

# SOLAR ON EVERY VEHICLE

SONO  MOTORS



SONO MOTORS – MARCH 2023

Company Presentation



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## COMPANY OVERVIEW

## Sono Group – German engineering and a global vision



**HQ in Munich, Germany, founded in 2016**



**IPO'ed in Nov. 2021** (NASDAQ: SEV)



**~110 employees** expected by June 1, 2023 (~80 engineers)<sup>1</sup>



**~€290m raised**<sup>2</sup>



**Solar business commercialized and started to generate revenues**<sup>3</sup>

1) Layoffs of approx. 250 out of approx. 360 employees were communicated at the end of February 2023. 2) Angel/Seed: ~€3.3m, Series A: ~€5.6m, Series B / Crowd: €7m, Convertible notes: ~€9.3m, Series C 2020: ~€38m, IPO 2021: ~€142m, Follow on spring 2022: ~€38.5m, CEF as of November 30, 2022: ~€17.2m, Convertible debentures December 2022: €30m 3) Approx. €180k for Q1-Q3 2022.

## MANAGEMENT BOARD<sup>1</sup>

4



**LAURIN HAHN**  
Co-CEO & Co-Founder



**JONA CHRISTIANS**  
Co-CEO & Co-Founder



**TORSTEN KIEDEL**  
CFO



**MARKUS VOLMER**  
CTO



FREENOW ✓ FLiX



FOTON  
福田汽车



## SUPERVISORY BOARD



**MARTINA BUCHHAUSER**  
Chair



**ROBERT JEFFE**  
Vice Chair



**ARND SCHWIERHOLZ**  
Financial Expert



**SEBASTIAN BÖTTGER**  
Community Member



**JOHANNES TRISCHLER**  
Employee Representative



citi



Morgan Stanley CREDIT SUISSE



UBS

N26

airberlin



Lufthansa FLiX



NELESO



SONO MOTORS

1) Chief Operating Officer Thomas Hausch has decided to step down from his role, but will continue to support the Company's transition in the course of 1H 2023.



SONO SOLAR TECHNOLOGY

# Problem & Solution





# The Problem: increasing energy costs; meeting sustainability goals

## GOVERNMENT, STATES & MUNICIPALITIES



Having to meet **regulatory targets**, e.g. from EU Transport Greenhouse Gas Emission's directive



Bannings of fossil fuels towards **green(er) cities**



**Grid overload** and destabilization as well as strong increase in demand for sustainable electricity



Lack of **charging infrastructure**

## OEMS & FLEET OWNERS



**Total Cost of Ownership**



Pressure on **CO<sub>2</sub> emissions reduction** (e.g. penalties by cities)



**Limited range** for e-vehicles and **constant concern** about having to charge



**Costs of energy** (diesel or electricity via battery)

**Tailwind through subsidies from Government, States & Municipalities for electrification & CO<sub>2</sub> avoidance**



# The Solution: Versatile solar tech for various vehicles and use cases

## BUSES



- Reducing CO<sub>2</sub> emissions
- Reducing TCOs<sup>1</sup>
- Running auxiliary systems

## REFRIGERATED VEHICLES



- Prolonging operating hours
- Reducing risks of cooled goods getting wasted

## RECREATIONAL VEHICLES



- Increasing independency
- Running auxiliary systems

## AUTOMOTIVE OEMS



- Increasing range
- Increasing independency
- Reducing TCOs
- Convenience

1) TCO = Total Cost of Ownership.



