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CONTENTS

| 1 | EXE | CUTIVE SUMMARY | 4 |
|---|---|---|--|
| 2 | INTI | RODUCTION | 5 |
| | 2.1 2.2 | Review Scope | 5 5 |
| 3 | KEY | LCL PROJECT AREA CHANGES | 6 |
| | 3.1 3.2 3.3 3.4 3.5 | Smart Meters & Change of Trial Zones Time of Use Trials & Wind Twinning Automatic Network Management and Demand Response Change of Zones from LCZ to EIZ Electric Vehicles, Heat Pumps & SSEG | 6 7 8 9 |
| 4 | REV | IEW OF THE USE CASE CHANGES | 11 |
| 5 | 4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 GEN | UC1 - WIND TWINNING UC2 - ENABLING AND INTEGRATING DISTRIBUTED GENERATION UC3 - ENABLING ELECTRIFICATION OF HEAT AND TRANSPORT. UC4 - USING SMART METERS TO FACILITATE SMART GRIDS. UC5 - DEMAND SIDE MANAGEMENT. UC6 - NEW DISTRIBUTION NETWORK PLANNING AND OPERATIONAL TOOLS UC7 - THE LOW CARBON LONDON LEARNING LAB. UC8 - DEVELOPMENT OF NEW NETWORK DESIGN AND OPERATION PRACTICES IERAL REVIEW OF PROJECT | 11 12 12 12 13 13 13 |
| | 5.1 5.2 5.3 5.4 | REVIEW OF PROJECT STRUCTURE REVIEW OF LEARNING AND BENEFITS REVIEW OF COST IMPLICATIONS OTHER DNO FEEDBACK ON CHANGE REQUEST | 14 14 14 15 |
| 6 | SUM | MARY | 16 |





1 Executive Summary

Attn: Dora Guzeleva - Ofgem

Dear Dora,

The following is the requested review undertaken by TNEI on behalf of Ofgem and based on the information originally provided to Ofgem by Low Carbon London (LCL), the additional evidence requested by TNEI, notes from the interview with the key LCL project team, and some further evidence provided by LCL subsequent to the interview.

The structure of this note is first a review of the key areas where changes have been identified, then a review of the modified Use Case document submitted by UKPN and then a review of the cost implications and finally a short summary.

Where appropriate, signposts are provided to the relevant evidence documents supporting the view, although some of the following are also notes from my interview with the LCL project management team.

In all I am broadly comfortable with the direction that the project is heading and that it is on-track to achieve the stated learnings and deliverables. There have been some changes that have been necessary due to external factors and learnings as part of the process, but these appear to be being managed effectively and are not unexpected on a project of this nature.

Regards,

attant

Graeme Bathurst Petrofac-TNEI (Technical Consultant to Ofgem)

cc. Sam Cope - Ofgem Rebecca Langford - Ofgem





2 Introduction

2.1 Review Scope

The key aim of the review of the change request was an assessment of the revised costs that are being proposed for the project. The key activities that were required from the consultant for the review are set out below.

- ISSUE FAMILARISATION/BACKGROUND
 - \circ $\,$ Meet with Ofgem for an explanation of the information that has been provided to date and Ofgem concerns
 - Consultant then to review this information and identify the key areas for testing
- DETAILED COST REVIEW
 - Undertake a review of the revised summaries of work scope, amended use cases and cost information that has been provided by UKPN
 - Where the project scope has been changed the consultant will examine the cost changes that are being proposed
 - Seek to clarify issues that are identified with UKPN
 - For each area of change in the project, the consultant will either confirm that UKPN's cost approach appears reasonable or else highlight and explain concerns identified. Where UKPN have provided further justification for the costs these will be highlighted

The above work was to be undertaken quickly to help Ofgem come to a decision regarding the change request.

