New Thames Valley Vision

MODIFICATION TO THE DEPLOYMENT OF COLD THERMAL STORAGE

Change Request 002

Document Owner	Project/Organisation Role
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Employment Manual Version Control

Version	Date	Author	Change Description
V5	22/12/2014	Gordon Hewitt	Amendments to Bid Submission and Project Direction Added
V4	28/11/2014	Mark Stannard	Inclusion of formal DNV review of change request (Section 6)
V3.1	21/11/2014	Mark Stannard	Inclusion of Minutes from NTVV project partner review board (Section 5)
V2.1	24/09/2014	Mark Stannard	Inclusion of DNO responses to change request (Section 4)
V1.8	09/04/2014	Mark Stannard	Review
V1.6	23/4/2013	Nigel Bessant	Review
V1.0	17/3/2014	Mark Stannard	First Draft

1 Introduction

The New Thames Valley Vision (NTVV) is a Low Carbon Network Fund Tier 2 project selected during the 2011 funding round. This five year project is focussed on the low voltage (LV) network and aims to demonstrate how electricity distribution networks can better serve their customers by understanding, anticipating and supporting their energy use as they move towards low carbon technologies. The project explores a mixture of analytic, technological and commercial solutions.

As a result of a material change in circumstances since the project started which affects SEPD's ability to deliver one aspect of the project (deployment of cold thermal storage) as set out in the Full Submission, SEPD have identified the need to submit a Project Change Request, as required under paragraph 3.101 on page 63 of the LCNF Governance Document v.6.

In response to an analysis of the current uptake of cold thermal storage in the study area and drawing on insights from successful large scale deployments in the United States of America and Canada, SEPD (Southern Electric Power Distribution) have developed a new deployment approach for cold thermal storage which modifies the quantity, size and recruitment approach. Importantly, this deployment approach has been designed to ensure relevant learning is generated with regards to the coordinated installation and operation of cold thermal storage. In particular, it is believed this revised approach will successfully demonstrate a mechanism which will ensure targeted and efficient installations that will deliver predictable and reliable reductions in peak demand.

This change request document:

- Defines the aspects of the project affected by the change including progress to date
- Sets out changes to the way in which this aspect will be delivered and the timescale for analysis and reporting.
- Explains the reasons for the change
- Explains why the proposed changes are in customers' best interests

Following correspondence from Ofgem, additional work has been carried out;

1. Formal written responses from all DNO's – Section 4
2. Review of approach by NTVV project partners, captured in meeting minutes, from Project Partner Review Board – Section 5
3. Formal review of approach by DNV GL – Section 6

2 Cold thermal storage Units in the Thames Valley Area

2.1 Full Bid Submission for NTVV (2011)

The Full Submission for the NTVV project included an aim to deploy a total of 50 ice cooling storage units (generically referred to as cold thermal storage units in this document) to demonstrate the extent to which thermal storage can increase the available 'controllable' load.

- *"NTVV aims to... Deploy… 50 ice cooling storage units to demonstrate the extent to which thermal storage can increase the available `controllable' load within a home or business"*

[Full Submission page 7]

This aspect of the project was expected to deliver the following areas of learning:

- To explore the potential for cold thermal storage to offset air conditioning loads at peak times
- To understand the effectiveness of combinations of embedded thermal energy storage and demand reduction
- Understand the synergies in energy savings for the host customer

[Full Submission Appendix B page 65, Learning Outcome 4.4]

The initial findings from these activities would be reported in SDRC 9.8a(4) (LV Network Storage - November 2014) – covering both the network effects as well as the commercial arrangements and customer feedback).

At the project development stage, prior to award of LCN Funding and based on an initial review of US and Australian experience where this technology is widely deployed, it was envisaged that in the UK these units would be installed and funded by customers who wished to participate in a naturally occurring demand response market. The NTVV project would then additionally incentivise such customers in the study area to encourage the use of their cold thermal storage to improve network performance by avoiding local network peaks.

2.2 Progress against this plan

Customer engagement in support of cold thermal storage trials built on the work during bid development and proceeded in combination with the recruitment activities associated with Automated Demand Response (ADR) trials as both topics concern the same customer population (commercial customers, including public sector, in Bracknell, Thames Valley). As planned, customer engagement activities across the Bracknell study area were designed to identify where existing cold thermal storage units were and where these would likely to be installed during the course of the project.

2.3 Customer Engagement in Bracknell

To understand the distribution and readiness of cold thermal storage, the project undertook two separate engagement exercises.