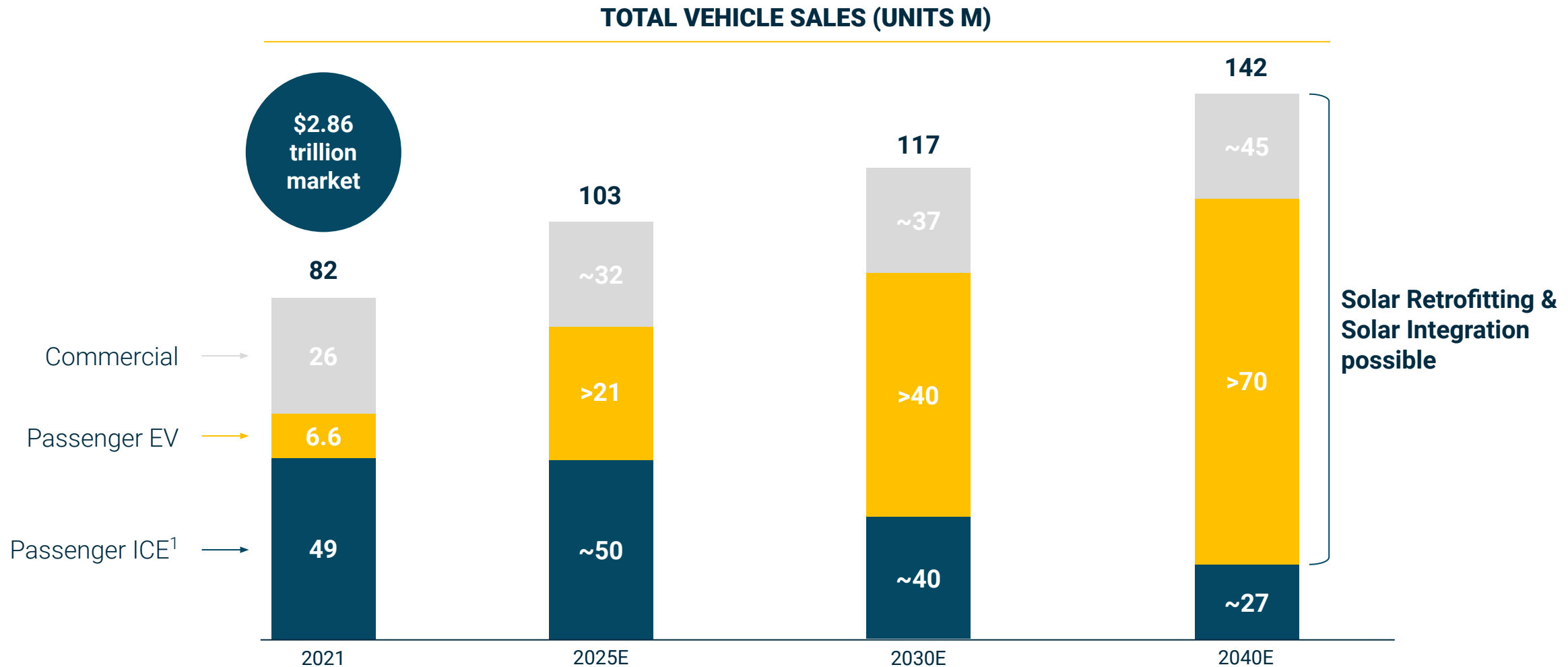
SONO SOLAR TECHNOLOGY

# Market & Demand





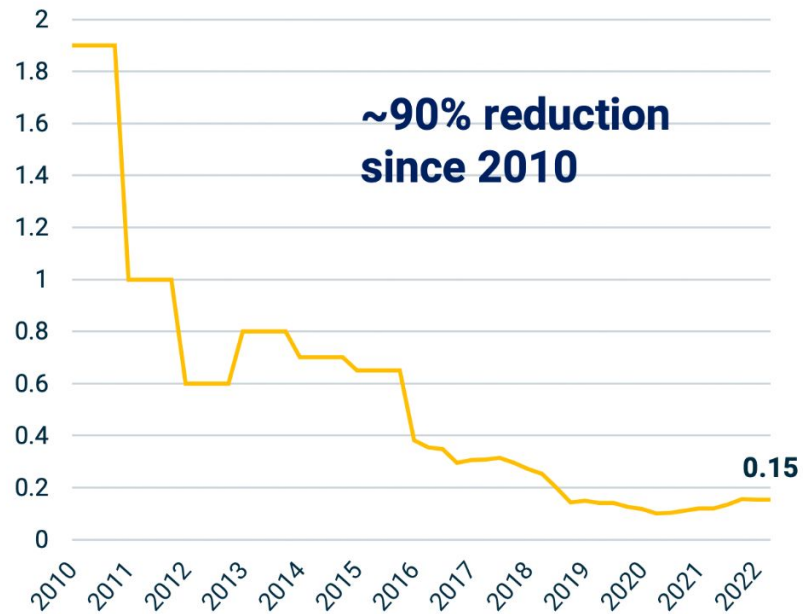
# Strong global growth of huge addressable market for solar integration



