-CHP will be evaluated based on equipment costs (which will be assessed in consultation with industry) and the cost of gas and the value of electricity generated by the units.

Industry views are sought on design of the trial and the specific outcomes expected as set out above.

4. Technologies and Scale

The proposed micro-CHP trial will contain both commercial (3-phase) and domestic (single-phase) units. A key lesson from the UK trial is that the commercial (3-phase) and the domestic scale (single-phase) micro-CHP technologies are not at an equivalent level of maturity in the market. For this reason the field trial of the commercial 3-phase technology will differ in structure to the single-phase domestic units.

The initial field trails will include:

- Single-phase domestic – 6 units.
- 3-phase commercial – 12 units.

SEI wish to trial products with a successful operational history and manufacturers/technologies will be invited to participate in the trial based on equitable and transparent criteria. Three letters of reference from companies or individuals with units installed in sites similar to those proposed for the trial will be required as the primary qualification criterion.

Additional criteria for evaluating the suitability of technologies being offered will include:

- Corporate CV.
- History of development of generic micro-CHP technology and the number of units installed.
- Number of units installed for specific product being offered.

The trial may comprise one, or more than one, domestic and commercial technologies. This will depend on the availability of units that meet the qualification criteria and the tenders received from supplier-installers.

Industry views are sought on the appropriateness of the scale of the trial and the qualification and evaluation criteria.

5. Host Sites

5.1. Commercial Sites

Host sites will be selected by the supplier-installer on the basis of general guidance from SEI and the experts group. Sites that are more likely to be conducive to the successful implementation of micro-CHP are preferred to sites where the performance would be more uncertain. Such sites would include small nursing homes and guest-houses. Key considerations include:

- User/host usage profile.
- Access to the natural gas network.
- The Dundalk Sustainable Energy Zone.
- Willingness to participate and grant access to data monitors.
- Geographical location. From a logistical and maintenance perspective it would be advantageous to cluster the installations in a few geographical locations.

The sites will have a contractual arrangement with the micro CHP supplier/installer and the supplier/installer will be responsible for providing technical support and maintenance for the units.

5.2. Domestic Sites

As the domestic micro-CHP industry and market is less developed than is the case for commercial scale units, it is planned that the supplier-installer should work in close co-operation with SEI in selecting the domestic host sites.

As the experience in the UK is that domestic scale units require a greater level of maintenance and management it is intended to cluster all six units in close proximity to each other.

SEI are currently in preliminary discussions with Local Authorities concerning the possibility of conducting the domestic trial in Local Authority housing. It is also considered that conducting the trial within the Dundalk Sustainable Energy Zone may yield advantages through synergies with other programmes (eg Demand Side Management) planned for the zone.

Considerations in selecting the sites include:

- Attractiveness of micro-CHP in terms of costs, revenues and payback.
- Appropriate heat load and usage profile (Domestic units work best with consistent heat load / daytime occupancy).
- Access to the natural gas network.
- The Dundalk Sustainable Energy Zone.
- Willingness to participate and grant access to data monitors .
- Possibility of clustering the units in adjacent houses and metering the electricity imported and exported from all six houses.

- Availability of 'matched pair' houses which would allow parallel condensing boiler trials to be carried out.