1. Engagement to identify potential participants for commercial customer trials (ADR and cold thermal storage) across the Bracknell study area

Based on assessment of maximum demand, 194 buildings in the study area were identified as possible candidates for cold thermal storage and as having potential to explore ADR technology. The occupiers of these potential buildings were contacted and 95 direct reviews were held at individual properties. During this process the project found no buildings with existing cold thermal installations.

The remaining 99 candidate buildings could not be contacted or were unwilling to participate in the NTVV trials. It is therefore highly unlikely that these sites would be engaged under this project because of incompatibilities in building type, site purpose or customer preference.

2. Formal Ice Energy Storage Meetings

On the reaching the conclusion that there were no buildings with existing cold thermal storage, three meetings were organised with the most supportive customers (as demonstrated by their active participation in other NTVV trials and adoption of other innovative technologies independently of the NTVV). These meetings were designed to formally introduce the concept of cold thermal storage and to explore the potential business case/operational benefits for the building occupier that may arise from this technology.

Reviews with each customer identified social/community reasons for considering this technology and also operational benefits to the customer – for example it could provide additional reserve cooling under emergency situations when the main cooling source failed. However the customers could not identify sufficient tangible economic benefits for them and would not consider funding the purchase of these devices. In one instance a customer specifically indicated that they would need to ensure that payback could be realised within 3 years and did not anticipate cold thermal storage could deliver this return in this time period at their site.

Having identified no commercial interest amongst even the most likely early adopters, the project has concluded that there is insufficient market force for individual customers in the Bracknell study area to fund cold thermal storage units at this time.

2.4 Cold thermal storage venders

Having concluded that it was unlikely to find customer funded units in the Bracknell study area during the course of the project, the project began to explore opportunities for an alternative approach for

deployment through direct engagement with cold thermal storage vendors. This review highlighted four companies that have some form of offering, a brief overview of each is provided below:

1. Colt - Based in the Netherlands, Colt is an internationally active company with devices only made bespoke for customers. Their installations in the past have required a large concrete base to be constructed which was seen as a barrier for installation with customers as well as being a more laborious approach.
2. IBK Koudetchniek - Based in the Netherlands producing 'Ice Buffer' technology, devices are made bespoke for customers. The aim of this product is to provide reliability/ back up in the event of failure of existing cooling systems. IBK's solution in the past has also required a concrete base to be constructed rather than having a self-contained unit.
3. Honeywell Building Solutions – A US company with a UK base, Honeywell have some experience with cold thermal storage units abroad but do not have an 'off the shelf' market offering. They have had no enquires or installations in the UK and they therefore don't see a large potential market for their offering as it stands in the UK.
4. CALMAC - This solution has some of the Cold Thermal Storage attributes necessary however, installation of these devices requires for the units to be partially buried in sand. Following analysis of the air conditioning units in Bracknell it appears that the Majority of potential customers have their devices on the roof rendering this impractical.
5. Ice Energy - A company based in the US producing utility scale cold thermal storage units. They have a market ready offering, with a standard proven approach. This is to install large units on behalf of the utility packaged with a set of incentives. Very experienced running trials in California and showed great interest to explore the opportunity of moving to the UK market. Ice Energy were the only company with an appropriate product and scale to fit NTVV project learning outcomes.

The market analysis summarised above showed that some providers were small companies catering for specialist requirements and all except ICE Energy were supplying bespoke offerings based on individual customers' needs. In addition it was found that only Ice Energy's devices are programmable by a network operator to provide demand response. On this basis the team decided that Ice Energy were the most appropriate vendor as they specifically target and work in partnership with utilities and their product provides demand response capability; their offering is therefore most suitable to the needs of the NTVV.

2.5 Progress Reporting

On 19th June 2013, SEPD submitted the routine NTVV Project Progress Report. This report identified risks and mitigations associated with cold thermal storage in Bracknell. On 24th July 2013 Ofgem asked for some further details on this risk and also asked to be kept up to date through the minutes of the SEPD PPRB and PSG meetings. On 19th December 2013, SEPD submitted a further Project

Progress Report. This most recent report identified ongoing activities designed to explore the potential for a customer driven market and alternative means for deploying storage to ensure the intended learning outcomes are achieved. The minutes from monthly Partner Project Review Board, as shared with Ofgem, similarly track these developments.