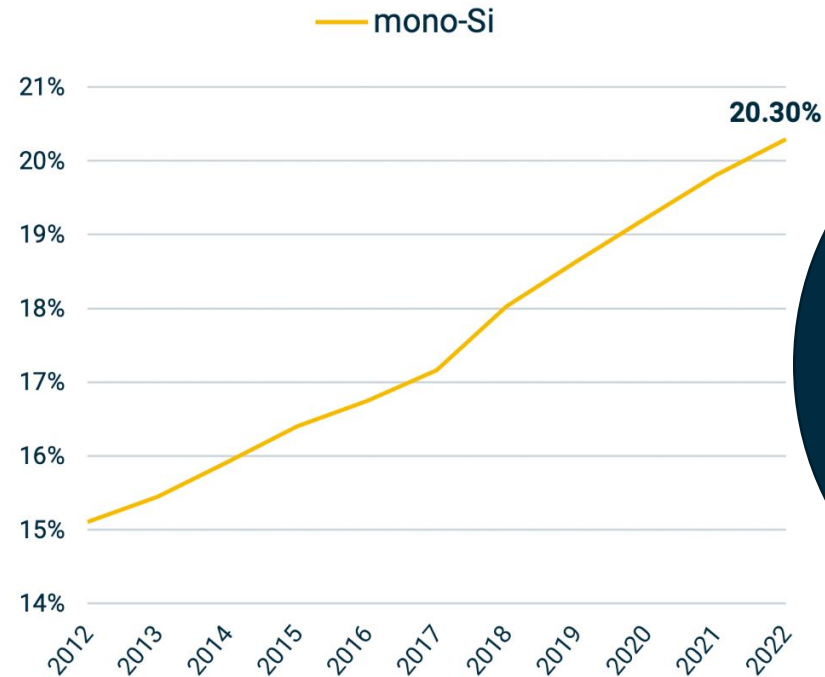
1) Internal Combustion Engine.  
Sources: BNEF 2022, IEA 2022, OICA, EV-Volumes.com..

