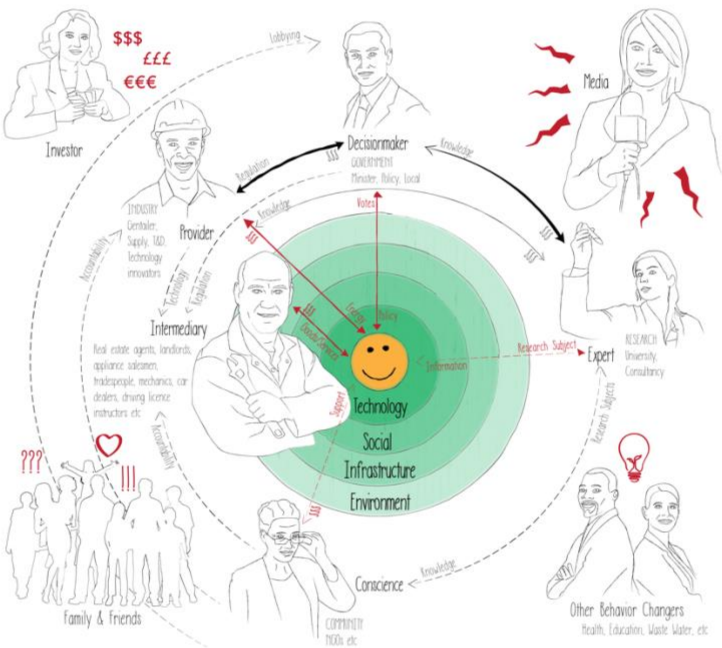
International Energy Agency
Energy Technology Initiative on
Demand-Side Management Technologies and Programmes



Subtask 11: Real-life case studies

Task 24 – Phase II
Helping the Behaviour Changers

Designing a Behaviour Change Programme for Hospital Facilities Staff

December 2017

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Contents

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Acknowledgements

We'd also like to acknowledge with special thanks the many people who contributed to the success of this programme.

At CHS, we'd like to thank (in alphabetical order): Audra Achiu, Jim Bishop, Larry Bost, Roger Boyington, Dale Burris, Jerry Bryson, Travis Carlton, Bill Collin, Kady Cowan, Danny Denis, Robert Dodson, Michael Dudish, David Fry, David Gagliardi, Thomas Grosso, Terrance Hood, Clarence Jones, Tom Kaufman, Emrick Kravec, Tim Ledgerwood, Jerry Merwin, Jeff Morris, Tyler Rains, Elizabeth Ratner, Michael Roberts, Joe Ross, Jen Sellers, Ron Smidt, Tim Thomson

External Task 24 workshop participants: Mark Brown (Accelerated Innovations), Ben Futrell (UNCC), Julie Hyde (Duke Energy), Mac McCord (Envision Charlotte)

Energy Summit evaluators: David Bligh, Robert Cox, Kathy Kuntz, Eric Mazzi, Mithra Moezzi, Paula Morgenstern, Sea Rotmann, Ed Rubinstein, Reuven Sussman, Eileen Westervelt, Linda Varangu

Executive Summary

The Carolina Healthcare System (CHS) is among the leading healthcare organisations in the Southeast United States and one of the most comprehensive, not-for-profit healthcare systems in the country, employing 62,000 people and 7,500 beds. In its commitment to energy management, efficiency and conservation, the organisation is pursuing strategies to decrease its energy use. The goal is a 20% reduction of 12 acute, rehab and long-term care hospitals' Energy Use Intensity (EUI) by end of 2017. One strategy to achieve this goal has been to implement a behaviour change programme called *Energy Connect* to encourage building facilities staff to integrate energy efficiency into their maintenance routines. Building operators account for a small percentage of people in each building, but have a disproportionally high impact on energy use. Therefore, changing their energy-use behaviours could dramatically reduce overall energy consumption.

A Novel Design Process

The purpose of this report is to describe the novel collaborative process by which *Energy Connect* was designed and implemented to allow other hospital and commercial building managers to implement similar programmes. The culture of energy use differs across any given region and, thus, no single programme can be equally applied in all locations. Therefore, this paper describes the approach that was used to create the programme, along with a description of the programme itself.
Energy Connect began when a new *Energy Leadership Council* was convened by CHS. In the following years, an out-of-the-box energy efficiency training programme was implemented, followed by a *Task 24* workshop, and eventually a three-day summit for experts and CHS staff to meet and discuss the programme. The out-of-the-box training programme was customised and changed to fit CHS's behaviour and culture change mandate, and the workshops and summit resulted in interventions and evaluation recommendations that were implemented by the sustainability director and others. The programme is still evolving and ongoing, with regular input being provided by an internal programme design team, and outside experts.

Training Programmes

CHS collaborated with the Sustainably Integrated Buildings and Sites (SIBS) Centre at University of North Carolina Charlotte (UNCC) to implement a pilot training programme with 15 volunteer facilities staff from seven buildings. This standard programme for any type of commercial building, named *Building Retuning Training*, is based on materials provided by the Department of Energy (DOE). Following initial experiences with the DOE training programme, the training was then modified to better meet the energy literacy needs of the frontline facilities staff. It was at this point that plans for the formal *Energy Connect* programme began to develop. The new training programme was designed to encourage frontline staff to integrate energy-saving checks into their daily routines, specifically checking equipment set points and resetting manual overrides.

Task 24 Workshops and Summit

The CHS Sustainability Director joined Subtask 11 of the IEA DSM Task 24 on behaviour change, in September 2016. This Subtask focuses on taking all the theoretical and practical tools developed by Task 24 over the last 5+ years, into actionable practice. The goal was to visualise the current 'energy system' in CHS, deciding on an *End User* group and behavioural issue to focus on, and then co-designing a pilot intervention with a group of internal and external experts, the so-called *Behaviour Changers*. It was informed by a survey and in-depth interviews with building operators and facilities management staff, which highlighted the baseline energy culture at CHS, as well as inefficiencies and barriers that needed to be addressed. The follow-up workshop was conducted a few months later, on the first day of the *Energy Connect* Summit.

The Summit was a three-day meeting during which the first day was a Task 24 workshop to design an effective behavioral intervention, and the second and third days were an evaluation meeting to design an evaluation that would complement the intervention. The Task 24 workshop was comprised of the CHS internal programme design team (15 CHS facilities staff members), and the evaluation meeting included a group of experts in energy management and social science research. By the end of the Summit, the CHS team had an effective plan to implement and evaluate the *Energy Connect* programme.

Goals

The goals of the programme set the parameters of the intervention and evaluation. They were to:

- Reduce energy use intensity
- Save money
- Empower building operators, mechanics, and engineers
- Positively impact patient experience
- Create a culture of energy savings

Broadly speaking, these were operationalised as:

- Empowering building operators to make energy-efficiency adjustments within their buildings,
- Implementing measurable behaviour interventions that yield predictable results,
- Creating a system-wide alignment for energy savings,
- Becoming a recognisable energy-saving programme across CHS,
- Helping all CHS teammates become aware of their own role regarding energy savings and act on that awareness, and
- Making the spectrum of energy actions visible and shift to a culture of conservation at CHS.

