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| **Respondent:** | *Joe Duddy* |
| **Company Name:** | *RES Ltd.* |
| **Please express your views regarding the Workgroup Consultation, including rationale.**<br>**(Please include any issues, suggestions or queries)** | RES welcomes the intent of National Grid to clarify the provisions of the Grid Code with respect to Energy Storage. A clear technical framework is essential to successful development and operation. |

**Standard Workgroup Consultation questions**

| Q | Question | Response |
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| 1 | Do you believe that GC0096 Original proposal or any potential alternative that you may wish to suggest better facilitates the Grid Code Objectives? | Yes, the GC0069 original proposal described in the legal text included with the consultation better facilitates the Grid Code Objectives. |
| 2 | Do you support the proposed implementation approach? | Yes. |
| 3 | Do you have any other comments? | No. |
| 4 | Do you wish to raise a Workgroup Grid Code Alternative Request for the Workgroup to consider? | No. |

**Specific GC00096 questions**

| Q | Question | Response |
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| 5 | Do you agree with the proposed 'Electricity Storage' definitions? Please provide your reasoning for your answer to this question. If you answered no, what would you include / amend / remove? | The definitions of Electricity Storage given in early parts of the consultation document and in the red-lined legal text are different. The former includes the addendum *"in a controllable manner".*<br><br>RES agrees with the definition provided in the red-lined legal text i.e. *"The conversion of electrical energy into a* |

| Q | Question | Response |
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| | | *form of energy which can be stored, the storing of that energy, and the subsequent reconversion of that energy back into electrical energy"* provided that synchronously connected inertial machines are excluded from this definition (e.g. synchronous compensators and synchronously connected flywheels which exchange electrical and kinetic energy dependent on changes in the System frequency which are outside the direct control of the User). |
| 6 | Do you agree with the decision to not define 'Energy Storage'? Please provide your reasoning for your answer to this question. | Yes. Electrical energy could be converted into a form of energy which can be stored and then subsequently that energy could be used for a purpose other than reconversion back into electrical energy. This is energy storage and it is adequately covered by existing Grid Code provisions for Customers and Demand Facilities who may use electrical energy for this and other purposes. |
| 7 | Do the proposed changes provide suitable flexibility for viable 'Electricity Storage' technologies and topologies? Or, do you feel these proposed changes limit the development of 'Electricity Storage' in any way or present barriers to entry (please provide supporting justification / evidence)? | |
| 8 | Do you believe new Pump Storage schemes should be incorporated into the proposed approach on 'Electricity Storage'? Please provide your reasoning for your answer to this question. | Yes. This approach will eventually simplify the Grid Code when the CC section becomes redundant and only the ECC section will apply. |
| 9 | Do you believe existing Pump Storage schemes should be incorporated into the proposed approach on 'Electricity Storage'. Please provide your reasoning for your answer to this question. | No. Existing Pump Storage schemes should not be subject to the ECC section and existing requirements in the CC section are sufficient. |
| 10 | Do you believe if the definition of Pumped Storage should be included within the definition of Electricity Storage. Please provide your reasoning for your answer to this question. | Yes. This would avoid the risk of undue discrimination. There are no good reasons for excluding Pumped Storage from the relevant requirements which apply to Electricity Storage Modules. |
| 11 | Do you believe there are any unintended consequences behind these proposed changes, either | |

| Q | Question | Response |
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| | within the Grid Code/D-Code, CUSC, BSC or elsewhere? Please provide your reasoning for your answer to this question. | |
| 12 | Do you believe that it is appropriate to apply the same approach to Storage providers as adopted for Power Generating Modules? Please provide your reasoning for your answer to this question, in particular, if you answered no, please state why and what different approach should be adopted. | Yes. It is the reconversion of stored energy back to electrical energy which distinguishes Electricity Storage from energy storage (which RES considers is a process which can apply to Customers and Demand Facilities, see response 6 above). A Power Generating Module, which converts a form of energy into electrical energy, therefore has a strong resemblance to an Electricity Storage Module which converts a form of stored energy (previously converted from electrical energy) back into electrical energy. |
| 13 | Do you agree that it is appropriate to include Electricity Storage within the definition of Generation and its related terms. Please provide your reasoning for your answer to this question, in particular, if you answered no, please state why and what different approach should be explored. | Yes. It is the reconversion of stored energy back to electrical energy which distinguishes Electricity Storage from energy storage (which RES considers is a process which can apply to Customers and Demand Facilities, see response 6 above). A Power Generating Module, which converts a form of energy into electrical energy, therefore has a strong resemblance to an Electricity Storage Module which converts stored energy back into electrical energy. |
| 14 | Do you believe there are any other unintended consequences behind these proposed changes? Please provide your reasoning for your answer to this question. | |
| 15 | Do you believe that it is appropriate to classify storage as an EU Code User with the premise that Generators who own or operate Electricity Storage Modules are explicitly excluded from satisfying the requirements of the EU Connection Codes and that they would not be enforceable under EU law. Please provide your reasoning for your answer to this question. Do you believe that this exclusion is adequately defined in the proposed draft changes to the Grid Code legal text? | Yes. This seems an efficient way to apply appropriate grid code requirements to Electricity Storage. The exclusion is appropriate and adequate. |
| 16 | Do you agree that it is appropriate to specify that these requirements are applicable from the date on which | Yes. This was a reasonable provision of RfG to limit the exposure of Generators to the risk of change in legislation. |