# Timing is perfect: two trends why solar integration makes sense *now*

**PV MODULE PRICE (\$/W) DECREASING**



**PV MODULE EFFICIENCY INCREASING**



**SOLAR IS NOW  
ONE OF THE  
CHEAPEST  
ELECTRICITY  
SOURCES**

IEA, 2020



# The Passenger Vehicles industry is waking up to integrate solar ...

GLASS SOLAR

POLYMER SOLAR

Other OEMs

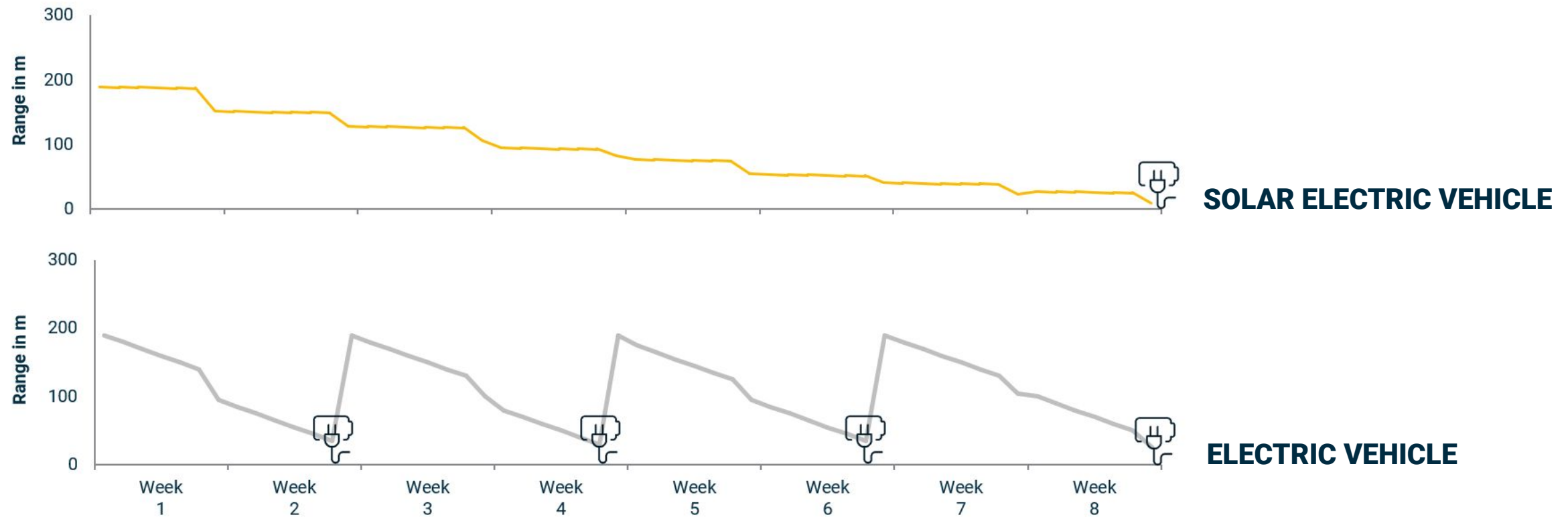


WEIGHT	Heavier	Lighter
PRODUCTION	Slower & Complex	Faster & Lean
PRICE	Expensive	Affordable

Sono has a **technology edge** over other solar integration solutions



... because commuters get up to 4x more range and may benefit from significant savings per year, while worrying less about charging



**The average daily distance driven with a car in German metropolitan areas is 16 km<sup>1</sup>.**  
An SEV only needs **1 charge to drive >1,000 km<sup>2</sup> (>620 mi)** while other vehicles with the same battery size and the same consumption need at least 4 charges to reach the same distance.





# 23 customers prove the strong demand for Sono's solar technology



1) 9 non-binding LOIs and 3 purchase orders (with 2 customers we had both an LOI and a purchase order). 2) 12 non-binding LOIs and 16 purchase orders / contracts signed and/or products delivered (with 5 customers we had both an LOI and a purchase order). 3) As of February 15, 2023.

# SOLAR CUSTOMER TRACTION

Our solar technology already delivered to first customers





# ... because Solar makes sense economically - also for ICE buses

- Solar bus kit saves up to **1,500 liters** of diesel per year<sup>1</sup>
- Up to **€2,360 p.a. savings** of fuel costs<sup>2</sup>
- Potential **payback period** is around **4 years** while buses are ~13 years in operation<sup>3</sup>
- Europe proposed a revision to **CO2 standards** for trucks, trailers, and buses<sup>4</sup>
- **Tailwinds** for **avoiding CO2 emissions** and penalties for manufacturers and operators



**saves  
4 tonnes of  
CO<sub>2</sub> per bus  
per year<sup>1</sup>**

1) Assumptions: 320 days in operation p.a. in Munich. Depends on operating hours, alternator efficiency and other factors. 2) Average diesel consumer price per liter for commercial customers in 2022 was 1.57 €/l and 5.955 €/gallon, source: <https://www.bgl-ev.de/images/downloads/dieselpreisinformation.pdf>. 3) Source: <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3410025401>. 4) Source: [https://climate.ec.europa.eu/system/files/2023-02/policy\\_transport\\_hdv\\_20230214\\_proposal\\_en\\_0.pdf](https://climate.ec.europa.eu/system/files/2023-02/policy_transport_hdv_20230214_proposal_en_0.pdf).