Intervention and Evaluation

Summit participants collaboratively determined five key interventions that would change operator behaviour and, ultimately, the culture of energy management at CHS. The five interventions that were chosen for this pilot focused on set-point adjustments in the building automation system. They were:

1. Create a system for tracking relevant adjustments/overrides in buildings.
2. Create a manual describing best practices/processes for addressing the most common maintenance issues.
3. Recruit Building Automation System champions. The two roles of the champions will be to (1) take responsibility for monitoring key performance indicators for their building, and (2) encourage others to take action to make their buildings more efficient (these roles may be designated to one person or divided between two people at each site).
4. Make energy data visible to site level staff with dashboards.
5. Educate non-facilities staff about the role of front line staff.

Through an iterative process of brainstorming and discussion, the evaluation team proposed 10 outcome measures that could be useful, attainable and persuasive for determining success of the programme. Each of these would be measured at different frequencies and different control groups. The proposed outcome measures were:

1. A logbook documenting adjustments made to building systems
2. Monthly billing data
3. Energy Use Intensity and Energy Star Scores
4. Measures of money spent on maintenance, equipment, labour and vendor calls
5. A collection of staff anecdotes about patient satisfaction with operators' building adjustments
6. Survey of operators to reflect on the Energy Connect programme
7. Survey of facilities staff about job satisfaction and knowledge of energy-efficiency savings
8. Survey of non-facilities staff
9. Interviews with energy champions, facilities directors, and senior managers
10. Attendance numbers at energy management meetings and training sessions

Preliminary Analysis

Preliminary analysis of results show that the *Energy Connect* programme is well on its way to achieving its goals. This highly collaborative, participatory action research approach has shown itself to be effective in helping programme managers. Pulling together a group of experts from multiple stakeholder sectors, who, together with *End User* representatives, can help co-design, implement and evaluate a successful behaviour change intervention is a productive method for creating a programme that can be scaled up across organisations. With ongoing evaluations and improvements, we anticipate that this programme will change organisational energy culture at CHS and lead to ongoing, sustained energy savings.

Background

The Carolina Healthcare System (CHS) is among the leading healthcare organisations in the Southeast United States and one of the most comprehensive, not-for-profit healthcare systems in the country, employing 62,000 people and 7,500 beds. In its commitment to energy management, efficiency and conservation, the organisation is pursuing strategies to decrease its energy use. One such strategy is implementing programmes that encourage building facilities staff to change their behaviour. The CHS behaviour change programme, *Energy Connect*, is an intervention that encourages operators to detect and act on energy inefficiencies within the buildings they are responsible for. Building operators account for a small percentage of people in each building, but have a disproportionally high impact on energy use. Therefore, if they were to change their behaviours, they could dramatically reduce overall energy consumption.

Energy Use at CHS Facilities

Since 2013, Carolinas HealthCare System (CHS) has strengthened the foundation of energy management through leadership, communication, training, and benchmarking. In the same year, CHS set a goal to reduce 12 acute, rehab and long-term care hospitals' Energy Use Intensity (EUI) by 20% before the end of 2017. At the time of writing, CHS has reached 17% EUI reduction three months before the deadline. Through systematic technical and process changes to increase efficiency and reduce consumption, CHS has saved a total of $8.8 million over the last four years.
The role of energy management at CHS is demonstrated simultaneously to frontline teammates and executive leaders. Energy reporting tools and resources, including monthly benchmarking reports and key performance indicators, have anchored the energy management programme and framed the energy conversation across CHS.

The strategic pursuit of the CHS reduction goal lead the organisation beyond infrastructure investments to attempting to shift energy-use culture within the organisation. CHS has thus implemented mandatory energy literacy training for building operator and facilities management staff, involved administrative and financial leaders in energy decisions, and raised patient and teammate awareness of energy use.

Baseline Indicators of Energy-Use Culture

Based on an initial survey of 113 facilities staff members at CHS, and 20 in-depth interviews with CHS employees at all levels of facilities service and management, we were able to get a sense of energy-use culture at the start of the Energy Connect programme.

According to interviewees, the biggest barriers to engaging in energy efficiency behaviours at CHS were lack of capital, technology that needed to be upgraded, a lack of understanding, and a lack of time. Interviewees disagreed on whether staff had the knowledge and skill required to implement energy-reducing measures. In the survey, respondents claimed that it was, on average, somewhat easy (Mean = 3.15/7, lower numbers are easier) to save energy using current equipment, and that they were somewhat familiar with energy consumption (Mean = 3.27/7, lower numbers are more familiar) and energy costs (Mean = 3.79/7) at their facilities. Interviewees and survey respondents suggested a number of potential measures for breaking down these barriers, but providing information or skills training was the most common.

Interviewees were interested in reducing energy consumption at CHS. As such, they indicated they were passionate about energy management and enjoyed solving energy problems. However, they also generally perceived that energy efficiency was a low priority for other CHS staff and that, although other staff could be made to care and change their behaviour, they would need more motivation, incentives and information in order to do so. They also generally believed that those in management or corporate positions (i.e. positions higher than their own) should be doing more to improve energy planning and use practices.

In addition to surveys with frontline facility teammates, over 20 interviews were conducted with corporate, and site-based energy and facility leaders across CHS. Based on feedback from these interviews, observations in the field and discussions with programme advisors, many insights have been collected about the current and potential energy-saving culture at CHS. Not dissimilar to other large populations[1], employees at CHS have poor perceptions of their energy habits, with the following four specific barriers being identified most often:

1. *Hierarchical culture in health care* resulting in slow decision-making, extreme risk aversion and silos of expertise. Regarding energy savings, we see evidence that building operators are not part of corporate decision making, meaning that those closest to the work do not get a say in how it is done. They can only restrict solutions from being identified or undo solutions that have been put into place.
2. *CHS does not value the skills* required to run the buildings and, as one interviewee put it, “we don’t hire technically-skilled people to run the complex systems installed.” In addition, facilities and maintenance staff who have been in their role for decades do not have access to skills training that would keep them up to date with the buildings they are responsible for.
3. *Willingness to fix problems is much stronger* than willingness to get it right from the start. At CHS we often heard “we can only consider first costs and if the payback is less than five years it can’t be done”. This condition encourages shortsighted quick fixes that, at best, maintain the status quo and, at worst, ultimately increase energy costs.
4. This also *cultivates a tolerance for short-term solutions*. Many building mechanics and operators describe their job as “putting out fires and juggling grenades.” A pre-requisite to achieving persistent energy savings is having the time to plan, test and reflect on new solutions. The current maintenance culture does not make time for such practices.