2.2 Low Carbon London Project Interview

The Low Carbon London project interview was conducted on the 26th of September 2012 (11am - 5pm) at UKPN Newington House with the following attendees:

- Liam O'Sullivan LCL Project Director
- Brian Kelly LCL Programme Manager
- David Boyer LCL Solution Design Manager
- Dave Openshaw UKPN Head of Future Networks (by telephone)
- Keith Hutton UKPN Head of Regulation (initial part only)
- Graeme Bathurst Ofgem Technical Consultant (TNEI)





3 Key LCL Project Area Changes

3.1 Smart Meters & Change of Trial Zones

3.1.1 Summary of Issue

The lack of an available SMETS compliant meter has created an issue for the project that was not allowed for in the project design or risk mitigation. The project design required both half-hourly metering as well as local point of supply voltage monitoring. The Version 1 of the SMETS has basic voltage monitoring and Version 2 of SMETS has more advanced voltage monitoring. Generation 2A and 2B Smart Meters are not SMETS-V1 compliant.

The 5,000 meters rolled out for this trial with EdF Energy are the L&G 5326 meter, which is a Generation 2B meter. 500 meters were initially rolled out to test the installation.

The project team has reacted to the lack of SMET meter availability by proceeding with the existing available Generation 2B meters, and sourcing additional voltage measurement units for critical network locations. The existing Gen2B meters have limited voltage data capture.

3.1.2 TNEI Impact Assessment

The objective of the metering data was two-fold. The data is required to develop statistically sound load profiles of the selected different customer load types, and to provide a sufficient number of customers for Time of Use (ToU) trials such that any small tariff driven load change is statistically detectable. This drove the requirement for 5000 SM customers to provide 1500 ToU SM customers as well as sufficient numbers for the load profiles.

The load profiles are required to provide the basis for LV network modelling using the ADMD (After Diversity Maximum Demand) method, and subsequent testing of the existing network via the "network planning tool" as part of Use Case 4. It is not necessary for these meters to be in any specific geographical location as the customer type is more critical.

The Operational Data Store is the collation of all data from network topology, electrical parameters and MPAN profiles, and will be the source of the modelling data for the network planning tool. The ODS will be part of an enduring solution for UKPN. Additional data points are required within the PI (data historian) system, this is achieved in a temporary means via another system for the purposes of this project.

The Engineering Instrumentation Zones (EIZ) will be used to verify the methodology of using the updated customer demand profiles for network planning purposes. The location of the network monitoring is critical for this verification, but the customer meters are not critical for testing.

The ICL report on state-estimation in UC4 and UC8 on the requirements for network monitoring is on the HV rather than LV network. The EIZ and Tier 1 network datasets are stated to be sufficient for observability of the system, from the description of the proposed EIZ instrumentation then this appears valid.

These changes appear to be a reasonable reaction to the investigatory work undertaken and issues faced with currently available Smart Meters.

3.1.3 Cost Implications

Part of the Petrofac group

The cost base is largely unchanged as the same number of meters will be required and the head-end system supplied by Logica is still required. As the non-SMETS compliant meters now have to be replaced by 2018 by SMETS compliant meters, the time-expired value of the meters installed in advance for this trial need to be under-written by this project.





The Logica head-end is provided as a licensed service, some equipment may become redundant, or run by a supplier, however the hope is that this will ultimately be novated to the DCC once set-up. There are some costs associated with customisation and hook-up of specific meters.

The change request is primarily about under-written the Gen2B meters now that their costs cannot be socialised. Suppliers would not be rolling out the meters as rapidly, i.e. they would wait until SMETS compliant meters were available.

3.1.4 Relevant Evidence

Evidence 01 - SDA C 03 Location Model V1_0.pdf

Evidence 02 - To inform smart meter trial design V1 0.pdf

3.2 Time of Use Trials & Wind Twinning

3.2.1 Summary of Issue

There was the original ambition for trialling "multiple tariffs" in UC5, these were to be Static, Dynamic and Wind Twinning. The objective was to observe customer response rather than network modelling as such, so as to inform how load profiles (for ADMD) may change, and subsequently to inform how this could be modelled to resolve network issues.

Analysis by ICL of the numbers of customers required for statistically representative results flagged an issue with the volume of participants required. As such, a decision was taken by LCL to focus on a combined dynamic ToU trial with a combined price tariff, and aim to get input on the static tariff from other Tier 2 projects (i.e. CLR). The objective was ultimately more about testing the benefit or impact on networks of flexible tariffs.

Data injects in this context were that the customer interventions were to be simulated high/low price or wind days to ensure a sufficiently valid number of events, rather than wait for natural existing events that may not presently be sufficiently frequent. This is essentially a combined Energy and Network tariff response.

