Appendix 1

Glossary

Activated sludge process: a biological wastewater treatment by which bacteria that feed on organic waste are continuously circulated and put in contact with organic waste in the presence of oxygen to increase the rate of decomposition.

Aerobic: "with oxygen", used for biological treatment systems characterised by the presence of oxygen, mostly as oxygen dissolved in water.

Alternating current (AC): electric current that reverses direction 50 or 60 times per second.

Anaerobic: requiring absence of air.

Aquifer: large body of permeable or porous material situated below the water table that contains or transmits groundwater.

Battery: a type of battery that can be given a new charge by passing an electric current through it is also called a storage battery. A lead-acid battery uses plates made of pure lead or lead oxide for the electrodes and sulphuric acid for the electrolyte; these remain common for off-grid installations. A lithium battery uses a liquid lithium-based material for one of its electrodes. A flow battery uses two chemical

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components dissolved in liquids contained within the system and most commonly separated by a membrane.

Blackwater: water from toilets. Compare greywater.

Brackish water: water that is neither fresh nor salt.

Brine: a solution containing large concentrations (higher than seawater) of sodium chloride and other salts.

Capacity: the rated capacity (for example 1 *MW*) of a power-generating plant, referring to the instantaneous electricity output.

Capacity factor: the ratio between the actual output of a power plant and the theoretical output of the same plant operating at full capacity. The capacity factor is considered over a specific time period, for example a year.

COD: chemical oxygen demand. Method of measuring the content of all oxidable substances in the water.

Conversion efficiency: the ratio between the produced energy from an energy conversion device and the energy input into it. For a solar PV the conversion efficiency gauges the percentage of solar (light) power reaching a module that is converted into electric power. If 100 *kWh* of solar radiation is received and 15 *kWh* electricity is generated, then the conversion efficiency is 15%.

Cut-off voltage (in a battery): the minimum allowable voltage. It is this voltage that generally defines the "empty" state of the battery.

Direct current (DC): the unidirectional flow of electric charge. A battery is a good example of a DC power supply. The electric current flows in a constant direction, distinguishing it from alternating current (AC).

Depth of discharge (DoD): the percentage of battery capacity that has been discharged expressed as a percentage of maximum capacity.

Desalination: reducing the contents of total dissolved solids or salt and minerals in sea- or brackish water into fresh water.

Discharge time: defined as the energy capacity divided by the nominal power. The time over which the energy stored in a storage device can be discharged at the nominal power rating.

Distributed generation: a small-scale power generation technology that provides electric power at a site closer to customers than central power plant generation.

Distributed renewable energy: energy system where generation and distribution occur independently from a centralised network. The system is close to the point of consumption.

Efficiency: the ratio obtained by dividing the actual power or energy by the theoretical power or energy.

Energy capacity: the amount of energy that can be stored and recovered from a storage device, expressed in joules or *kWh*.

Fossil fuel: fuels such as coal, crude oil or natural gas, formed from remains of plants and animals.

Fouling: the process of becoming dusty or clogged, for example, in which undesirable foreign matter accumulates in a bed of filter or ion exchanger media, clogging pores and coating surfaces, thus inhibiting or delaying proper bed operation. The fouling of a heat-exchanger consists of the accumulation of dirt or other materials on its wall, causing corrosion and roughness and ultimately leading to a lowered rate of efficiency.

Fresh water: water with less than 1,000–2,000 parts per million (*ppm*) of dissolved salts.

Generator: device that converts the rotational energy from a turbine to electric energy.

Greywater: domestic used water from kitchen, bathroom and laundry sinks, tubs and washers. Compare blackwater.

Groundwater: water that is below the land surface in pores or crevices of soil, sand and rock, contained in an aquifer. If the groundwater has a negligible rate of natural recharge on a human timescale it is often called fossil or non-renewable water.

Hydropower: the harnessing of flowing water – using a dam or other type of diversion structure – to create energy that can be captured via a turbine to generate electricity. Large hydropower is typically

a power rating of more than 30 *MW*. Small hydropower is typically less than 10 *MW*.

Intermittent electricity: electric energy that is not continuously available due to external factors that cannot be controlled. Sources of intermittent electricity include solar and wind power. Their electrical output cannot be used at any guaranteed time to meet fluctuating electricity demands.

Inverter (solar): a power electronics device that converts power from solar PV modules or batteries in DC form into alternating form (AC) at a required frequency and voltage output. This can be used by a local, off-grid network. The inverter circuit's AC output voltage waveform is not a sine wave but usually a square wave or a distorted sine wave.

Levelised cost of energy/electricity (LCOE): measure of the total cost (for example, measured in cost per *kWh*) to produce electricity, including capital cost, operating, maintenance and fuel costs. The cost is discounted back to a common year using a discount rate.

Levelised cost of storage (LCOS): the average cost to store and discharge energy (cost per *kWh*). The LCOS is calculated over the entire lifetime of the storage and includes the capital and operational costs. The cost is discounted back to a common year using a discount rate.

Off-grid renewable energy: renewable energy generation that is not connected to a larger electricity system or network.

Osmosis: the spontaneous net movement of solvent molecules (such as water molecules) through a semi-permeable membrane into a region of higher solute concentration (such as seawater), in the direction that tends to equalise the solute concentrations on the two sides.

Photovoltaic: production of electric current at the junction of two substances exposed to light. A photovoltaic cell (PV cell) is a specialised semiconductor diode that converts visible light into direct current (DC). Some PV cells can also convert infrared (IR) or ultraviolet (UV) radiation into DC electricity.

Reverse osmosis: type of membrane filtration (see osmosis).

Scaling: precipitation of solid substances on the membrane in nano- and reverse osmosis filtration.

Silicon: the basic material used to make solar cells. It is the second most abundant element in the earth's crust, after oxygen. Silicon is a metal and, therefore, its atoms are organised into a crystalline structure.

Solar home system (SHS): a stand-alone (not connected to the electricity grid) system composed of a relatively low-power photovoltaic module, a battery and sometimes a charge controller, which can power small electric devices and provide modest amounts of electricity to homes for lighting and radios.

State of charge (SoC): the present battery capacity as a percentage of maximum capacity. SoC can be calculated by integrating the current over time.

Surface water: water pumped from sources open to the atmosphere, such as rivers, lakes and reservoirs.

System cost: this includes all components of a renewable energy system other than the photovoltaic panels or the wind turbine. This contains wiring, switches, a mounting system, one or many inverters, a battery bank and battery charger. Other soft costs include: financing, mechanical installation, electrical installation, system design, customer acquisition, permitting, inspection/certification, connection, operation and maintenance.

Variable renewable energy: see Intermittent electricity.

Water consumption: the volume withdrawn that is not returned to the source (i.e. it is evaporated or transported to another location) and so by definition is no longer available for other uses (see Water withdrawal).

Water footprint: the amount of fresh water utilised, for example for energy production (such as litres/*kWh*).

Water stress: defined as when renewable annual fresh-water supplies fall below 1,700 m^3 per person and year; *water scarcity* (limitation to economic development and human health and well-being) is below

1,000 m^3 per person; and *absolute scarcity* (main constraint to life) below 500 m^3 per person.

Water treatment: process of removing contaminants from water or used water in order to bring it up to water quality standards and for storage in fresh-water reservoirs.

Water withdrawal: the volume of water removed from a source; by definition withdrawals are always greater than or equal to consumption (see Water consumption).

Wind park (wind farm): a group of wind turbines in the same location used to produce electricity.