Goals of *Energy Connect*

The first and most important step in designing a behaviour change intervention programme is to determine its goals. These should be challenging but attainable, and they should be specific enough to permit measurement and evaluation. The primary goal of *Energy Connect* is to **save energy** by complimenting the traditional energy management already in progress at CHS. Lessons from *Energy Connect* will help CHS surpass its target of **reducing energy use intensity by 20% in 12 acute care facilities by 2017**. In addition, the programme aims to:

- Save money,
- Empower building operators, mechanics, and engineers,
- Positively impact patient experience, and
- Create a culture of energy savings.

To do this, the programme will:

- Empower building operators to make energy-efficiency adjustments within their buildings,
- Implement measurable behaviour interventions that yield predictable results,
- Create a system-wide alignment for energy savings,
- Become a recognisable energy-saving programme across CHS,
- Help all CHS teammates become aware of their own role regarding energy savings, and act on that awareness, and
- Make the spectrum of energy actions visible and shift to a culture of conservation at CHS.

[1] Attari et al (2010) Public Perceptions of Energy Consumption and Savings. PNAS 107, 37

Designing the *Energy Connect* programme

A Novel Design Process

Given the broad range of goals of the *Energy Connect* programme, and the complexity and size of CHS facilities, the *Energy Connect* founder, Kady Cowan, chose to use an unconventional strategy to design the programme. The strategy involved inviting experts in sustainability, energy management, engineering, anthropology, hospital and facilities administration and behavioural psychology to participate in an Energy Summit to collaboratively discuss programme design options (based on the model of Task 24 workshops[2]) with local facilities staff "on the ground." A parallel discussion about programme evaluation occurred with many of the same actors to create a protocol that was effective and accepted across the different parts of the organisation. In this way, the process of creating the programme itself helped achieve one of the programme goals – creating a culture of energy awareness. It is based on 'Design Thinking' which is a problem-solving technique using experimentation and evidence, and begins with a deep understanding of the needs and motivations of people within the organisation.[3]

Energy Connect also borrows from the 'Collective Impact Approach,'[4] which has been widely tested by social entrepreneurs (Kania and Kramer, 2011). It is the underpinning framework, together with the 'Task 24 Behaviour Changer Framework' (Rotmann, 2016), utilised and analysed by Task 24 during field research trials.[5] The main theory behind these frameworks is that any systemic change programme will greatly benefit from being designed, implemented and evaluated collaboratively, rather than by only one agent or organisation. Another distinguishing characteristic of working in this way is that these methods deeply support user-centred outcomes and help participants imagine possible alternate futures. This is augmented by the diversity of viewpoints and work styles of participants at the Summit. Both the participants and workshop leaders approached energy efficiency and behaviour change programme evaluation from a broad range of perspectives, including systems-level thinking, developmental evaluation, randomised control trials, qualitative methods, quantitative methods, and others.

The Timeline of Programme Development

In 2015, a CHS *Energy Leadership Council* was convened with representatives from corporate energy management, facilities management and the sustainability office. The council was instrumental in stewarding energy-savings projects for CHS and served as the first *Energy Connect* team tasked with designing the programme.

The early root of the *Energy Connect* programme began in 2016 as an out-of-the-box training programme developed by the U.S. Department of Energy (DOE) called *Building Retuning Training.* Dr. Robert Cox from University of North Carolina Charlotte (UNCC), along with a multidisciplinary design team, further developed and modified this training to eventually become a keystone element of *Energy Connect*. The details of this process are described later.

In October of 2016, Dr. Sea Rotmann held an initial *Energy Connect* Task 24 workshop to help further inform the *Energy Connect* design process. During the workshop, participants determined the *End User* group (building operators) and top themes to consider during a more detailed experimental implementation of the programme.

In early, 2017 the first three-day *Energy Connect* Summit was held to more formally design and develop the programme. The first day involved another Task 24 workshop to work with facilities staff and management in designing an effective behaviour change intervention strategy, based on the top themes that emerged during the first workshop. During the second and third days, Dr. Reuven Sussman led an expert workshop to create recommendations for programme evaluation.

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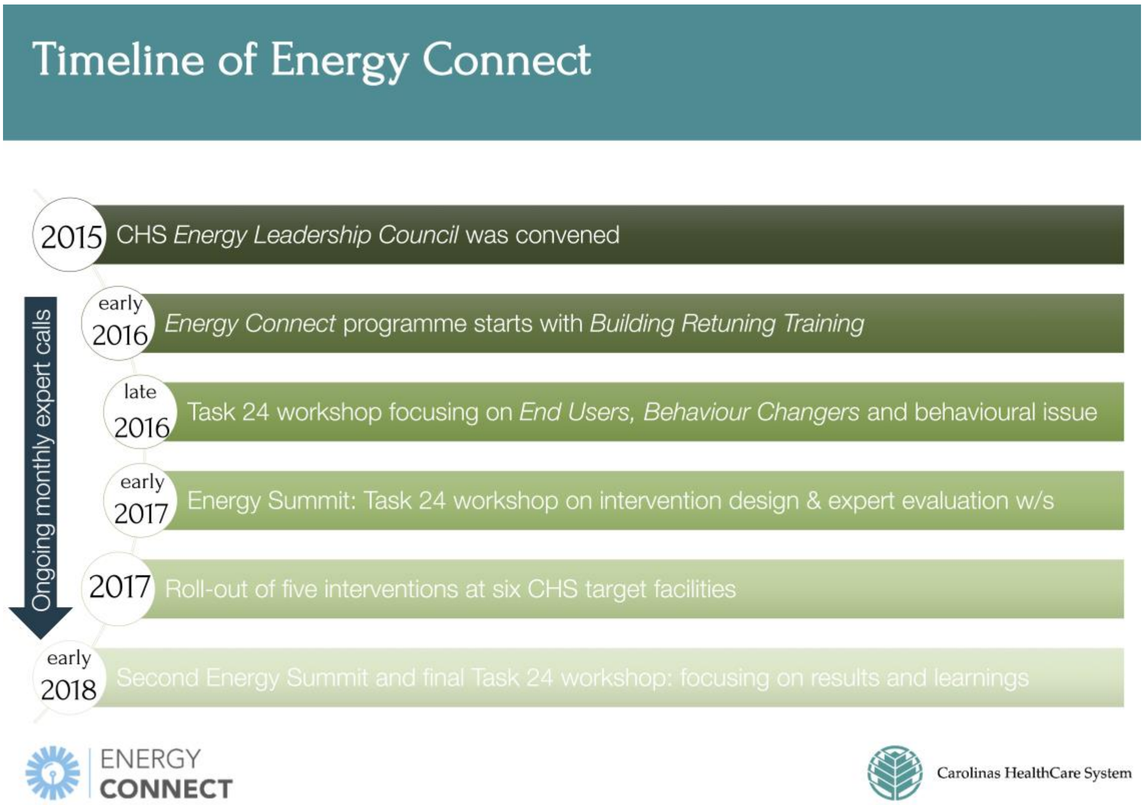
[2] See http://www.ieadsm.org/task/task-24-phase-2/#section-8 for Workshop minutes and outlines

[3] https://www.ideou.com/pages/design-thinking

[4] http://www.collaborationforimpact.com/collective-impact/

[5] Detailed in Rotmann (2016): http://www.ieadsm.org/wp/files/Rotmann-BEHAVE-2016.pdf and Cobben (2017).