The tariff structure was based on a survey by EdF on the number of levels and types. At present this has summarised expected customer behaviour, day ahead and billing formats and presentation to the customer. Reference was made to Tempo in France as the effectiveness of a simple strategy.

3.2.2 TNEI Impact Assessment

As the purpose was to observe customer behaviour and response on an individual level, rather than test network response, then the dynamic ToU trials appear to be satisfactory as outlined.

The analysis by ICL of the numbers of trial participants required for a statistically observable response given the relatively small potential demand changes appears to support the need to restrict the types of tariffs that are deployable.

It is suggested that LCL is allowed to proceed initially with a single dynamic tariff to observe responses, however suggested that the decision is reserved on the Wind Twinning tariff until it is proven that it is not required/necessary/relevant. i.e. there is presently not enough evidence yet to justify that it is not an appropriate approach to take.

3.2.3 Cost Implications

The change in scope to consider only a single combined ToU tariff does not appear to have any significant cost reduction advantages as the same overall number of customers is being used. The impact on IT costs have been closely considered in deciding the strategy for application of the dynamic ToU tariff.





3.2.4 Relevant Evidence

Evidence 02 - To inform smart meter trial design V1 0.pdf Evidence 03 - ToU Scope Impact Assessment - FINAL 0 Confidential v2.0.pdf

3.3 Automatic Network Management and Demand Response

3.3.1 Summary of Issue

The automatic network management is targeted at the distributed generation trials to monitor and develop towards active control. The initial project design was to directly control the participant generators, however there has been reluctance from the participants to be automatically controlled as part of a new system trial. As such, a small change to the design of the trial has been introduced to provide a manual control while the systems are tested and developed.

Sign-up of trial participants is well underway and volumes for Distributed generation (DG) have been achieved. Demand Response (DR) was proving difficult but shortly before the interview a new significant central London department store had agreed to provide 1.5MW of flexible demand capacity into the trial.

A further key difference is the introduction of commercial aggregators rather than direct DNO control of generators and building turn-down. This provides the customers with a single technical and commercial interface for both provision of generation and demand flexibility which covers both system balancing and network response.

3.3.2 TNEI Impact Assessment

The development of Aggregator provision of combined demand response and generation control is a very positive development for networks particularly as UKPN are using a third party for provision of technical system services.

Significant technical issues have been discovered on the ability for customers to provide building turn-down which needs further consideration for the long-term.

The Accent Report commissioned by LCL to review their customer engagement strategy identified a number of issues with the presentation of the business case for the customers and subsequent follow-up. This was done to provide an independent view of the UKPN approach. The issues have been recognised by the project as new learning and a small task-force has been set-up to address the identified issues. It was also used as an opportunity to contact other parties outside of UKPN normal business contacts.

3.3.3 Cost Implications

There is some overlap between the ANM trials and DR trials in terms of participants however the costs are predominantly due to the ANM equipment and Participant Incentives. The number of schemes and trial participants appear to be similar and as such no material scope change has occurred. There is a cost reduction due to consolidation or reduction of direct-control equipment; however this has been recycled into aggregator payments or customer incentives. As such the change is relatively costneutral. The use of Aggregators does not radically change the overall system requirements.

3.3.4 Relevant Evidence

Evidence 04 - ANM Triggering DR Trial Proposals rev 3.pptx

"LCL Trial by numbers"





3.4 Change of Zones from LCZ to EIZ

3.4.1 Summary of Issue

The use of the Low Carbon Zones (LCZ) within London has lessened from the original project brief partly because the LCZs are winding down due to reductions in funding, but primarily because the customer demand types within the zones were not sufficiently broad to cover the needs for UC4 and others. LCL is still working with the Project Managers of the LCZs were they exist but they stressed that the use of these zones originally was only as areas in which the trials could be done and observed.

The Engineering Instrumentation Zones (EIZ) have been focused onto two areas where the network has sufficient suitable customer types and can be instrumented to observe and characterise that network in detail. These have been reduced from three down to two and there is an associated saving in less network monitoring equipment and installation time.

3.4.2 TNEI Impact Assessment

This appears to be reasonable approach and the documents reviewing the LCZs suggests that they were not all appropriate for robust trial outputs.