| Q | Question | Response |
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| | main plant items are procured rather than the Completion Date. Please provide your reasoning for your answer to this question, in particular, if you answered no, please state why you feel this is the case and if you believe there is a more appropriate solution. | Such protection reduces the cost of generation schemes and therefore encourages competition and low priced energy for consumers. For the same reason, it would be a good idea to offer similar protection to the developers of Electricity Storage schemes. |
| 17 | The current legal drafting is based on the proposed requirements being applicable based on a Storage User who had concluded Purchase Contracts for its Main Plant and Apparatus on or after 1 January 2019. This assumes implementation is based on the date main plant items are procured as noted in question 16, but do you have any preference for an implementation date. Bearing in mind the proposed changes are unlikely to be approved until mid 2019, a more appropriate date may be 1 January 2020. Do you support this implementation date? If not please state why and what alternative you believe would be more appropriate. | On the assumption that the proposed changes would be approved around mid 2019, RES would support 1 January 2020 as the implementation date and the date from which the proposed changes should apply to a Storage User who had not yet concluded Purchase Contracts for its main plant items.<br><br>If the proposed changes are approved at a later time, then the proposed threshold of 1 January 2020 should be postponed until at least 6 calendar months after such approval and not *"10 business days after an Authority decision"* as stated in the consultation document section 7. |
| 18 | Do you believe that Electricity Storage Modules which form part of a License Exempt Embedded Medium Power Station (LEEMPS) are adequately catered for in these provisions and it is clear that a License Exempt Embedded Medium Power Station comprising of storage would be caught by the requirements in the Grid Code from the obligations in the Distribution Code. | Yes |
| 19 | Do you believe that the list of storage technologies shown in Annex 3 is sufficient or should some technologies be added or subtracted? Please provide your reasons for your answer to this question. | Yes. Although there are other forms of Electricity Storage which are not specifically listed, the catchall phrase "Other" is comprehensive. The functional description of Electricity Storage allows "Other" to be classified when they are proposed by a User. |

| | **Legal text comments** | |
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| | Glossary and Definitions<br><br>*"Flywheel"* | The definition and its proposed usage are appropriate for synchronously connected flywheels only, they are unsuitable for inverter connected flywheels. Electricity Storage may be carried out by inverter connected high speed flywheels which may not contribute inertia to the System (unless they are connected by an inverter with Virtual Synchronous Generator control) and which may be fully controllable Electricity Storage Units. Therefore the definition and its usage should be amended accordingly to avoid confusion with high speed flywheel Electricity Storage Units e.g.<br><br>*"Synchronous Flywheel: An item of synchronously rotating Plant for the specific purpose of contributing inertia to the System. One or more Synchronous Flywheels would not be considered to be an Electricity Storage Module unless it could be operated in a controllable manner for its AC input and output power."* |
| | Glossary and Definitions<br><br>*"Non-Controllable Electricity Storage Equipment"* | Further to the above comment on "Flywheel" definition, this definition should be amended accordingly e.g.<br><br>*"Non-Controllable Electricity Storage Equipment: An item of Electricity Storage Plant, including but not limited to a Synchronous Flywheel or Synchronous Compensation Equipment."*<br><br>It would be clearer to move the latter part of this definition i.e. *"For the avoidance of doubt, Non-Controllable Electricity Storage Equipment would not be considered to be part of an Electricity Storage Module or classed as an Electricity Storage Unit"* from this definition and into the definitions for Electricity Storage Unit. |
| | Glossary and Definitions<br><br>"*Electricity Storage Module"* | Further to the comment on *"Non-Controllable Electricity Storage Equipment"* above, amend this definition as follows<br><br>"*Electricity Storage Module: A Synchronous Electricity Storage Unit or Non Synchronous Electricity Storage Unit. For the avoidance of doubt, Non-Controllable Electricity Storage Equipment would not be considered to be classed as an Electricity Storage Unit."* |
| | Glossary and Definitions<br><br>*"Minimum Generation"* | It is not clear how this would apply to an Electricity Storage Module. |
| | Glossary and Definitions<br><br>*"Registered Capacity"* | With respect to an Electricity Storage Module, it is not clear whether *"normal full load capacity"* refers to charging or discharging. Note that the charging capacity of an |