3 Change to the deployment of cold thermal storage

Having concluded that it is not possible to carry out cold thermal storage trials as original planned since there are no cold thermal storage units in Bracknell at this time and that there is insufficient customer interest/market force to fund and install these units at present, the project has actively researched alternative deployment approaches. This change request proposes an alternative approach to deployment of cold thermal storage which will still enable delivery of relevant learning and does not require any amendment to the project budget. It has been based on the American utility-based experience of Ice Energy (http://www.ice-energy.com/).

This changed approach does not rely on customer funding or market forces to encourage uptake but rather, focuses on DNO requirements to position larger scale units at critical points on the electricity network. Having identified the key network locations, a third party recruitment and installation expert would work on behalf of the DNO to install units at customer premises. These units would by funded by the DNO to provide cold thermal storage to regularly shift the electrical demand of refrigeration plant to times of low network demand; customers would elect to receive the cold thermal storage and to routinely use it in return for new air-conditioning refrigeration plant.

The key benefits that this approach would produce are:

- Efficient and targeted deployment to maximize network benefit. The original customer driven/market led approach would not enable a similarly targeted approach
- Predictable and regular operation agreed in advance with the customer in return for new air conditioning plant at the customer's premises. The original customer driven/market led approach would not have resulted in 'guaranteed' participation and would have required significant over recruitment to deliver the same level of predictability
- Customers receive new 'latest generation' refrigeration plant, which with the addition of storage allows this plant to operate at times of lower ambient temperature. Greater plant efficiency and operation at cooler times is expected to result in lower overall energy requirements for the customer to deliver the same daytime cooling.
- Customer cooling is provided from pre-cooled ice, which has been found to give a better quality and faster cooling response as it does not have the cool-down times associated with the cycled operation of refrigeration plant.
- Additionally, these DNO managed units would come with the ability to control associated pumps and fans to provide a demand response capability in addition to cold thermal storage alone to increase peak demand reduction.

3.1 Description of the change

The project requests to change the quantity, size and recruitment approach associated with the deployment of cold thermal storage as follows:

	Original Proposal	Requested Change
Deployment approach	Customer funded/marked led	DNO funded/network targeted
Incentive for participation	The project had budgeted for additional incentives of up to £2,000 over the project life cycle to encourage customer to deploy their storage to address network constraints and reduce peak demands. This would be in addition to the market incentives that triggered the customer to fund the cold thermal storage units,	Customers would receive cold thermal storage, and also new refrigeration plant (where appropriate) for free in exchange for their commitment to deploy thermal storage and demand response when requested by the network operator. Refrigeration plant (if installed) would be owned by the customer, cold thermal storage units would be owned by SEPD.
Type	Storage only	Storage with network scheduled demand response (where appropriate)
Quantity	50 units	3 units
Estimated peak reduction	Not previously established – since no previous UK based experience. However a market driven, opt-in approach would be likely to produce lower levels of demand reduction since participation rates could vary and, as units may well be of varying capacity, diversity-type factors may reduce the aggregated demand reduction coincident with times of peak	54kW – as assessed by the cold thermal storage vendor having performed desk-top based analysis of building types (from satellite images) and anticipated cooling demands (as based on temperature and load profiles) in combination with experience from extensive American deployments.

The project recommends that the associated learning outcomes be reported in September 2015 as per section 3.3, below.

3.2 Analysis to support requested change

To assess the appropriateness of the proposed change, the project has considered the proposal and contrasted it with traditional reinforcement under three criteria: cost-effectiveness, contemporary practice (based on American experience) and delivery of stated learning objectives. We have compared against traditional reinforcement because there are no existing cold-thermal units in use or likely to be in use within the project timescale under the expected customer funded/market led approach, therefore the principal alternative to the proposed change at this stage would be to truncate this aspect of the project without deploying cold thermal storage.

Cost-effectiveness

The proposed deployment plan requires the DNO to fully fund the units and to use this as a customer incentive for participation. Under LCNF definition, this incentive would be classified a 'payment to user.' Whilst small quantity trials do not exhibit the normal economies of scale that a full deployment could achieve, this proposal will remain within the original 'payments to users' budget for cold thermal storage originally anticipated for the NTVV.

To assess overall cost effectiveness of the proposal the price of these units was benchmarked against traditional reinforcement costs. The cost of releasing new capacity on an existing system (known as the marginal cost) is quantified in terms of £/kVA. Under this proposal, the marginal cost of cold thermal storage is slightly higher but of the same order of magnitude as traditional reinforcement. This comparison is expected to become even more favourable with a) the benefit of economies of scale and b) recognition of the additional capacity released at higher voltages. Typically, the increased capacity from installing a new asset can only be realised at the voltage level it is associated with; whereas peak demand reduction measures benefit all voltage levels at the point of connection and above.