**SONO SOLAR TECHNOLOGY**

Technology, IP and Patents



# 4 Pillars: Vertically integrated & proprietary<sup>1</sup> automotive solar technology

## 1. BASE PRODUCT



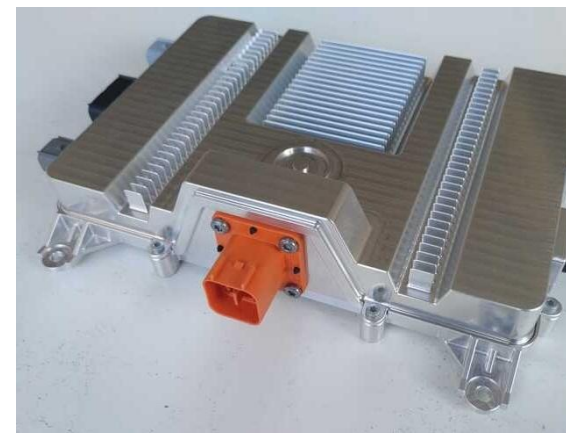
**Preassembly of  
solar cells**

## 2. SOLAR BODY PANEL



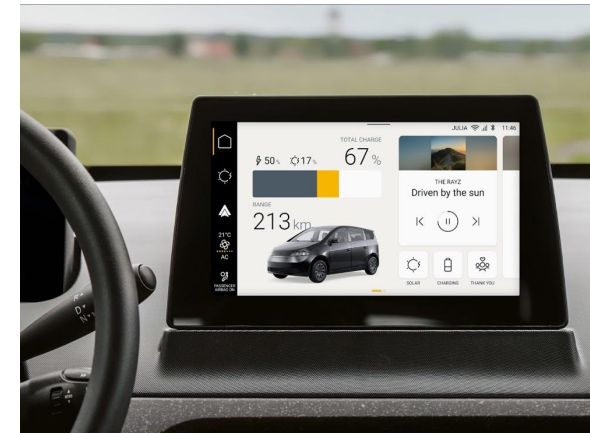
**Integration of  
pre-assembled solar cells  
into vehicle body**

## 3. POWER ELECTRONICS



**Specialized solar power  
electronics providing  
CAN<sup>2</sup> communication**

## 4. SOFTWARE



**Live energy data and  
optimization of energy  
yields**

**Intellectual property: 52 patents<sup>1</sup>**

1) 52 patents filed or granted in total (including same patents filed in different jurisdictions), 4 patents granted, 48 patents or patent/utility model applications filed as of February 15, 2023.

2) Controller Area Network.



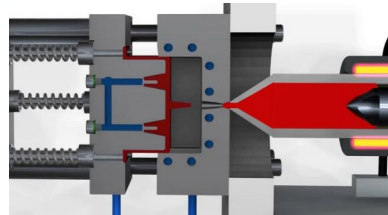
# Our core technology is a patented solar assembly process

### SONO MOTORS' BASE PRODUCT



Special **pre-assembly** of the **solar cells** to **protect** them from high- temperature and high-pressure processes

### INJECTION MOLDING

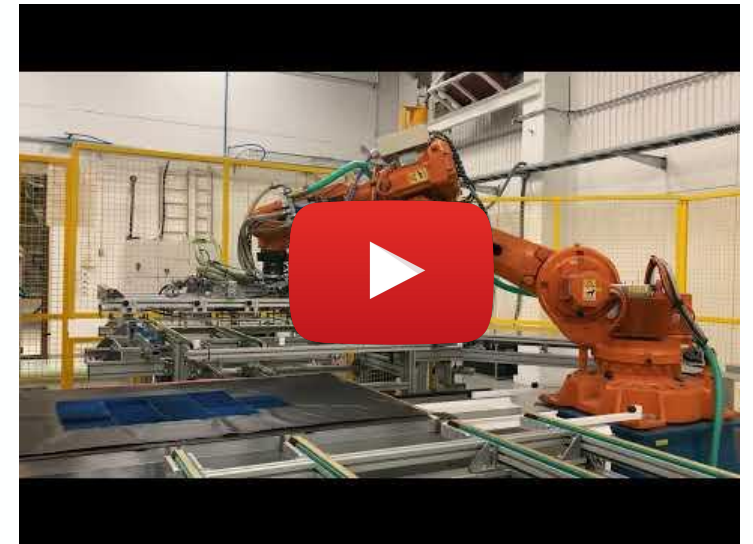


Adapted patented **injection molding process** to allow solar integration

### SOLAR BODY PANEL



**Seamless integration** of solar cells into body panels



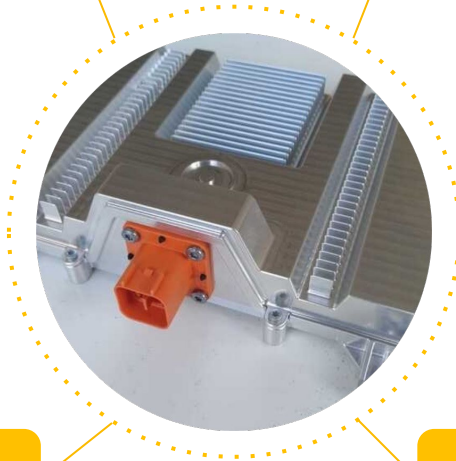


## SOLAR POWER ELECTRONICS

Our MCU<sup>1</sup> provides a significant technological edge over existing solutions

### HIGHER ENERGY YIELD

- **Intelligent algorithm** enables >90% **conversion efficiency**
- **Fast adaptation to changing sun conditions** enables 99% **tracking efficiency**
- **Individual tracking** of differently oriented solar panels through multi-channel architecture