| | **Legal text comments** | |
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| | | Electricity Storage Module could differ from its charging capacity. Redraft to remove this ambiguity by referring to the *"normal full load discharging capacity"* of Electricity Storage Units.<br><br>Also, while item (a) excludes Units *"forming part of a CCGT Module or Power Park Module or Power Generating Module or Electricity Storage Module"*, item (b) provides guidance with respect to CCGT Module and Power Park Module but not to Electricity Storage Module. This inconsistency should be addressed. |
| | Glossary and Definitions<br><br>*"EU Code User"* | The proposed 1 January 2019 applicability date for Storage Users is impractical because it is before the approval of this grid code modification. It should be amended to no later than 6 months after this grid code modification is approved. |
| | PC.A.3.1.4(a)(ii)(2)(a) | It is not clear why the Network Operator should inform The Company about the types of batteries employed at each Embedded Small Power Station which includes battery Electricity Storage Units. This was not described in the consultation document.<br><br>This requirement should be deleted in the absence of a clear and proportionate justification. |
| | PC.A.3.4.3 | It is not clear why the Generator should inform The Company about the types of batteries employed at each of its battery Electricity Storage Units. This was not described in the consultation document.<br><br>This requirement should be deleted in the absence of a clear and proportionate justification. |
| | PC.A.4.6 | What does "Electricty Storage Module load" mean? The context suggests it means charging active power. This could be drafted more clearly. |
| | PC.A.4.7.1(a) | Delete "Storage" and substitute "Electricity Storage" |
| | Planning Code | Is The Company not interested in the amount of Electrical Energy which can be charged and discharged (or the maximum duration that Rated MW can be maintained)? |
| | ECC.6.3.1 | Is it necessary to clarify three times *"Power Generating Modules (which includes Electricity Storage Modules)"*? Once is helpful, three times is excessive and hinders readability, particularly as this point is made clear by the |

| | **Legal text comments** | |
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| | | Glossary and Definitions. |
| | Figure ECC.6.3.2.4(c) and Figure ECC.6.3.2.6(b) | These figures do not explicitly indicate the reactive power capability required of Electricity Storage Modules when charging. They should be amended accordingly to ensure clarity.<br><br>Specifically, the region bounded by -0.05 to 0.05 Q/Pmax which presently extends between 0.2 pu power and 0 pu active power should be extended to -1 pu active power (or some other expression denoting maximum charging power) |
| | Figure ECC.6.3.2.4(a) p29, second Figure ECC.6.3.2.4(a) p30 | There are two figures ECC.6.3.2.4(a). They should be given unique references and the references should be updated in the body of the ECC. |
| | ECC.6.3.7.1.6 | In a similar manner to the allowances made in ECC.6.3.3.1.1(c), allowances should be made for the finite charging energy capacity of Electricity Storage Modules.<br><br>Please add *"In the case of an Electricity Storage Module, an allowance will be made for the storage capability of the Electricity Storage Module."* |
| | ECC.6.3.15.10(i) | *"In the case of a Power Park Module, the requirements in ECC.6.3.15.9 do not apply when the Power Park Module is operating at less than 5% of its Rated MW"*<br><br>The definition of Rated MW refers to output and therefore charging (input) is less than any positive % of Rated MW. Is The Company content that Electricity Storage Modules are not required to remain connected in accordance with ECC.6.3.15.9 when they are charging? |
| | ECC.6.3.16.1 and sub-clauses | Refers to "reactive current", "maximum rated current", "rated Active Power", "Rated Active Power" and "rated Reactive Power" which are not defined terms.<br><br>Amend to use defined terms. |
| | ECC.6.5.6.4(e) | A state of charge signal and a Power Available Signal will be of limited use if The Company does not know the size of the associated energy store (not collected in proposed Planning Data). An energy store at 50% state of charge could be exhausted in 5 minutes or 5 hours.<br><br>"State of charge" is not a defined term in the Grid Code. State of charge (Coulombs or ampere hours) is frequently confused with state of energy (Joules or MWh). I expect that The Company is only interested in the latter.<br><br>Is The Company only interested in the Power Available to |

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| | **Legal text comments** | |
| | | be discharged from an Electricity Storage Module and not the power available to be charged into it? The definition for Power Available refers to exported Active Power only. |