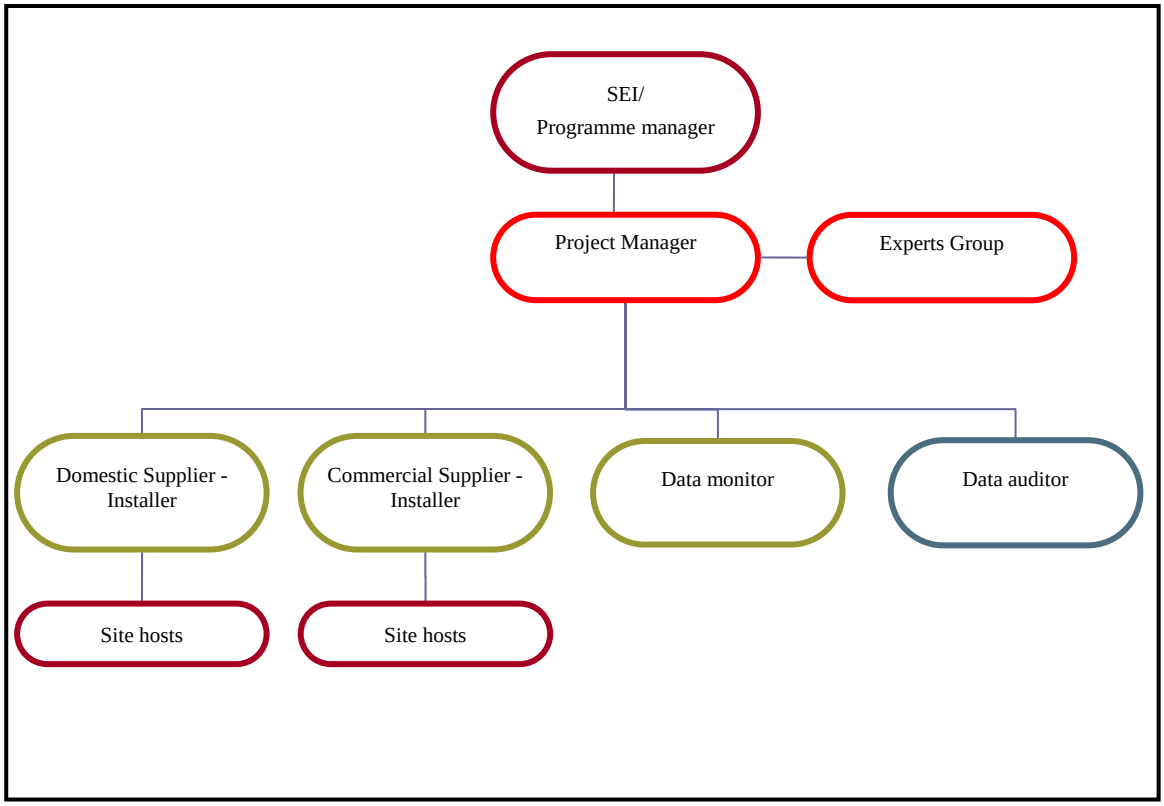
Industry views are sought on the approach to site selection and on the ability of the commercial scale industry to deliver suitable host sites.

6. Micro-CHP Project Team

The project will be conducted in three phases:

- Phase 1 – Project initiation and appointment of micro CHP team;
- Phase 2 – Installation of micro CHP plants, metering and monitoring equipment;
- Phase 3 – Data Collection, monitoring. analysis and evaluation. The data collection phase will run for two years.

The following chart outlines the structure of the project team.



SEI will enter into contracts with each service contractor:

- Equipment Supplier-Installers.
- Data Auditor.
- Data Monitor.

The following sub-sections provide a brief description of the tasks associated with each service contract.

6.1. Commercial Supplier-Installer

SEI plan to publish an invitation to tender for the supply, installation, maintenance and provision of technical support for twelve domestic scale micro-CHP units. The question as to whether the contract should be broken into lots (eg two lots of six) is presently being considered.

The commercial supplier-installer shall be responsible for:

- Suggesting candidate host sites for SEI's approval and liaising with SEI to find suitable host sites.
- Entering into a contract for the supply, installation and maintenance of micro-CHP units with the host sites or organisations.
- Liaising with the data monitor to facilitate the installation of the necessary instrumentation.
- Meeting minimum response times in the event of failure of the units. A (next working day) response time is suggested.
- Supplying and installing commercial micro-CHP units in host sites.
- Making good defects in the installations identified during testing and commissioning.
- Meeting the CER's and ESB Network's connection, switching and protection requirements and complying with the CHP Directive.
- Removal of the units and making good the host's premises where necessary at the end of the trials or the host's request.

6.2. Domestic Supplier-Installer

SEI plan to publish an invitation to tender for the supply, installation, maintenance and provision of technical support for six domestic scale micro-CHP units. It is recognised that the suppliers of domestic scale micro-CHP do not currently have a presence in the Republic of Ireland and that relationships between suppliers and installers will have to be established. Proposals from installers offering a domestic micro-CHP product would be welcome as would proposals led by suppliers but including a local installer and technical service base.

