

# TUBE ICE PLANT — 62.4 kWp ON-GRID SOLAR

Single-line diagram · Panel layout · Bill of materials

|                |                                                                                                         |                 |                         |
|----------------|---------------------------------------------------------------------------------------------------------|-----------------|-------------------------|
| <b>Project</b> | Solar PV for a tube ice machine (18 kW 3-phase compressor motor + auxiliaries), daytime operation 6–8 h | <b>Document</b> | TN-20261019-ICE01 Rev01 |
| <b>System</b>  | On-grid, zero export · 96 × LONGi 650 W = 62.4 kWp · Huawei SUN2000-50K-MC0                             | <b>Date</b>     | 19 October 2026         |

## 1. Design basis

| Item                                                           | Value                                                                             |
|----------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Running load (compressor ~17 kW + cutter, pump, condenser fan) | ~20–22 kW, 3-phase 400/230 V                                                      |
| Daily energy at 6–8 h operation                                | ~130–175 kWh/day                                                                  |
| PV array                                                       | 62.4 kWp; DC/AC ratio 1.25; ~245 kWh/day average (~89,000 kWh/yr)                 |
| Solar-only operation (clear day)                               | About 09:00–15:30; PV ≥ 22 kW from ~9:00 (~24 kW) to ~15:30                       |
| Grid role                                                      | Motor start, early/late hours and cloudy periods; no export (smart meter control) |
| Motor starting                                                 | Soft starter / VFD reduces start current from ~190 A (DOL) to ~50–60 A            |

## 2. String design

| String | Table  | Modules        | MPPT  | Vmp @ 52 °C | Voc @ 0 °C | Isc (STC / +10% rear) |
|--------|--------|----------------|-------|-------------|------------|-----------------------|
| S1     | T1     | 16 × 650 W     | MPPT1 | ≈ 603 V     | ≈ 835 V    | 16.5 / 18.1 A         |
| S2, S3 | T2, T3 | 2 × 16 × 650 W | MPPT2 | ≈ 603 V     | ≈ 835 V    | 33.1 / 36.2 A         |
| S4, S5 | T4, T5 | 2 × 16 × 650 W | MPPT3 | ≈ 603 V     | ≈ 835 V    | 33.1 / 36.2 A         |
| S6     | T6     | 16 × 650 W     | MPPT4 | ≈ 603 V     | ≈ 835 V    | 16.5 / 18.1 A         |

Inverter limits: 1,100 V max input; MPPT range 180–1,000 V (rated 600 V); MPPT2/3 accept up to 44 A short-circuit current; 23 A per input. All strings are inside the limits with margin.