These workshops were preceded by monthly phone calls with the experts, during which the group commented on the proposed programme elements and format of the workshop itself. They also reviewed and commented on preliminary information before arriving at the workshop, in order to maximise the efficiency of the in-person interaction time that was available. In the year following the workshop, this panel of experts are continuing to participate in monthly calls to discuss progress on the programme and provide guidance on how to respond to ongoing design and implementation issues. The phone calls facilitated important communication opportunities as well as establishing a sense of cohesion and social bonding between group members that helped improve working relationships on site during the workshop.



Objective of This Report

The objective of this report is to describe the novel, highly collaborative process of development and design that was used to create *Energy Connect*, and present the recommendations that came out of this process. We aim to provide a description of the CHS experience so that other healthcare organisations, as well as the international energy community, can learn from the experience and create their own effective behaviour change programmes. Although no single programme will be applicable in all healthcare facilities, the process used to develop the programme can be transferable – including to other large-scale commercial buildings managed by building operators.

Early Development of *Energy Connect*

Building Retuning Training

In May 2016, CHS collaborated with the Sustainably Integrated Buildings and Sites (SIBS) Centre at University of North Carolina Charlotte (UNCC) to implement a pilot training programme with 15 volunteer facilities staff from seven buildings. This programme, named *Building Retuning Training*, was a standard programme for any type of commercial building and is based on materials provided by the Department of Energy (DOE). Kady Cowan, founder of *Energy Connect* and Director of Sustainability at CHS, with Dr. Robert Cox, Director of the SIBS Center at UNCC, modified the training programme based on initial experiences with those volunteers. This modification started with a “discovery” phase, followed by a “sense-making” phase.

Through building relationships, this ‘discovery’ phase of deepening the understanding of the needs and motivations of people was easier to complete. Initial surveys of facilities staff, focus groups, observations and interviews provided the raw data to root the design process. Participants who completed the initial survey and had less than six years of experience were significantly less confident about their ability to recognise energy-efficiency opportunities than those with more experience (in general, respondents to the baseline survey had a great deal of experience doing maintenance work; usually over five years). Most survey respondents and trainees agreed that training should happen annually (as opposed to quarterly or semi-annually), and should last only one to three hours. Informal or instructor-led sessions were generally preferred. Survey respondents wanted the training to cover HVAC, lighting, and alternative energy sources. They also provided specific suggestions for energy efficiency and HVAC upgrades that CHS could implement.

A key insight from the first year of energy training for facilities staff was their interest in learning. Facilities staff as a whole do not have access to subject-specific training very often. We found that most trainees were exposed to energy management for the first time. In addition, the *Energy Connect* training programme helped familiarise them with the basics of the controls, sequences and mechanical equipment.

The next design phase was sense-making, in which the designers narrowed down what was learned into themes and patterns. Based on the research and initial experiences with the DOE training programme, the training was modified to better meet the energy literacy needs of the frontline facilities staff. It was at this point that plans for the formal *Energy Connect* programme began to develop. The new training programme was designed to encourage frontline staff to integrate energy-saving checks into their daily routines, specifically checking equipment set points and resetting manual overrides. The same volunteers then participated in the newly redesigned *Energy Connect* training programme and provided a second round of feedback.

Initial Task 24 Workshop[6]

The Energy Leadership Council, in conjunction with site-based facilities leaders, were invited to participate in the first Task 24 workshop in October 2016. This workshop created a visual overview of the current system and all its players, using the *Behaviour Changer Framework* of Task 24. For detailed descriptions of the Task framework, its step-by-step process and actor types, see Rotmann (2016) and Rotmann (2017). The internal and external ‘Behaviour Changers’ at the workshop included hospital *Decision Makers*, Energy *Providers*, Research *Experts*, *Middle Actors* such as facilities staff, and the *‘Conscience’* (Kady Cowan and her team of sustainability professionals). These participants undertook a collaborative visualisation process to consider possible energy efficiency behaviours and intervention strategies. They then focused the conversation on top themes to consider during a more detailed experimental implementation of the programme. When these top themes were discussed in collaboration, it became clear that **set-point adjustments in the Building Automation Systems (BAS)** should be the main behavioural focus of the experiment. The experimental mind-set allowed the design team to test ideas while rapidly evolving them into tangible actions based on real-time feedback.

[6] Detailed workshop minutes can be found on http://www.ieadsm.org/task/task-24-phase-2/#section-8

Fig 1. Some of the Energy Connect *Behaviour Changers in front of the Task 24 "Behaviour Changer Framework"*

The group discussed the multiple benefits and co-benefits that each *Behaviour Changer* could experience following a successful behavioural intervention. In addition, the group used Task 24 storytelling tools[7] to tease out the different stories and perspectives of the *Behaviour Changers*. All of this helped create empathy and understanding between the different actors and their sometimes-conflicting mandates. It also provided an overview of the different tools that each *Behaviour Changer* would bring to the intervention.

Energy Connect Summit

Expanding on its roots as a training programme, the *Energy Connect* Summit in February of 2017 was then used as a launch pad for creating new programme elements (beyond only training), and planning an evaluation strategy. The summit attendees provided guidance for how to expand and monitor progress of the *Energy Connect* programme.

[7] Rotmann (2017): http://www.sciencedirect.com/science/article/pii/S2214629617302049

Intervention Design Workshop

On Day 1 of the *Energy Connect* Summit on February 8, 2017, Dr. Rotmann led a workshop to collaboratively develop potential interventions that could comprise the *Energy Connect* behaviour change programme. Dr. Rotmann led the workshop as part of the IEA DSM's Task 24 research programme, which is the first global research Task focusing solely on behaviour change in energy.[8] This workshop built on the insights from the October 2016 workshop (discussed above).

The attendees at the *Energy Connect* design workshop were largely internal CHS staff, along with Dr. Robert Cox and Ben Futrell from University of North Carolina Charlotte, who had long-standing insights into CHS' buildings and energy programmes. Similar to the initial Task 24 workshop, the attendees represented the 'Behaviour Changer Framework' actor types: *Decisionmakers* in charge of hospital facilities; *Providers* in charge of the hospital energy plants and building automation systems; *Experts* both internally and externally in charge of analysing and evaluating the system; *Middle Actors* who work with the Building Operators in Energy Teams; and the *Conscience*, Kady Cowan's sustainability team, driving the process. There was also an *End User* (i.e., Building Operator) representative at both the design and evaluation workshops. The attendees were recruited in part from the original training programme.