Contemporary practice

Based on experience associated with American utilities, the project now understands that a targeted approach where the network operator offers to fund installations in selected locations, based on network requirements, has become normal international practice - even in America where there is often a mature and well funded market for local demand response. With regard to cold thermal storage Ice Energy, based on American experience, have assessed that approximately 90% of the derived benefits are associated with the network and the wider customer base, whilst only about 5-10% is associated with the individual hosting customer. As such, Ice Energy recommend a utility funded deployment model.

Likewise, Ice Energy have developed a customer incentive model which includes additional replacement of old refrigeration plant as a practical and pragmatic mechanism which benefits both the customer and the network operator. Replacement refrigeration plant is not only attractive to the customer but benefits the utility by ensuring a smooth and efficient implementation plan to introduce storage across a wide area in response to a network need. This approach is also cost effective since the price of a refrigeration unit is relatively small when considered alongside the mobilisation costs for installing storage; both storage and refrigeration would be installed at the same time, therefore these mobilisation costs are shared and the risk of compatibility issues arising in integration of the cold thermal storage units with existing refrigeration plant is avoided. In effect the general incentivising trend associated with cold-thermal storage has been to increase the incentives provided by the network operator..

The principal alternative, which would default to waiting for a customer funded/market led approach runs counter to contemporary practice, would not realise the benefits as identified above and may never result in the use of such storage mechanisms in the UK to support the local network.

Delivery of stated learning outcomes

This proposal will ensure the delivery of all stated learning outcomes and would also include the additional benefit of enhanced understanding of how a DNO can target cold thermal storage to efficiently meet a network need. The principal alternative would only allow the project to quantify the status quo – namely the present absence of cold thermal storage found within customers premises.

3.3 Revised analysis and reporting schedule

Having conducted a thorough review of existing and future prospects for cold thermal storage in the Bracknell Study area, additional research to understand customer motivations and subsequently developed a whole new proposal the analysis in support of the stated learning outcomes for cold thermal storage has been delayed.

Proper assessment of learning outcomes will require operation of storage during the summer months whilst ambient temperatures, and the associated air conditioning loads, are at their highest. Due to the time delays noted above it is unlikely that the proposed network operator funded units can be installed in time to ensure a rigorous assessment over the summer months. As such, the project recommends that the report into the performance of cold thermal is removed from SDRC 9.8a(4) LV Network Storage - November 2014:

"(4) LV Network Energy Storage (Method 4, Learning Outcome 4.1)

- Installation (requirements, permissions, unit costs, safety considerations, timescales)
- Benchmark the battery and thermal storage methods.
- Battery Storage (demand shifting from individual and aggregated operation, management of network voltage, thermal. power quality and losses)
- **Ice Energy Storage (demand shifting from individual and aggregated operation, commercial arrangements and customer feedback)**
- Thermal Energy storage (assess additional generation permitted within existing network, management of network voltage, thermal)"

[Full Submission Appendix K p49, Description of proposed report scopes as per Successful Delivery Reward Criteria (SDRC) 9.8]

The element of the report relating to cold thermal storage, highlighted in bold above, would be submitted as a separate report released in September 2015, once a full summer's operation has been

observed. The Description of proposed report scopes as per SDRC 9.8 above would be amended to reflect this.

3.4 Why the change is in the best interests of customers

Based on the analysis identified in section 0 above, the project is confident the change request is in the best interest of customers having considered cost-effectiveness, contemporary practice and the continued delivery of stated learning objectives.

3.5 Changes to Bid Submission

Page seven of the original NTVV bid submission SSET203 states:

NTVV aims to:
o Demonstrate, with around 30 customers, how demand management can be achieved for large commercial customers via a building management system
o Involve around 30 small business customers in exploring the extent to which a version of this building management system could be applied to SMEs
o ~~Deploy a total of 100 hot water energy storage units and 50 3 ice cooling storage units to demonstrate the extent to which thermal storage can increase the available `controllable' load within a home or business~~

Will be amended to:

o Deploy a total of 100 hot water energy storage units and 3 large scale ice cooling storage units, with associated incentive structure, to demonstrate the extent to which cold thermal storage can increase the available `controllable' load within a home or business.