### ALL VEHICLES TYPES POSSIBLE

- **Direct charging of High Voltage systems** possible (400V-800V). Suitable for BEV and heavy vehicles powertrains
- Additionally, **Low Voltage capable** (24V-48V). Suitable for vehicle auxiliary systems

### DATA GENERATION

- Data: **worldwide solar map** generated through customers for free
- Planned development of **AI-based intelligent algorithms** based on location, use-case and solar irradiance

### AUTOMOTIVE COMPLIANCE

- **Certification** according to **automotive standards** planned
- Capable of **CAN<sup>2</sup> Communication**

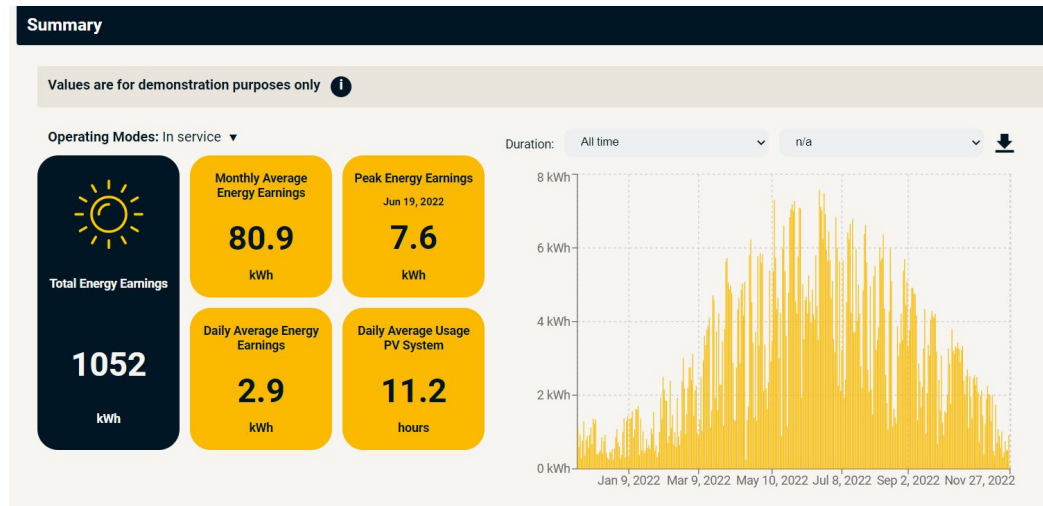
1) MCU = Maximum Power Point Tracking Central Unit. 2) CAN = Controller Area Network Source: Company information.



## SOLAR DATA

# Software: Solar data tracking and visualization for better customer experience

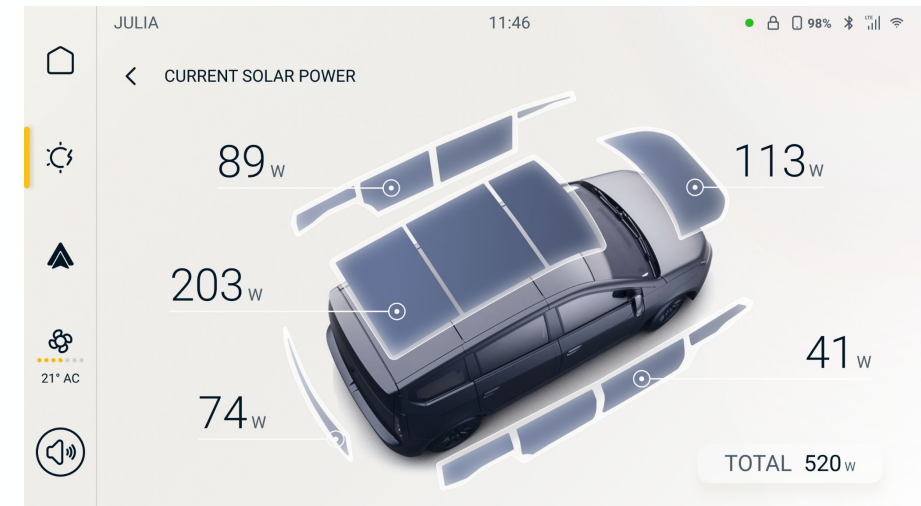
### DASHBOARD



#### Fleet solution (B2B):

- Easy **web-access** to **monitor the solar data** of your fleet
- View detailed **energy earnings** per vehicle for insights into the performance of the solar solution
- Extract the data directly or as automatically-created **monthly reports**