The design workshop used the World Café method to collaboratively identify behaviours and strategies to track BAS set-point adjustments by Building Operators at CHS. The purpose of this *Energy Connect* pilot was to encourage operators to **check and maintain set points on building HVAC systems** (and other energy-using systems) as part of their normal routine. HVAC set points can sometimes be temporarily adjusted and, if these overrides are not reset, these adjustments may last months or years. This can result in significant wasted energy as well as compensatory behaviours by occupants, such as space heaters, that further compound the problem. In some cases, operators may even change the temperature in the central air distribution system in response to a set of small problems in patient rooms. Such a change can cause patient room and office systems to simply reheat the cold air being fed from the central system. This issue causes significant energy waste and, in the experience of the authors, such issues are relatively common.

Specific Activities of the Intervention Design Workshop

Visualising the Energy System by Revisiting the "Magic Carpet" Exercise

The workshop started with a visualisation exercise in which participants were led through the October 2016 *Behaviour Changer Framework* (also dubbed "the magic carpet") exercise. The purpose was to introduce or re-introduce everyone to the overall system and each of the players, with their varying mandates, stakeholders, restrictions and tools. It also helped elucidate their relationships with one another and the building operators, who were the *End Users* whose behaviours were targeted in this scenario. The result was a spirited discussion updating the original framework with further insights and information. This exercise provided the background to the more in-depth design discussions (below).

World Café Sessions

A World Café[9] is a simple, effective and flexible format for large group dialogue, with 4-5 person groups discussing key questions and creating valuable insights. Participants were asked to react to four different common scenarios around overriding BAS set-points. These were created based on insights developed during *Energy Connect* training and surveys.

- Scenario 1 – Check building schedules for overrides
- Scenario 2 – Complaint triggers
- Scenario 3 – Task priorities
- Scenario 4 – Work orders

[8] www.ieadsm.org/task/task-24-phase-2/

[9] http://www.theworldcafe.com/

The result from each scenario was summarised by each group and presented to the rest of the team. Each scenario was then discussed and each member of the group voted on which one/s they most thought should be chosen as the final scenario for which an intervention would be designed. Ultimately, this process revealed in-depth issues and barriers pertaining to each scenario, and ended with ranks assigned to the most preferred, highest opportunity/lowest risk interventions. The issues and barriers were then discussed with a second group of key CHS staff, who further elaborated and fine-tuned them.

Fig 2. The CHS Behaviour Changers *discussing 4 scenario options in groups*

Five Recommended Intervention Strategies

The outcome of the Intervention Design Workshop was a series of five recommended interventions that would save energy, save money, positively affect patient outcomes and create a culture of energy savings among building operators. Five specific Intervention Strategies were recommended:

1. Create a system for tracking relevant adjustments/overrides in buildings.
2. Create a manual describing best practices/processes for addressing the most common maintenance issues.
3. Recruit Building Automation System champions. The two roles of the champions will be to (1) take responsibility for monitoring key performance indicators for their building, and (2) encourage others to take action to make their buildings more efficient (these roles may be designated to one person or divided between two people at each site).
4. Make energy data visible to site level staff with dashboards.
5. Educate non-facilities staff about the role of front line staff.

Telling a good story

Lastly, another storytelling and future visioning exercise rounded out the workshop. These exercises helped the Behaviour Changers understand their parts in the overall intervention, and create a narrative about how and why it would positively benefit their main stakeholders. Future possible headlines in the *Charlotte Observer* were used to envision the communication of a successful outcome of this pilot. Some of the stories and how this process came about are described in Rotmann (2017).

Evaluation Workshop

The evaluation workshop of the Energy Connect Summit took place over two days (February 9-10, 2017). It included 13 volunteer advisors from across North America and abroad, with expertise in hospital energy efficiency, programme evaluation, social science research, and behaviour change interventions.

The programme began with a tour of one facility and a discussion with CHS operators and managers about the culture of energy use, as well as the physical energy systems, within the organisation. The group was then briefed about the behaviour change intervention strategy developed the previous day in the workshop hosted by Dr. Rotmann. Using small breakout groups and full-group discussion, the team then considered the range of potential outcome measures and research strategies that could demonstrate that the intervention met its stated goals. Each breakout session involved four to five groups, with four to six members in each. Groups brainstormed ideas amongst themselves and wrote them on large whiteboards. They then came together to present the results of their discussions to the larger group in order to further narrow down the most successful path forward.

Fig 3. Energy Connect *Summit panellists on a tour of a CHS facility*

The larger group began by broadly considering a wide range of potential outcome measures and research designs, and then narrowed down the options based on **feasibility, usefulness, and credibility**. The evaluation group then presented the options to members of the CHS Energy Leadership team (consisting of facilities operators and managers) to solicit additional comments on their feasibilities.

Determining the Top Recommended Evaluation Strategies

Small breakout groups independently brainstormed ideas for (1) outcome measures, and (2) evaluation designs.

Outcome Measures

The group started by brainstorming all possible outcome measures that both addressed the goals of the *Energy Connect* programme and tested the effectiveness of the specific intervention elements. Next, the breakout groups attached frequency and timing of measurement to each potential outcome. The groups further rated trade-offs in each measurement on the dimensions of usefulness, accessibility (ease of acquisition), credibility to building operators, and credibility to management. Finally, all participants voted publicly on which measures they thought would be “best overall.”

The session moderator, Dr. Sussman, combined notes and ratings from all of the groups' discussions to prepare a series of 10 recommended outcome measures that could be used to evaluate the programme. These were:

1) A logbook documenting adjustments made to building systems
2) Monthly billing data
3) Energy Use Intensity and Energy Star Scores
4) Measures of money spent on maintenance, equipment, labour and vendor calls
5) A collection of staff anecdotes about patient satisfaction with operators' building adjustments
6) Survey of operators to reflect on the Energy Connect programme
7) Survey of facilities staff about job satisfaction and knowledge of energy efficiency savings
8) Survey of non-facilities staff
9) Interviews with energy champions, facilities directors, and senior managers
10) Attendance numbers at energy management meetings and training sessions.

Research Designs

The Summit participants divided themselves into subgroups to discuss potential evaluation designs that could best suggest that the intervention *caused* a change in energy savings, cost savings, positive patient experiences, and empowerment of building operators to make energy-efficiency adjustments change in behaviour (and ruling out alternative explanations). This can be difficult within the constraints of a real-world field test of a programme with many interconnected elements. The combined expertise and differing backgrounds of Summit participants were instrumental in this aspect of the intervention design.

Recommended Designs

The participants recommended several research designs for the variety of proposed outcome measures. For energy use and energy cost data, the group recommended using matched control buildings for comparison, as well as USA-wide databases, such as CBECS or nation-wide Energy Star™ ratings databases. Building energy use and cost data could also be compared longitudinally over time to determine if historical use is higher than current use (after the intervention). The participants identified several limitations and potential concerns with using each of these approaches, but stressed that, together, these designs could determine if the intervention is likely to have caused the desired changes. The participants also agreed that if resources were available a formal energy model could be beneficial. For survey and interview data, participants recommended a patchwork of both within- and between-subject designs. Primarily, surveys and interviews would be done with the same respondents before and after the intervention but, in addition, respondents' answers would be compared to similar participants in non-intervention locations.