### 3. Single-line diagram

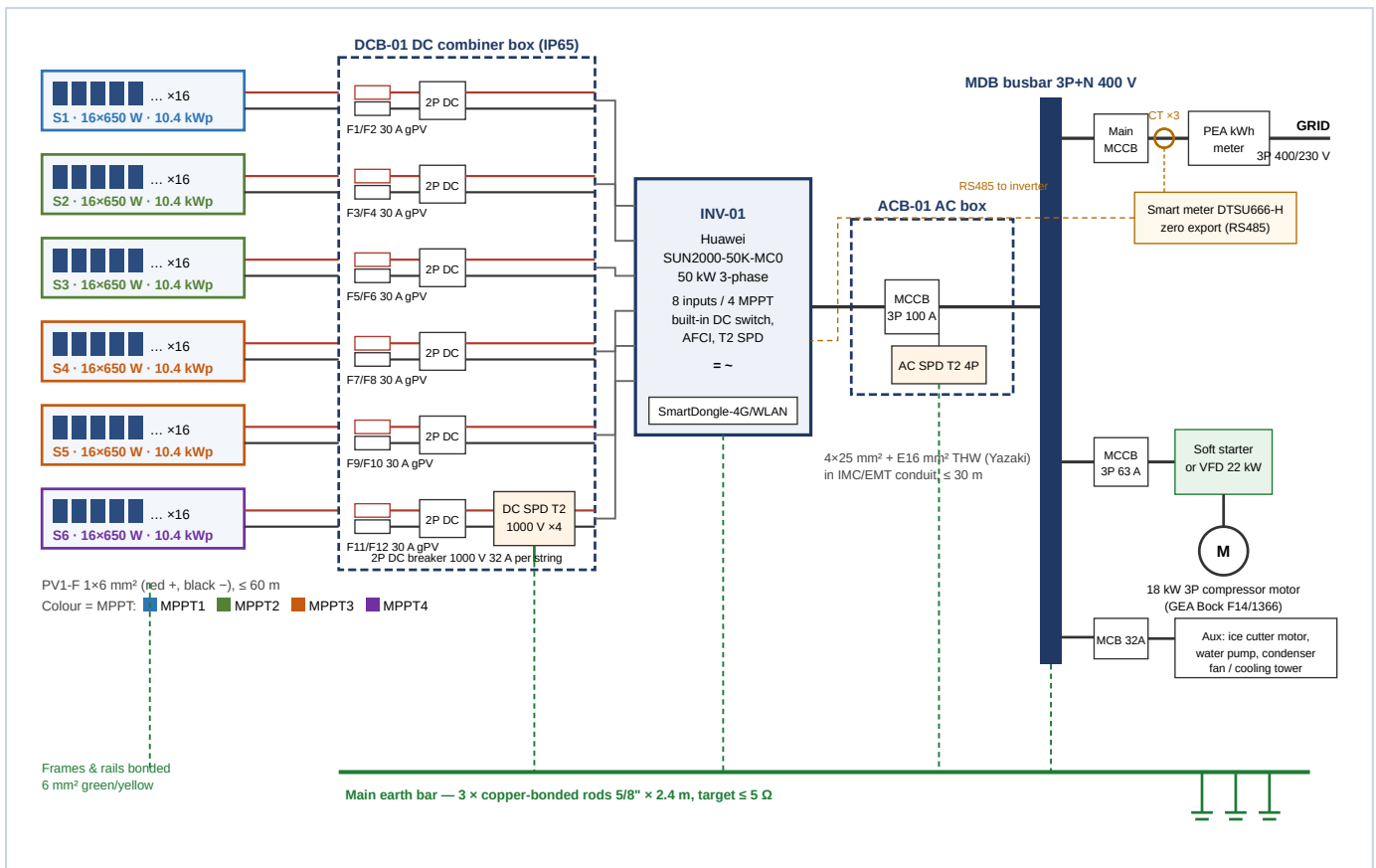


Figure 1 — Single-line diagram. DCB-01 DC combiner box and ACB-01 AC box next to the inverter; the smart meter and CTs at the grid inverter keep export at zero. Earth bonding shown dashed green.