Page 67 of the bid states:

SEPD proposes to initially install three units in conjunction with the building management system Tier 1 project. The system will be trialled on a small scale to prove the functionality and understand the associated cost savings. The devices are simply retro fitted to existing air conditioning units thereby making the installation quick, simple and low cost.
The devices will then be rolled out to 50 commercial premises connected to Bracknell primary substation as part of NTVV. As the storage devices provide a saving in energy costs to the customer and a benefit to the network, the procurement and installation costs will be part funded by the building owner. The large deployment will provide significant benefit to the network in terms of peak demand shifting and will prolong

reinforcement requirements

Will be amended to:

The project will position 3 large scale units at critical points on the electricity network. Having identified the key network locations, a third party recruitment and installation expert would work on behalf of the DNO to install units at customer premises. These units would be funded by the DNO to provide cold thermal storage to regularly shift the electrical demand of refrigeration plant to times of low network demand; customers would elect to receive the cold thermal storage and to routinely use it in return for new air-conditioning refrigeration plant.

Page 102 of the bid (Appendix K) states deliverables for SDRC 9.8a (4) LV Network Storage [Method 4]. The Cold Thermal Storage element of SDRC 9.8a (4) was due in November 2014
"Ice Energy Storage (demand shifting from individual and aggregated operation, commercial arrangements and customer feedback) will be delivered in September 2015.

3.6 Changes to Project Direction

Page nine of the Project Direction outlines the deliverable for SDRC9.8a (4) which includes the deliverable for Cold Thermal Storage.

Focus: Knowledge Sharing of methods 1, 2, 3 and 4 a, b and c) throughout Project - Prepare final reports on the trials carried out on the subjects listed in "Evidence 9.8" as well as an end of project report;* d) April 2017 - Hold a project review seminar to discuss the learning from the project. Attendees will be invited including Customers, Ofgem, DNO's, product suppliers and other stakeholders to discuss the way forward.* * Description of proposed report scopes as per Appendix K	a) November 2014 - (1) End Use and Network Monitoring Evaluation [Methods 1 and 3], (2) Demand Side Response Evaluation [Method 2], (3) Network controlled Automated Demand Response evaluation & Energy Efficiency [Method 2], (4) LV Network Storage [Method 4], (5) EV Chargers Usage Evaluation and Issues [Methods 2 and 1], (6) Smart Meter performance [Method 1], (7) Integration Solution Control Evaluation [Methods 1, 2 and 4] and (8) Overall Proven Benefits (both financial and customer service) [Method 1]

Part 4 relates to LV Network Storage including Battery Storage, Hot Thermal and Cold Thermal Storage element of SDRC 9.8a was due in November 2014. The report section

"Ice Energy Storage (demand shifting from individual and aggregated operation, commercial arrangements and customer feedback)" will be delivered in September 2015.

4 DNO Feedback to NTVV Change Request 002

As part of this Cold Thermal Storage Change Request, Ofgem requested for the opinions of other DNO's regarding the value of the learning to their organisation before any approval decision is made. The headings below give a summary of the responses received. Their full submissions can be seen in appendix 1.

4.1 DNO Response Summaries

Scottish Power Energy Networks - Alan Collinson

SPEN believe the proposed changes offer the same level of learning (or perhaps a bit higher) as was contained in the original SSE proposal, but probably with increased chances of a successful outcome. They feel management of "electrical cooling" or air conditioning load is generally most applicable to networks with summer peak loading and that they can see a trend of summer loads increasing more quickly than winter loads in certain areas of their network.

Electricity North West - Steve Cox/ Simon Brookes

ENW is very supportive of the deployment of Cold Thermal Storage proposed as the trials will deliver valuable information on its use. This is an area where they are unaware of any UK evidence on the use of cold thermal storage for managing peak demands and so believe there is value in SSEPD completing the trials and delivering the learning to the industry. The change in deployment approach has no impact on the value of the learning.

Northern Power Grid - Mark Nicholson

NPG expressed an interest in the learning that would be created however, they are keen to know a little more regarding the reasoning as to why this technology may become more prevalent and what the drivers behind this are. This is a topic that we are more than happy to address and will engage in dialogue with NPG and share with all DNO's and Ofgem with our findings.

UK Power Networks - David Boyer/ Martin Wilcox

David Boyer responded with a positive tone stating that the learning would be of value to their business. They note that cold thermal storage is particularly relevant to urban network of which LPN have many. They are keen for the NTVV project to conduct this work and would like us to consider relevant diversity factors when attributing value across the network voltages which will be included in our analysis.