### INFOTAINMENT SOLUTION



#### Customer Experience (B2C)

- Historical and **real-time solar data** available
- Solar yield provided to customers on all touchpoints: in-vehicle infotainment, **mobile app**, operations center
- Planned development of **AI-based range prediction** capabilities



# Patents: Our disruptive technology is well protected



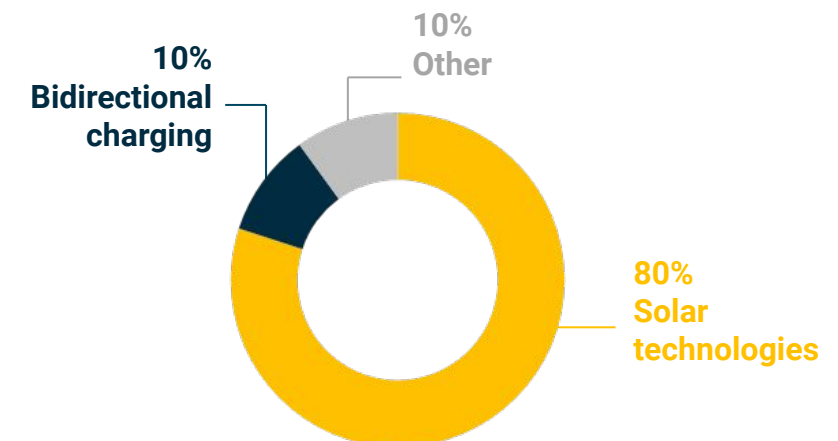
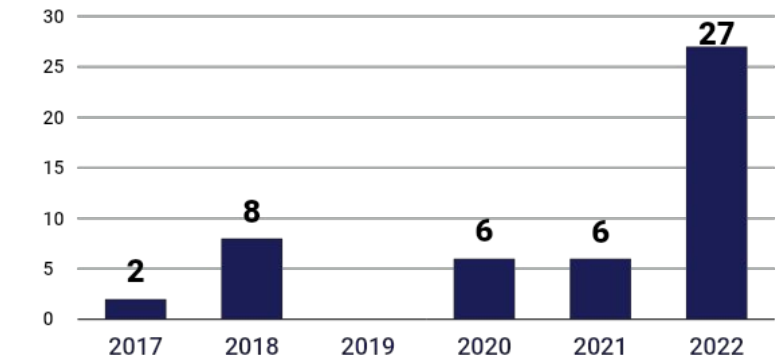
## Compression injection molding

- Method for producing a PV panel using a thermosetting polymer (Reaction Injection Moulding - RIM)
- Compression moulding

## Other selected patent applications in the solar technology:

- Method for **manufacturing a photovoltaic module**
- Method for **fabricating a curved photovoltaic module** including adapted positioning of photovoltaic cells
- Method for fabricating a photovoltaic module including **laser cutting** of a photovoltaic label
- **Car body panel** including a solar cell arrangement and method for producing same
- Method for fabricating a PV<sup>2</sup> module using **in-mould labeling** with specific temperature management
- **PV sandwich panel** and method for producing sandwich panel
- PV sandwich panel with improved sustainability
- Method for **producing a PV label** for PV panel production and corresponding PV label
- Cover for an open load bed of a vehicle
- PV Panel **back structure**
- Method for **thermal treatment** of a laminated composite

## Dynamics of applications



1) In total (patents relating to the same technology, but filed in different jurisdictions, are counted separately), 4 patents granted, 48 patent applications/utility model applications filed as of February 15, 2023. 3 applications were filed in 1Q 2023.  
2) PV = photovoltaic.