3.4.3 Cost Implications

The change of the monitoring to focus only on two EIZs rather than three has provided a cost reduction against the original budget based 10 zones. It is noted that the original budget allocation for the 10 low carbon zones was insufficient against the envisaged requirements. There is insufficient detail to provide a definitive view on this however it is not unreasonable.

3.4.4 Relevant Evidence

Evidence 01 - SDA C 03 Location Model V1_0.pdf

3.5 Electric Vehicles, Heat Pumps & SSEG

3.5.1 Summary of Issue

Trial participant sign-up has been challenging for all three categories. Since the CR submission there has been some positive movement on EV participants.

Electric Vehicles (EV) have currently secured 25 residential and 40 commercial vehicles at the time of the CR1 submission but not able to be used for ToU trials. Subsequently a further 30 residential vehicles have been sourced via EdF Energy that can be used for ToU trials. Increasingly more residential and commercial vehicles are participating. EV uptake modelling will be based on modelling performed at ICL Transport School (John Pollock) with the trial participant data used to inform and verify the usage modelling.

Heat Pump (HP) customer trial recruitment not proving to be good value to get participants due to high recruitment effort and cost for very limited return. This is partially believed by LCL to be because London is unlikely to be an early adopter of this technology due to building type and density.

Small Scale Embedded Generator (SSEG) participation is limited, partially because of the lack of uptake originally anticipated. The inclusion of SSEG was originally within the planning and learning use case and has just been given prominence in one location. The primary learning is to understand network voltage impact and develop technology specific load profiles for demand growth estimation in network models.

The objective for all three technologies was to recruit sufficient numbers of participants to monitor consumption/generation to develop customer type profiles similar to normal demand profiles. These could then be used for the desktop modelling where the network impact assessments could be performed.





3.5.2 TNEI Impact Assessment

EV participants are lower at present than ideal. The central objective was to develop a set of demand profiles for different customer types that could then be used in network modelling to assess impact of different levels of EV uptake. There was always going to be a level of usage modelling required, however now there will have to be a heaver bias towards usage modelling to derive the load profiles for the network assessment.

HPs are believed to be reasonably straight-forward to model as they are based on known heat requirements. ICL to use established models and verify using trial data where available.

SSEGs are unlikely to provide significant learning in this case due to the relatively low numbers and expected density within the London area. It is only a minor part of the overall project and as such not a critical feature. It appears to be included in the network modelling and impact analysis for completeness rather than necessity. For other licence areas the implications of SSEG is more critical due to higher expected uptake and so the specific learning may be more valuable from those areas.

TNEI suggest that the project progresses with EVs, drop HPs trials and leave to other LCNF projects (potentially continue with those already signed-up to maintain relationship and reputation). Allow SSEG to be incorporated where already signed up, and include in network modelling impact assessment based on other datasets.

3.5.3 Cost Implications

Recruitment is the largest cost and has already ceased based on an internal project decision of appropriate value of return against cost. No active intervention trials were planned and investigations were to be via desktop study within the existing ICL budget. These can still be performed although the EV trials may require additional traffic/usage pattern modelling from the transport group of ICL for the data inputs.

3.5.4 Relevant Evidence

Evidence 05 - LCL - 072012 CR - Trial Strategy Review - EV - v1.1.pdf Evidence 06 - LCL - 072012 CR - Trial Strategy Review - HP & SSEG - v1.1.pdf





4 Review of the Use Case Changes

Overall the revised Use Case document needs to reflect the contract position rather than just as an internal project control document. There are a number of minor editing changes (name-changes or typo corrections) and others that appear to be clarifying or changing intent.

Due to the volume of changes within this document, it is not clear what the material changes are as they are lost within the minor changes; some of which appear to be preferred wording changes rather than material changes. The use of comments in the track-change version to clarify intent is not ideal as if these are significant points then they need to be introduced as explicit change or removed.

My recommendation is that if this document is contractually significant between Ofgem and UKPN, then the project scope changes are clearly split-out from the internal clarification changes. The change document should then only contain the material changes that UKPN need Ofgem to review and accept rather than the "nice to have textual improvements". The following is a case-by-case review of the changes to the use cases:

4.1 UC1 - Wind Twinning

The primary change appears to be that this will no longer be run as a separate "wind twinning" tariff but bundled within the dynamic ToU tariff in UC5. This was an outcome of the ICL analysis of participant volumes required.