## 4. Panel layout

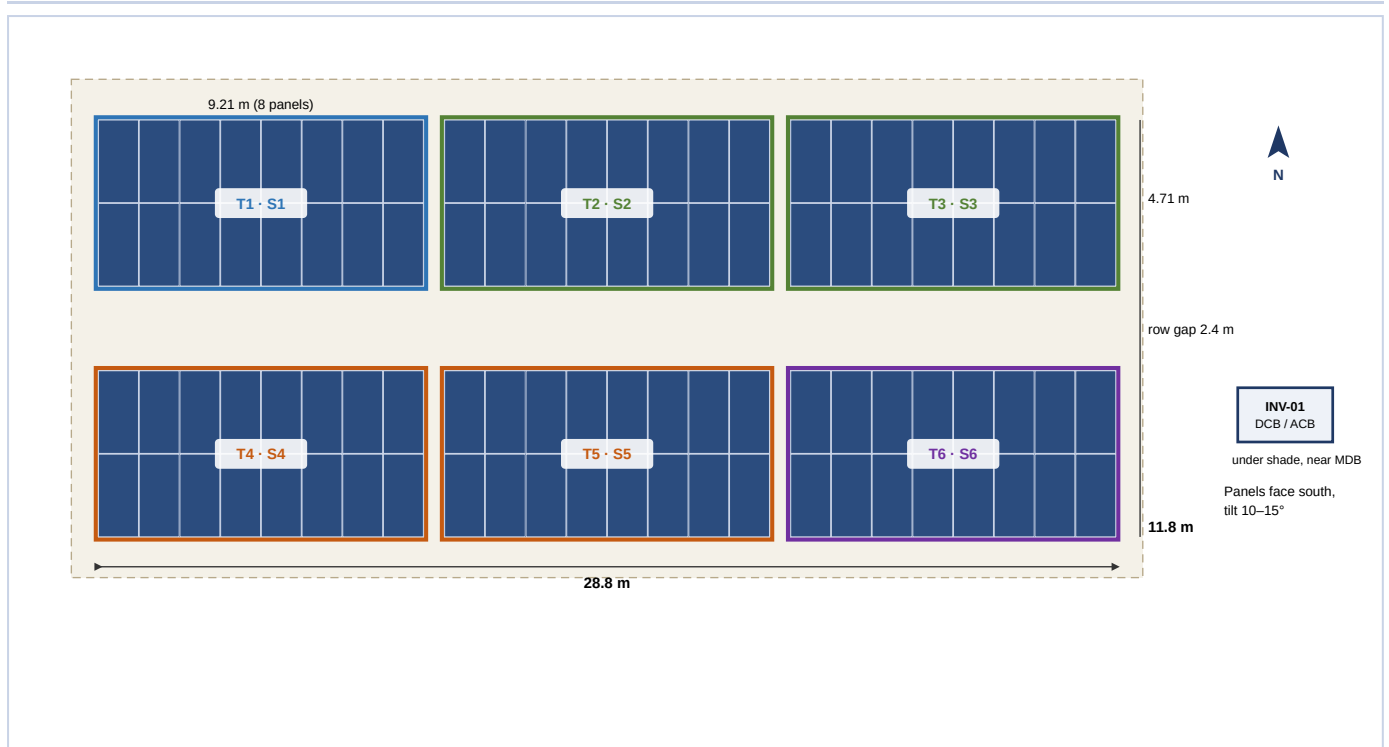


Figure 2 — Ground or flat-area layout: 6 tables (T1–T6) of 2 × 8 panels in portrait, one string per table, colour-coded by MPPT. Array 28.8 × 11.8 m ≈ 340 m<sup>2</sup> including the 2.4 m row gap and walkways. On a metal-sheet roof the same 96 panels fit about 280 m<sup>2</sup> of south- or east/west-facing roof, mounted on rails.