Implementing and Evaluating

Design team

An essential component of the energy behaviour programme was the convening of a committed design team. The purpose of the team was to help decide on early elements of the programme so that the energy behaviours would complement the traditional energy management work already in progress, such as retro-commissioning and operating room ventilation schedule set-backs. Members on the design team include individuals responsible for energy management at the corporate and facility level. With the assistance of the design team, six target facilities (of 11 that were originally considered) were selected for the *Energy Connect* pilot. Energy cost data, ENERGY STAR™ scores and Energy Use Intensity measures (kBTU/SF) were summarised for these pilot sites. Prior to the rollout of *Energy Connect*, these metrics did not show clear increases or decreases in energy use.

Intervention

Armed with recommendations developed at the *Energy Connect* Summit, as well as access to a network of motivated outside experts who participated in the Summit, Kady Cowan began working with her team to develop, implement and evaluate the planned interventions immediately. Given the limited available resources, and the need to be efficient, interventions are currently being rolled out one at a time across different sites. Despite including "on-the-ground" staff in the discussion of potential interventions, unforeseen implementation challenges were expected.

Getting the attention of the facility leaders at the six test sites was not difficult. All facility leaders were interested and willing to implement *Energy Connect* and are eager to see energy savings at their sites. In five of six pilot sites, the *Energy Connect* implementation began with the UNCC introduction to energy management and building operations five-week course. Frontline facilities staff were introduced to some of the conceptual and technical aspects of energy management with a sharp focus on systems and actions they have control over such as the Building Automation System. At the same time, they were introduced to other elements of the *Energy Connect* programme and CHS energy management in general. Intervention Strategy #4 (i.e. energy data sharing) was introduced early as a feedback tool. Trainees were invited to consider becoming energy champions for their sites to help their teammates continue to think about and act on energy-saving ideas after the training was complete. Strategies for responding to comfort complaints (Intervention Strategy #2) were introduced and in some cases used as a class activity to build the energy-saving problem solving skills the facilities staff need. Toward the end of the five-week class the group collectively started to map out a simple energy management plan for the site so they could see progress and plan for the future.

In 2017, the initial phases of *Energy Connect* have been very iterative. We asked for and responded to the feedback from our target *End User* audience and their managers as it was provided. The *Energy Connect* design team have been making course corrections along the way to improve the delivery, acceptance and relevance of the programme to our main users, building mechanics and operators.

The *Energy Connect* Summit resulted in several proposed interventions, each with its own successes and barriers. As part of the implementation process, Kady Cowan consulted her team and a group of outside experts (former Summit delegates) to determine how best to modify, improve or correct the intervention in order to maximise its effectiveness. The two interventions that have been most challenging to implement are documenting adjustments in the system and educating non-facilities staff about energy savings. The table below summarises the five interventions, along with the successes, barriers and revisions that were made to it.

Table 1. The five Energy Connect *interventions, successes, barriers and revisions*

Original Intervention	Successes	Barriers	Revised Intervention
Create a system for tracking relevant adjustments/ overrides in buildings	- Universally agreed very important - Successfully implemented at a limited number of sites	- Diversity in knowledge about what to track - Diversity in common tools used for tracking (print, online)	No revisions
Create a manual describing best practices/process for addressing most common maintenance issues	- Process flow in place at all test locations - Seen as generally useful for helping to remember all steps	- Getting feedback from the frontline on the tool - Frontline perceive they are doing all the steps all the time	Simplify manual to just standardised hot/cold call process flow
Recruit Building Automation System (BAS) champion(s) who are knowledgeable about key performance indicators	- Frontline and their supervisors love this idea - Hosted first champion event in October 2017	- Getting the programme developed quickly to capitalise on the frontline enthusiasm	Recruit *Energy Connect* Champions who have an interest in energy savings and coaching mind set
Make energy data visible to site level staff with dashboards	- First time many actors have seen energy data for their facility on a regular basis - Frontline staff are getting familiar with the data and know what to look for	- Getting the energy data in a usable (simple) format - Getting the energy data in a timely fashion	Energy data sharing with a monthly flyer
Educate non-facilities staff about the role of front line staff	- An effective pathway to open dialogue between operators and occupants to solve energy problems	- Challenging to get the occupants' attention on energy topics	Energy conversations and feedback between operators and occupants to support the perception of Operators as energy experts

Training Curriculum

The findings from the activities to date demonstrate that operators are best empowered by offering a multi-stage training programme. Survey results have shown that frontline facilities staff have a variety of different experiences. During the initial pilot offerings of the training programme, the team discovered that very few operators have the prerequisite knowledge required to understand the higher-level technical concepts found in the DOE's *Building Retuning Training*. In 2018, we are thus planning to offer a training curriculum focused on developing three sets of expertise:

1. *Energy Literacy*: As a first step, all frontline facilities teammates will receive basic energy literacy training. This training will have two broad focus areas. First, teammates will be educated on basic concepts in energy management, including the meaning and significance of metrics such as *Energy Use Intensity* (EUI) and the differences between demand and consumption. A goal of this activity is to introduce all frontline staff to the data provided as a part of Intervention Strategy #1 (i.e. creating a system for tracking adjustments). Second, teammates will be exposed to basic energy-related concepts encountered by entry-level individuals in their day-to-day activities. This includes a basic introduction to different lighting and HVAC systems. It also, however, introduces elements of Intervention Strategy #2 (i.e., a manual for common maintenance issues). Most specifically, many frontline staff spend much of their time responding to patient or staff comfort complaints or replacing failed lights. These small actions have an impact on energy consumption, but operators have no formal training to help them understand those implications. For instance, operators responding to a comfort complaint may lower the set-point when a patient is hot rather than going through a troubleshooting process to recognise that a heating valve is faulty. A major goal of the initial training is to

standardise the response to these day-to-day issues and to help understand the impact these small issues can have on creating unintended energy waste.

2. *Understanding and Optimising Air-Side Energy Distribution*: More advanced operators will be offered the opportunity to learn how to optimise energy distribution throughout the hospital. In this more advanced training, attendees will learn about HVAC controls and how these can be used to optimise energy distribution in the building. Most of the hospitals in the CHS system use central energy plants that distribute hot water, chilled water, and steam to air handlers within the main hospital. Since most operators are concerned with activities inside the hospital rather than at the central energy plant, we decided to first focus on the air-side distribution systems. The primary goal of this training is to have operators understand how patient and operating room systems interact with the main air-distribution system. Operators learn basic concepts from building retuning so that they can spot opportunities to save. Examples include learning how to spot opportunities to increase air temperature or reduce fan speeds, both of which can have significant energy-savings impacts. During this training, we will be working more formally to develop Intervention Strategy #1 (i.e., logging overrides). We believe that operators who are more knowledgeable about system operations will be best equipped to understand which overrides have significant energy impacts. As such, the trainees will be the “energy champions” identified as part of Intervention Strategy #3.
3. *Understanding and Optimising Water-Side Energy Distribution*: In this case, more advanced operators would again be exposed to concepts required to optimise central energy plants. The format would be similar to that of the air-side training.