The domestic supplier-installer shall be responsible for:

- Liaising with SEI to find suitable host sites. (SEI are currently in discussions with Local Authorities concerning the possibility of trialling domestic micro-CHP in Local Authority housing).
- Liaising with the data monitor to facilitate the installation of the necessary instrumentation.
- Entering into a contract for the supply, installation and maintenance of micro-CHP units with the host sites or organisations.

- Meeting minimum response times in the event of failure of the units. A next day response time is suggested.
- Supplying and installing domestic micro-CHP units in host sites.
- Making good defects in the installations identified during testing and commissioning.
- Meeting the CER's and ESB Network's connection, switching and protection requirements and complying with the CHP Directive.
- Removal of the units and making good the host's premises where necessary at the end of the trials or the host's request.

6.3. Data Monitor

The data monitor's role will be to supply, install and maintain the meters and monitoring equipment required to measure and log all the parameters needed to produce the data for the evaluation of the units' performance. The data monitor shall:

- Provide a detailed design specification of the data monitoring equipment proposed for the host sites for consultation and agreement with SEI and the data auditor. (The metering and monitoring equipment will be required top meet minimum specified requirements).
- Liaise with the equipment supplier-installer to co-ordinate the installation of the micro-CHP unit and the monitoring equipment at each host site;
- Address and make good any defects identified during testing and commissioning of the instrumentation and ensure that the monitoring equipment functions according to the specification.
- Routinely (monthly) download the raw data monitored (pressures, temperatures, flows) and supply the data to the data auditor and SEI for analysis;
- Address any queries raised on the data in a timely manner and take action to correct any errors should anomalies or inconsistencies in the data become apparent;
- Periodically visit the site to physically inspect the meters and monitoring equipment and to validate the data being logged.

6.4. Data Auditor

The data auditor's primary role will be to advise SEI on the quality and independence of data provided throughout the trial. The data auditor will also be responsible for advising SEI during the pre-contract negotiations with the contractors to ensure that all contractors measure and report the data in a consistent manner. The data auditor shall:

- Assist SEI in developing the scope of work for the data monitors, equipment manufacturers and installers and deciding on the terms of engagement;
- Assist SEI in responding to queries and refining the scope of work for the data monitors, equipment manufacturers and installers;

- Liaise with the data monitor and the supplier-installer to ensure that data is monitored and reported in accordance with the Specification of Requirements (developed by the Carbon Trust for the UK trial) and to the same standard across the trial;
- Attend the testing and commissioning of the micro-CHP units and metering and monitoring equipment installed;
- Contribute to the development of defect lists for the equipment supplier-installer and the data monitor to ensure that the installations meet the specification and that the equipment is being installed consistent with the requirements of the trial;
- Produce reports to SEI on the findings of each audit;
- Audit and assess the data collected by the data monitor on an ongoing basis. This should include an evaluation of the data for each site and an assessment of the processes used to monitor, collect and report the data;
- Identify anomalies or inconsistencies in the data collected and liaise with the data monitor and SEI to find and correct instrumentation or systematic errors;

6.5. Host Sites

The hosts will be required to sign an agreement:

- Agreeing to facilitate the installation of the micro-CHP units and monitoring equipment.
- Agreeing to operate the micro-CHP and to notify the equipment supplier-installer and the data monitor in the event of a failure of the micro-CHP unit.
- Permitting access to their premises by the data monitor (and other parties as necessary).
- Permitting use of the data collected on their premises for analysis and publication in furtherance of the aims of the trials.

Industry views are sought on the roles of the different members of the project team and on the interfaces between the roles.

7. Project Funding

The new CHP grants programme includes a provision for micro-CHP trials. This budget will be utilised to procure the services and equipment required to conduct the trial.

Services

SEI will provide funding to procure the following discrete contract services:

- Project management, analysis and reporting.
- Installation of micro CHP and metering and monitoring equipment.
- Data Monitoring including the installation cost of the metering and monitoring equipment.
- Data Auditing;

Equipment

SEI will provide funding of up to 40% of the capital cost of individual installations, through a series of stage payments throughout the duration of the trial. The stage payments will be linked to milestones and deliverables as follows:

- Testing and acceptance of the units.
- Each two months of successful operation where the minimum response times specified are met.

Industry views are sought on the level of funding provided and the funding mechanisms.