The change from use of live forecast data from NGET to simulated wind events reflecting a future higher level of wind generation is a semantic point as this would have been required in any case to obtain a meaningful trial result. The main implication may be that as NGET do not formally require this service at present, then it is not possible to "contract" with them as suggested in the use-case.

There are a number of minor editing changes, comments, and other changes that appear to be clarifying or changing intent. Other changes relate to name changes and general tweaking which are not material can be neglected for the purposes of this change request.

4.2 UC2 - Enabling and Integrating Distributed Generation

Of the changes noted in the revised use case, there do not appear to be any material changes. The main "change" is that direct automatic control of DG by the DNO has been found to unacceptable by many participants. Further clarity on the point "<u>Modelled</u> actions to be taken by ANM..." should be included in this text as from the interview discussions this text does not correctly describe the intended approach.

Some of the proposed wording changes could be interpreted as a subtle shift from physical testing different solutions to only modelling, i.e. "...test <u>by modelling</u>,...", "<u>Envisaged</u> performance..." and as such LCL is recommended to review these to ensure that this is deliberate rather than unintended.

The point is made by LCL that participant uptake has been challenging due to the external environment changes and slower than expected ramp-up of DG; and that this has implications on the trials.

There are a number of minor editing changes, comments, and other changes that appear to be clarifying or changing intent. Those that are not material changes should be neglected for the purposes of this change request.





4.3 UC3 - Enabling Electrification of Heat and Transport

This represents a material change based on the lack of market update on Electric Vehicles and Heat Pumps. The change reflects the drop-out of participant organisations and other EV programmes that were reasonably envisaged at the bid stage. The changes reflect the reduced amount of live operational data that will be received as part of the trial.

UC3.2 now explicitly includes SSEG and wraps Heat Pumps into a common Distributed Energy Resource (DER) category. It also proposes to extend coverage across all three UKPN licence areas for the collection of demand profile data.

The extension of UC3.2 is of questionable additional value as some of this learning can be achieved via other projects.

There are a number of minor editing changes, comments, and other changes that appear to be clarifying or changing intent. Those that are not material changes should be neglected for the purposes of this change request.

4.4 UC4 - Using Smart Meters to facilitate Smart Grids

The main change here is that the smart meter roll-out will now be across the full London licence area rather than restricted to the LCZs and Green Enterprise District. This change was to ensure sufficient participants of different customer types could be gathered to make the collected data statistically relevant. The Engineering Instrumentation Zones are now focused on two of the LCZs rather than spread across all zones.

The other change relates to the unavailability of SMETS compliant meters and that Gen2B meters will be used instead. This should be made more explicit in the use case as well as the proposed use of additional voltage monitoring to capture the otherwise missing voltage profile information.

There are a number of minor editing changes, comments, and other changes that appear to be clarifying or changing intent. Those that are not material changes should be neglected for the purposes of this change request.

4.5 UC5 - Demand Side Management

The removal of SMEs from DSM involvement was stated to be at direction from Ofgem. This should be confirmed by Ofgem that this is also their understanding as this appears to be one of the material changes.

UC5.1a has scaled back the energy efficiency measures to only include electrical efficiency measures and there is some change due to the reduced smart meter specification.

UC5.1b has a minor change to reflect that the key observation will be customer reaction to price change events rather than different ToU tariffs. This is possibly a clarification of intent rather than a change as such. There is additional detailing of the learning points sought from this trial which seem reasonable clarification rather than "changes".

UC5.2 has removed kVar metering from the data to be collected from I&C customers subject to DSM arrangements. Further detail is required as to why this change has been made although it is minor given kVar will still be monitored at the primary substation.

UC5.3 mostly reflects clarification and extension rather than a "change".

There are a number of minor editing changes, comments, and other changes that appear to be clarifying or changing intent. Those that are not material changes should be neglected for the purposes of this change request.





4.6 UC6 - New distribution network planning and operational tools

The main change is in UC6.4 where the scope has been changed significantly to remove the explicit specification of ENXSuite and moves to a more generic "carbon tool" approach. The intent of this needs to be clarified as from the cost analysis it appears that the licence fee for the use of this tool is still included.

No commentary has been provided on why this change has occurred and the need or benefits of the change.