During 2018, this programme will be launched at the flagship hospital in Charlotte, North Carolina. Frontline staff will receive initial knowledge assessments but all operators will be given the opportunity to experience the energy literacy training. Through a deeper assessment process, several operators will be identified for the Level 2 and 3 trainings. Work with these operators will be in small one-on-one settings. The energy literacy training, however, will be done in a large group and will involve a combination of hands-on and classroom instruction. Once these trainings are fully functional, annual refresher courses will be developed and offered. Such a rollout will begin in late 2018 or early 2019.

Evaluation

Using the group’s recommendations for evaluating *Energy Connect*, Kady Cowan has begun collecting data and preparing it for analysis. Given the large number of outcome variables, not all of the outcomes that were initially recommended have been measured to date. Rollout of the evaluation is happening in tandem with programme rollout, and monthly check-in calls with the expert Summit evaluators help to keep the project on track in the face of emerging challenges.

Multiple benefit metrics

Tangible co-benefits of the *Energy Connect* programme were predicted by the designers, users and evaluators from the very beginning. Some are easy to track and measure while others are more elusive and incremental. For example, we anticipate that frontline facilities staff will begin helping to generate ideas for how CHS can save energy. We also expect that individuals will attempt to implement energy-saving solutions on their own, and that awareness about energy savings and energy literacy will increase. Additionally, accountability for energy decision-making may increase alongside willingness to discuss energy savings internally and externally with vendors. Indeed, we have collectively noted preliminary evidence of these shifts already occurring since the start of the programme. Formal review of multiple benefit metrics such as vendor maintenance calls is ongoing to determine if the smoother operations derived from *Energy Connect* impacts maintenance costs. In addition, occupant complaints from work orders and standard hospital patient surveys are being analysed to determine if there is a correlation between *Energy Connect* and increased comfort and reduced complaints.

Discussion and recommendations

Areas for Improving the Design Process

The novel approach for designing *Energy Connect*, including convening a group of experts and staff into a highly collaborative design exercise, was effective and could be applied as a model for other similar institutions. Indeed, at the end of the evaluation workshop, participants were asked to complete a short evaluation of the Summit and participants gave extremely high ratings to all aspects of the Summit (mean ratings of >6 out of 7). Participants frequently commented that the greatest strengths of the summit were (1) including great people with diverse perspectives, (2) including good hospitality and planning, and (3) including CHS staff participation. Nevertheless, they also commented that the programme could be further improved in several ways as well.

A few participants suggested that the initial goals of the Summit were too ambitious, and that the group occasionally got too far along tangential topics. These were minor areas for improvement as opposed to fatal flaws in the process. Likely, the biggest area for improvement would be in the overlap of design and evaluation workshops during the Summit. If members of these two groups were more involved in each other's discussions, then there could have been more efficient cross-pollination of ideas. The expertise and ideas of outside energy efficiency and behaviour change researchers compliments the local understandings of the CHS context by CHS facilities staff. The times during the Summit in which participants visited each other's workshops were possibly the most productive and, therefore, expanding this facet of the Summit could be beneficial.

Overall, the Summit and developmental process for designing *Energy Connect* has been highly effective. A follow-up Summit is being planned for March 2018, during which participants will look back on implementation and evaluation of the programme during 2017, and how the programme may be improved or expanded for 2018.

A Blueprint for Developing a Behaviour Change Programme

Key Elements necessary for success

The CHS *Energy Connect* design process involved several interlocking elements that, together, gave rise to an effective plan. These are (1) a dedicated leader, (2) inclusion of relevant staff and management from the start, and (3) a panel of outside experts.

A dedicated leader is possibly the most essential element of the process because without the leader guiding and pushing forward the plan, the other elements cannot be brought into the fold. A leader with resources and time specifically allocated to working on this project helped move the process forward immensely. The leader, Kady Cowan, was instrumental in recruiting outside experts and involving staff and management. Furthermore, it was her vision that inspired the programme and continues to provide a general guiding direction. The first consideration for organisations interested in implementing behaviour change programmes should be hiring an effective leader and providing him or her with sufficient resources.

Including relevant staff and management in the programme design process is important for maximising the programme's effectiveness. Programmes that are perceived as forced onto staff or management, without consultation or buy-in, are unlikely to be effective. Although the programmes may get implemented, they will not be endorsed by those who matter, and this could undermine their effectiveness. An important goal of *Energy Connect* is to create a collaborative culture of energy efficiency and, therefore, getting buy-in from people who work in CHS helps achieve that goal. Furthermore, staff and management provide key insights about the local context into which the programme is being placed. Tailoring programmes as closely as possible to the local context and population is essential to maximising the likelihood that the programme will work.

A panel of outside experts provided a new perspective to designing the evaluation of the programme. Our panel was particularly helpful because it consisted of a broad spectrum of participants with expertise and experience in a variety of types of evaluation. Evaluating a complex programme with multiple elements rolled out at different times within the same population requires a variety of creative evaluation strategies. Our panel of experts not only provided this variety, were also open to using a mix of solutions without bias or favouritism toward one school of thinking. All but one of the evaluation experts were not living in the location of the programme and this further allowed them to bring perspectives that were new and fresh. The sense of group cohesion and comradery among experts came through and helped create an atmosphere of working on the problem for both experience and enjoyment. The panel of experts continues to be engaged in the process and volunteers to provide monthly advice on regular phone meetings about this project.

Collective Impact Approach and Behaviour Changer Framework

As discussed in Cobben (2017), Task 24 uses the *Collective Impact Approach*, originally designed for social entrepreneurs, together with its more bottom-up *Behaviour Changer Framework*. The 5 conditions listed that are needed to create such a collective impact are (Kania and Kramer, 2011):

1. **A common agenda** (*Energy Connect* goals),
2. **Mutually-reinforcing activities** (our Task 24 and Energy Summit workshops),
3. **A shared measurement system** (our evaluation system),
4. **Continuous communication** (our monthly phone calls), and
5. **A backbone support 'organisation'** (in this case, a combination of expert evaluators, Task 24 and Kady Cowan's team).