Western Power Distribution - Ben Godfrey/ Roger Hey

WPD do not feel that the proposed changes will diminish the outcomes as already assessed in the original cost benefit analysis carried out by Ofgem and their Expert Panel. They have an interest in the outputs of the NTVV cold thermal storage trials and see value in continuing with the project on the revised basis set out.

4.2 Conclusions

The responses from other DNO's regarding this change request have all been positive and fully support our approach. Some valuable suggestions have been made that will aid our thinking that we will be taking into account eg. Adding diversity factors to benefits analysis.

There were no examples of this learning being repeated and the expected learning was deemed to be of interest by all DNO's.

5 Section 5 – NTVV Project Partner Review Board

Following correspondence with Ofgem regarding feedback from other DNO's, Ofgem requested that we should include evidence of our review with project partners to ensure all parties feel that the proposed change request is the correct approach. This was a formal agenda item and the documentation was circulated prior to the meeting. This feedback can be seen below.

5.1 NTVV project partner review

"Progress update: Cold Thermal Storage Change Control

All project partners asked to formally review change request to reduce the number of cold thermal storage units from 50 to 3 after a request from Ofgem.

All PPRB attendees sent the material in advance of the board meeting.

MS began by giving the background to the change request and the primary driver for the change being that at this time there is no established market for Cold Thermal Storage in GB. Additionally, there was no provision made in the bid for funding to procure and install 50 units. The learning to date is that no SME is prepared to self-fund the installations as the ROI not delivered in a short timescale. This understanding was gathered during structured interviews with companies that were identified and approached in Bracknell. Additionally there was no unit available to meet the needs of the SME community.

MS gave an overview of the change control and the fact that the 3 large units, including new chillers, would be installed. A key point is that the 3 large units will deliver the same overall network load reduction as the 50 smaller units.

Project Partner comments on learning:

- *DNV GL states that the learning will be similar. DNV GL states that it is very important to understand how the unit will behave in a UK context.*

- *GE Digital Energy would not give an opinion of the change control as they have not been involved with this aspect of the project.*

- *University of Oxford state that the analysis may be more predictable with the reduced number and that care needs to be taken when selecting prospective sites to ensure that there is diversity of load from the final solution.*

- *University of Reading state that the work undertaken already has driven out a key piece of knowledge for other DNO's and academia in so far as there is no market for the SME community based on the long ROI timescale.*

Additionally, there was no specific concern flagged by any other project partner"

5.2 Conclusions

From the feedback received, the NTVV project partners raised no concerns regarding the level of learning that is to be expected and the feeling amongst all participants was positive.

The University of Oxford state that the selection of the sites will be important and they will therefore be involved in the selection phase of the project as appropriate.

This feedback has further confirmed the value of this piece of work.

6 Section 6 – Formal DNV GL Review of Change Request

To add rigour to the work the NTVV team have carried out regarding this change request, the project requested that DNV GL conduct formal analysis of the learning and present their recommendations. This letter can be seen below and confirms NTVV approach will provide comparable learning and will be of value to other DNO's.

DNV·GL

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DNV GL Energy
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Date:
28/11/2014

Dear Mark,

Thank you for seeking our written views on the new approach to the deployment of the cold thermal storage in the New Thames Valley Vision project.

Having reviewed the "Modification to the deployment of cold thermal storage – Change Request 002" V2.1 we think that the proposed changes are in customers' best interests. Based on our involvement in the cold thermal storage trial we would like to offer the following thoughts:

- From the customers engagement activities it became apparent that customers could not identify sufficient tangible risk free economic benefits and thus would not consider funding the purchase of these devices;
- In the US where cold thermal technology is more widespread, the majority of the benefits accrue on the utility side rather than the customer side and thus the units are subsidised by the utilities in order to reduce their peak demand;
- ICE Energy are the most appropriate body to deliver the solution based on the market analysis, which showed that they supply unique bespoke cold thermal storage units based on individual customers' needs that are easy to install and are programmable to serve the needs for demand management of a network operator;
- The proposed deployment plan ensures:
    - adequate incentives for customers to adopt cold thermal technology and participate in the trial;
    - the delivery of all stated learning outcomes in the original bid, as, even with less units installed, very useful conclusions can be driven about the ability of the technology to reduce demand over different periods of the year.

We hope this letter is helpful for SSEPD to secure the necessary approvals from Ofgem. If we can be of any further assistance please let us know.

Sincerely yours,
for DNV KEMA Ltd

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