4.7 UC7 - The Low Carbon London Learning Lab

The changes only appear to be the titles of the deliverables, and much of this is rewording and tightening of intent rather than major focus change. As such these do not appear to be material and questionable as to why they need to be changed at this stage.

4.8 UC8 - Development of new network design and operation practices

There do not appear to be any material changes in this use-case. The additional table in UC8.3 simply cross-references the responsibilities from UC8 into other UC deliverables.





5 General Review of Project

5.1 Review of Project Structure

The LCL PMO is run in a flexible manner resourced up and down as project demands to keep costs down and respond to project requirements. There is the potential risk of under-resourcing due to too-lean an operation, however this does not appear to be evidenced.

Dave Openshaw - UKPN Head of Future Networks is the LCL content owner

Liam O'Sullivan - Project Director and day to day management

Brian Kelly - Programme Manager

Director of Strategy & Regulation - Project Sponsor

Asset Management - Project Output Customer

The internal decision to review customer engagement through the appointment of Accent to review the approach and selected customer experience was beneficial and it appears that the criticisms were taken on-board and they sought to remedy these.

The PMO does a weekly deep-dive on each work-stream and there are monthly meetings of the Engineering Governance on the project. Partners are involved in the decisions but it is not a consensus process, UKPN is clear that it is their project and their decision. The project Partners have had some challenges in learning out to be partners rather than contractors, but by in large they have adapted and responded well. It was a positive surprise to the project team that the Aggregators have started actively working together to help develop the demand-side market.

There is associated evidence provided by LCL of all the internal project change control documentation, work package linkages and dependencies and an up to date organisation chart which lends credence to the above view.

5.2 Review of Learning and Benefits

It is too early in the project to measure the outputs directly, but I cannot see anything other than the minor Heat-Pump elements that are likely to not deliver the learning and benefits that were originally envisaged. There are some areas where it has not been able to meet up to the original ambition, however from the evidence presented by LCL in terms of project documents then it appears that the learning is on-track and will be realised.

Some of the initial learning is feeding through into this change request itself and is evident in the need to adapt some of the project methodology to achieve the endoutcomes. The effective dissemination of this learning both within UKPN and to the other DNOs and stakeholders in the LCNF process is important to ensure that the learning has enduring value.

There is the potential that additional learning from an explicit Wind Twinning tariff will not be obtained through the use of the combined ToU tariff. However this could be considered as part of the learning and it will have to be seen how effective a single combined tariff is.

5.3 Review of Cost Implications

Most cost savings appear to be procurement efficiencies and symptoms of the bid development versus project set-up. The project scope itself has not changed significantly in terms of activities, although some volumes and physical techniques have changed. From interview discussion it appears that the volumes are generally not the primary cost drivers however.





The project Partners appear to have engaged strongly with provision of additional savings or free resource/equipment.

UKPN senior management provided LCL with a direction to return costs early rather than hold until the end. Some of the "additional value" appears to be contingency or underwriting rather than real money and as such may be released or not realised as savings at the final project completion.

The cost changes are defended by LCL on a narrative basis against the key line item level rather than detailed bottom-up build-up. Seeing as the original budget that the project award was given was also formulated on this basis then it is not unreasonable. The narrative appears consistent with the other project documentation and review of the use-cases however it could be more clearly presented as some of the savings from line items are recycled into increased expenditure in others.

However, I am essentially comfortable with the intent of the savings and additional contributions at this high level and that they are in-line with the overall project position.

5.4 Other DNO Feedback on Change Request

UKPN has provided TNEI with the formal feedback from the other DNO's they have consulted with as part of the Change Request process. This was reviewed by TNEI only after completing the formal review process to minimise the risk of opinion contamination.

In general the other DNO's were supportive of the change request, and the sympathetic to the reasons for this change being necessary. Some offered support and potential data or knowledge sharing from their own projects if appropriate. The general comment was that this sort of change is to be expected from projects of this nature.





6 Summary

In all, I believe that the project is largely on-track in terms of achieving its objectives and has responded well to the learning and external changes.

The scope of the project has not changed significantly and therefore the expected learnings from the project can still be achieved provided the project continues on the current course.

The cost savings appear to be primarily due to procurement efficiency rather than significant scope reduction due to the change request.

This does appear to be part of a necessary evolution of an R&D project and as such flexibility is important to ensure that the project progresses effectively and efficiently.