In Hanleybrown, Kania and Kramer (2012) they updated the initial framework with three phases that have to be fulfilled for creating collective impact. In the first stage, **action has to be initiated** (Kady Cowan did this with Dr. Cox in 2016). In order to do so, the **landscape of the social problem** has to be understood first (our surveys and interviews) and a **champion** (Kady Cowan) has to arise. The importance of **champions** who should take care of attracting financial resources and creating a sense of urgency are vital. The champion should show the importance of collaboration (Task 24 workshops). In the second phase it is important to **organise for impact** (Expert group). This means that common goals, a shared measurement system and backbone organisation have to be arranged (done after the initial *Energy Connect* Summit). In the third and last phase **action has to be sustained** and impact should arise (currently underway, with constant reiteration and evaluation of success factors). **Active learning and coordination** is described to be essential for success (something we feel this programme has more than achieved). Overall, this programme has thus shown itself to be a great example of how the Collective Impact Approach can be successfully applied, in combination with the Task 24 *Behaviour Changer Framework*, in any sector or field.

Flexibility of Design

An ability to conduct a rigorous evaluation while also using the results of the evaluation to concomitantly improve the programme is one of the strengths of *Energy Connect*. The programme uses the process of developmental evaluation to put into play intervention ideas, evaluate them in the field and redevelop or expand them as necessary. This is an important aspect of the programme, but the ever-changing pieces of the programme increase the difficulty of conducting effective evaluations. Hence, we made use of an expert panel to provide evaluation recommendations that would be challenging to address without the diversity of a group of experts.

Keeping an eye on evaluation

Given that *Energy Connect* works by changing staff behaviours, the most effective strategy likely has many pieces that work together. This means that evaluating a specific piece and testing its effectiveness can be challenging. In order to address this challenge, we chose to embed the evaluation strategy into each piece of the intervention and consider if and how that intervention could be evaluated. With this in mind, the team was able to create a programme that was both influential and testable.

Conclusion

Collaboratively designing a behaviour change programme with the assistance of outside experts and local staff is a viable and extremely useful strategy. It allows the programme to overcome the pitfalls that may be inherent in individually-designed programmes and may lead to better designed and more accepted behavioural interventions, saving more energy in the process.

IEA Demand-Side Management Technology Collaboration Programme

The Demand-Side Management (DSM) Technology Collaboration Programme (TCP) is one of more than 40 Co-operative TCPs within the framework of the International Energy Agency (IEA). The Demand-Side Management (DSM) Programme, which was initiated in 1993, deals with a variety of strategies to reduce energy demand. The following member countries and sponsors have been working to identify and promote opportunities for DSM:

Austria	Norway
Belgium	Spain
Finland	Sweden
India	Switzerland
Ireland	Canada
Italy	United Kingdom
Republic of Korea	United States
Netherlands	ECI (sponsor)
New Zealand	RAP (sponsor)

Programme Vision: Demand-side activities should be active elements and the first choice in all energy policy decisions designed to create more reliable and more sustainable energy systems
Programme Mission: Deliver to its stakeholders, materials that are readily applicable for them in crafting and implementing policies and measures. The Programme should also deliver technology and applications that either facilitate operations of energy systems or facilitate necessary market transformations

The DSM Programme’s work is organized into two clusters:
The **load shape cluster**, and
The **load level cluster**.

The ‘load shape” cluster will include Tasks that seek to impact the shape of the load curve over very short (minutes-hours-day) to longer (days-week-season) time periods. Work within this cluster primarily increases the reliability of systems. The “load level” will include Tasks that seek to shift the load curve to lower demand levels or shift between loads from one energy system to another. Work within this cluster primarily targets the reduction of emissions.

A total of 24 projects or “Tasks” have been initiated since the beginning of the DSM Programme. The overall program is monitored by an Executive Committee consisting of representatives from each contracting party to the DSM Energy Technology Initiative. The leadership and management of the individual Tasks are the responsibility of Operating Agents.

These Tasks and their respective Operating Agents are:
Task 1 International Database on Demand-Side Management & Evaluation Guidebook on the Impact of DSM and EE for Kyoto’s GHG Targets – Completed
Harry Vreuls, RVO, the Netherlands

Task 2 Communications Technologies for Demand-Side Management – Completed
Richard Formby, EA Technology, United Kingdom

Task 3 Cooperative Procurement of Innovative Technologies for Demand-Side Management – Completed
Hans Westling, Promandat AB, Sweden

Task 4 Development of Improved Methods for Integrating Demand-Side Management into Resource Planning – Completed
Grayson Heffner, EPRI, United States

Task 5 Techniques for Implementation of Demand-Side Management Technology in the Marketplace – Completed
Juan Comas, FECSA, Spain

Task 6 DSM and Energy Efficiency in Changing Electricity Business Environments – Completed
David Crossley, Energy Futures, Australia Pty. Ltd., Australia

Task 7 International Collaboration on Market Transformation – Completed
Verney Ryan, BRE, United Kingdom

Task 8 Demand-Side Bidding in a Competitive Electricity Market – Completed
Linda Hull, EA Technology Ltd, United Kingdom

Task 9 The Role of Municipalities in a Liberalised System – Completed
Martin Cahn, Energie Cites, France

Task 10 Performance Contracting – Completed
Hans Westling, Promandat AB, Sweden

Task 11 Time of Use Pricing and Energy Use for Demand Management Delivery- Completed
Richard Formby, EA Technology Ltd, United Kingdom

Task 12 Energy Standards - to be determined

Task 13 Demand Response Resources - Completed
Ross Malme, RETX, United States

Task 14 White Certificates – Completed
Antonio Capozza, CESI, Italy

Task 15 Network-Driven DSM - Completed
David Crossley, Energy Futures Australia Pty. Ltd, Australia

Task 16 Competitive Energy Services
Jan W. Bleyl, Graz Energy Agency, Austria / Seppo Silvonen/Pertti Koski, Motiva, Finland

Task 17 Integration of Demand Side Management, Distributed Generation, Renewable Energy Sources and Energy Storages
Seppo Kärkkäinen, Elektraflex Oy, Finland

Task 18 Demand Side Management and Climate Change - Completed
David Crossley, Energy Futures Australia Pty. Ltd, Australia

Task 19 Micro Demand Response and Energy Saving - Completed
Linda Hull, EA Technology Ltd, United Kingdom

Task 20 Branding of Energy Efficiency - Completed
Balawant Joshi, ABPS Infrastructure Private Limited, India

Task 21 Standardisation of Energy Savings Calculations - Completed
Harry Vreuls, SenterNovem, Netherlands

Task 22 Energy Efficiency Portfolio Standards - Completed
Balawant Joshi, ABPS Infrastructure Private Limited, India

Task 23 The Role of Customers in Delivering Effective Smart Grids - Completed
Linda Hull. EA Technology Ltd, United Kingdom

Task 24 Behaviour Change in DSM: Phase 1 - From theory to practice - Completed
Phase 2 – Helping the Behaviour Changers
Dr Sea Rotmann, SEA, New Zealand

Task 25 Business Models for a more Effective Market Uptake of DSM Energy Services
Ruth Mourik, DuneWorks, The Netherlands

For additional Information contact the DSM Executive Secretary, Anne Bengtson, E-mail: anne.bengtson@telia.com and visit the IEA DSM website: http://www.ieadsm.org