**SONO SOLAR TECHNOLOGY**  
Business Model



# Diversified revenues across a variety of large industry sectors

## BUSES



- Key product: **Solar Bus Kit**

## REFRIGERATED VEHICLES



- Key products: **PV know-how + project management + MCU**

## RECREATIONAL VEHICLES



- Key products: **PV know-how + project management + MCU + Infotainment system**

## AUTOMOTIVE OEMS



- Key product: **license for the system/patents** (PVs on hoods, roofs, etc. and HV MCU)



## BUSES

# Solar Bus Kit: scalable solar retrofit for Diesel Buses

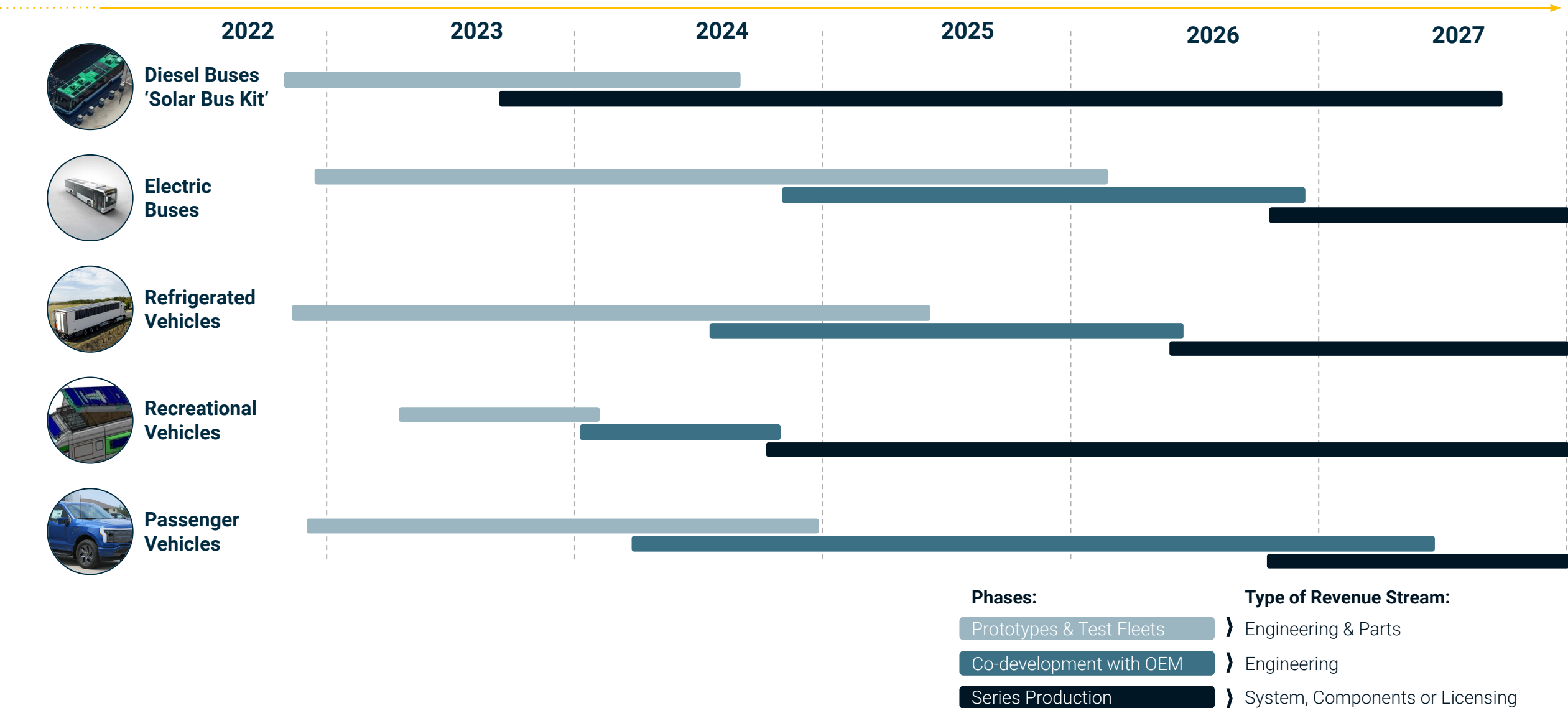
- Product successfully **launched and 15+ buses already equipped**
- Total **addressable market** is **~88,000 units** of 12 meter city diesel buses in Europe out of a total number of ~822,000 buses in Europe<sup>1</sup>



<sup>1</sup>) <https://www.acea.auto/files/ACEA-report-vehicles-in-use-europe-2023.pdf>  
Source: Company information and estimates.

KEY STEPS TO PLANNED SERIES PRODUCTION

3 Phases: Prototype, Development, Production







**oljo** 2018  
preisträger deutscher mobilitätspreis

**N** FUTURE 50



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