**Supporting Information**

**Life Cycle Assessment of Compressed Air, Vanadium Redox Flow Battery, and Molten Salt Energy Storages for Hot Climate Implementation**

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**Life Cycle Inventory Tables**

Table S1. Life cycle inventory data for VRF-B manufacturing, calculated for 1 kWh.

|  |  |  |
| --- | --- | --- |
| **Inputs** | **Unit** | **Amount** |
| Polypropylenes granulate | kg | 0.000625 |
| Thermal energy | MJ |  |
| Steel hot rolled coil | kg |  |
| Sulphur trioxide | kg | 0.000636 |
| Metal | kg |  |
| Water | kg |  |
| Electricity, medium voltage | MJ |  |
| Graphite, battery grade | kg |  |
| Copper | kg |  |
| **Output** | **Unit** | **Amount** |
| VRF-B | pcs |  |

Table S2. Life cycle inventory data for VRF-B storage manufacturing, calculated for 1 kWh.

|  |  |  |
| --- | --- | --- |
| **Inputs** | **Unit** | **Amount** |
| Intermodal container 20 high-cube | pcs |  |
| Container ship | kgkm |  |
| VRF-B | pcs |  |
| **Output** | **Unit** | **Amount** |
| Storage, VRF-B | pcs |  |

Table S3. Life cycle inventory data for manufacturing of intermodal container high-cube 20, calculated for 1 kWh.

|  |  |  |
| --- | --- | --- |
| **Inputs** | **Unit** | **Amount** |
| Softwood plywood | m3 |  |
| Hot rolled steel | kg |  |
| **Output** | **Unit** | **Amount** |
| Intermodal container 20 high-cube | pcs |  |

Table S4. Life cycle inventory data for manufacturing of VRF-B use, calculated for 1 kWh.

|  |  |  |
| --- | --- | --- |
| **Inputs** | **Unit** | **Amount** |
| Electricity | MJ |  |
| Storage, VRF-B | pcs |  |
| **Output** | **Unit** | **Amount** |
| Electricity, high voltage. | MJ |  |

Table S5. Life cycle inventory data for CAES manufacturing, calculated for 1 kWh.

|  |  |  |
| --- | --- | --- |
| **Inputs** | **Unit** | **Amount** |
| Compressors | pcs |  |
| Motor/ generator | pcs |  |
| Naphtha | kg |  |
| Plastic profile | kg |  |
| Stainless steel | kg |  |
| Polyethylene, HDPE | kg |  |
| Ship | kgkm |  |
| Steel hot rolled | kg |  |
| Intermodal container 40 high-cube | pcs |  |
| **Output** | **Unit** | **Amount** |
| CAES | pcs |  |

Table S6. Life cycle inventory data for the CAES compressor calculated for 1 kWh.

|  |  |  |
| --- | --- | --- |
| **Inputs** | **Unit** | **Amount** |
| Aluminium profile | kg |  |
| Tin plate steel | kg |  |
| Copper | kg |  |
| Silicone | kg |  |
| Stainless steel | kg |  |
| Steel sections | kg |  |
| **Output** | **Unit** | **Amount** |
| Compressor | pcs |  |

Table S7. Life cycle inventory data for the CAES motor calculated for 1 kWh.

|  |  |  |
| --- | --- | --- |
| **Inputs** | **Unit** | **Amount** |
| Cast iron | kg |  |
| Copper | kg |  |
| Diesel | kg |  |
| Electricity | MJ |  |
| **Output** | **Unit** | **Amount** |
| Motor | pcs |  |

Table S8. Life cycle inventory data for manufacturing of CAES use, calculated for 1 kWh.

|  |  |  |
| --- | --- | --- |
| **Inputs** | **Unit** | **Amount** |
| CAES | pcs |  |
| Electricity | MJ |  |
| **Output** | **Unit** | **Amount** |
| Electricity | MJ |  |

Table S9. Life cycle inventory data for manufacturing of intermodal container high-cube 40, calculated for 1 kWh.

|  |  |  |
| --- | --- | --- |
| **Inputs** | **Unit** | **Amount** |
| Softwood plywood | m3 |  |
| Steel plate | kg |  |
| **Output** | **Unit** | **Amount** |
| Intermodal container 40 high-cube | pcs |  |

Table S10. Life cycle inventory data for solar field construction, calculated for 1 kWh.

|  |  |  |
| --- | --- | --- |
| **Inputs** | **Unit** | **Amount** |
| Aluminium oxide | kg |  |
| Area | m2 |  |
| Cast iron | kg |  |
| Steel sections | kg |  |
| Concrete | kg |  |
| Copper | kg |  |
| Polycarbonate granulate | kg |  |
| Graphite | kg |  |
| Iron | kg |  |
| Duct board | kg |  |
| Lubricants | kg |  |
| Cobalt | kg |  |
| Paint | kg |  |
| Polyethylene high density | kg |  |
| Stainless steel | kg |  |
| Plastic compound | kg | 0.000413 |
| Steel sections | kg |  |
| **Output** | **Unit** | **Amount** |
| Solar field | pcs |  |

Table S11. Life cycle inventory data for molten salt storage calculated for 1 kWh.

|  |  |  |
| --- | --- | --- |
| **Inputs** | **Unit** | **Amount** |
| Area | m2 |  |
| Tinplate steel | kg |  |
| Concrete | kg |  |
| Electricity | MJ |  |
| Expanded polystyrene (EPS) | kg |  |
| Mineral wool | kg |  |
| Sodium Chloride | kg |  |
| Nitrogen | kg |  |
| Concrete bricks | kg |  |
| Solar field | pcs |  |
| Stainless steel | kg | 0.000176 |
| **Output** | **Unit** | **Amount** |
| Molten salt storage | pcs |  |
| Electricity | MJ |  |