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## 5. Bill of materials

| No.      | Item                                            | Specification                                                                            | Unit  | Qty |
|----------|-------------------------------------------------|------------------------------------------------------------------------------------------|-------|-----|
| <b>A</b> | <b>PV array and inverter</b>                    |                                                                                          |       |     |
| 1        | PV module                                       | LONGi LR8-66HVD-650M, 650 Wp, anti-glare, back-contact                                   | pcs   | 96  |
| 2        | Inverter                                        | Huawei SUN2000-50K-MC0, 50 kW 3-phase, 4 MPPT / 8 inputs, AFCI                           | set   | 1   |
| 3        | Smart meter (zero export)                       | Huawei DTSU666-H + 3 split-core CTs sized to the main breaker                            | set   | 1   |
| 4        | Monitoring                                      | Huawei SmartDongle-4G (or WLAN-FE), FusionSolar app                                      | set   | 1   |
| <b>B</b> | <b>Mounting structure (ground or flat area)</b> |                                                                                          |       |     |
| 5        | Mounting tables                                 | Hot-dip galvanized steel / aluminium frame, 6 tables of 2×8 panels portrait, tilt 10–15° | table | 6   |
| 6        | Mid clamps                                      | For 30 mm frame, stainless bolts (incl. 5% spare)                                        | pcs   | 176 |
| 7        | End clamps                                      | For 30 mm frame, stainless bolts (incl. 5% spare)                                        | pcs   | 50  |
| 8        | Footings                                        | Helical pile Ø89 mm or concrete pad per STR-02 design, 8 posts per table                 | post  | 48  |
| <b>C</b> | <b>DC side</b>                                  |                                                                                          |       |     |
| 9        | PV cable, red                                   | PV1-F 1×6 mm <sup>2</sup> , 1.8 kV DC, TÜV, LINK                                         | m     | 300 |
| 10       | PV cable, black                                 | PV1-F 1×6 mm <sup>2</sup> , 1.8 kV DC, TÜV, LINK                                         | m     | 300 |
| 11       | PV connectors                                   | Same make as the module connectors (pairs, incl. spares)                                 | pair  | 18  |
| 12       | DC combiner box                                 | KJL steel enclosure IP65 with gland plate, DCB-01                                        | set   | 1   |
| 13       | gPV fuse + holder                               | SUNTREE 30 A gPV 1000 V DC, 10×38, both poles of each string                             | pcs   | 12  |
| 14       | DC breaker                                      | SUNTREE 2P 32 A 1000 V DC, one per string                                                | pcs   | 6   |
| 15       | DC surge protection                             | SUNTREE Type II 1000 V DC, one per MPPT                                                  | pcs   | 4   |
| <b>D</b> | <b>AC side</b>                                  |                                                                                          |       |     |
| 16       | AC box                                          | KJL steel enclosure IP55, ACB-01                                                         | set   | 1   |
| 17       | Inverter output breaker                         | CHINT MCCB 3P 100 A, 25 kA                                                               | pcs   | 1   |
| 18       | AC surge protection                             | SUNTREE Type II 4P 40 kA 385 V AC                                                        | pcs   | 1   |
| 19       | AC cable (phases + neutral)                     | Yazaki THW 25 mm <sup>2</sup> (4 cores × 30 m)                                           | m     | 120 |
| 20       | AC earth cable                                  | Yazaki THW 16 mm <sup>2</sup> green/yellow                                               | m     | 30  |
| 21       | Conduit and fittings                            | IMC/EMT 1½", boxes, straps, glands                                                       | lot   | 1   |
| <b>E</b> | <b>Motor and load side (recommended)</b>        |                                                                                          |       |     |
| 22       | Soft starter or VFD                             | 22 kW 3-phase for the 18 kW compressor motor, with bypass contactor                      | set   | 1   |
| 23       | Ice machine feeder breaker                      | CHINT MCCB 3P 63 A in the MDB                                                            | pcs   | 1   |
| <b>F</b> | <b>Earthing</b>                                 |                                                                                          |       |     |
| 24       | Earth rods                                      | Copper-bonded 5/8" × 2.4 m, with clamps and inspection pits                              | pcs   | 3   |
| 25       | Earth conductor                                 | 16 mm <sup>2</sup> green/yellow to main earth bar                                        | m     | 50  |
| 26       | Bonding conductor                               | 6 mm <sup>2</sup> green/yellow for frames, rails and boxes                               | m     | 100 |
| <b>G</b> | <b>Services</b>                                 |                                                                                          |       |     |
| 27       | Installation                                    | Mounting, electrical installation, labelling                                             | lot   | 1   |

|    |                           |                                                                                      |     |   |
|----|---------------------------|--------------------------------------------------------------------------------------|-----|---|
| 28 | Testing and commissioning | IEC 62446 tests: polarity, Voc, Isc, insulation, earth resistance; zero-export check | lot | 1 |
| 29 | PEA documents             | Notification and documents for the zero-export system                                | lot | 1 |

## 6. Notes and items to confirm

- Loads are estimated from the nameplates in the photos (GEA Bock F14/1366 compressor driven by an 18 kW motor; Müller gear motor nameplate not readable). Confirm the auxiliary motor ratings and whether the condenser is air-cooled or uses a cooling tower.
- Grid connection assumed 3-phase 400/230 V with enough capacity to start the motor without solar. Confirm the main breaker rating so the CTs and cables can be sized exactly.
- Cable lengths assume the inverter within 30 m of the MDB and the array within 60 m of the inverter; quantities are adjusted after the site survey.
- Mounting assumes a ground or flat area of about 30 × 12 m facing south. For a roof installation, rails and clamps replace items 5 and 8 after a roof survey.
- Off-grid / backup option (if the grid is weak or absent): Solis S6-EH3P50K-H hybrid inverter with 60 kWh FlexCore-ID battery, with the same PV array.