



# dbAccess ESG Conference

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# Green energy and energy-efficient products are key ingredients to deal with climate change

## Our mission



We make life easier



We make life safer



We make life greener

Global megatrends drive energy demand and underline the increasing importance of microelectronics ...



... triggering superior growth in the markets successfully addressed by Infineon



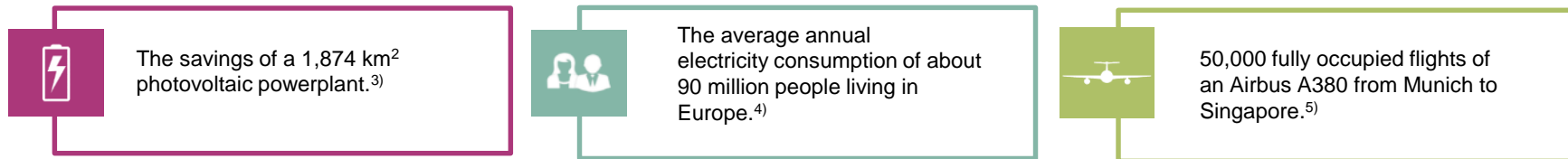
# Our products and innovations together with an efficient production are key elements to deal with climate change

## We contribute a CO<sub>2</sub> reduction of more than 54 million tons



\*The increase in the burden of CO<sub>2</sub> equivalents can be mainly explained by including manufacturing service providers for the first time into the calculation

## Our net ecologic CO<sub>2</sub> benefit is equal to...



For explanatory notes see page "ESG footnotes" in the appendix.

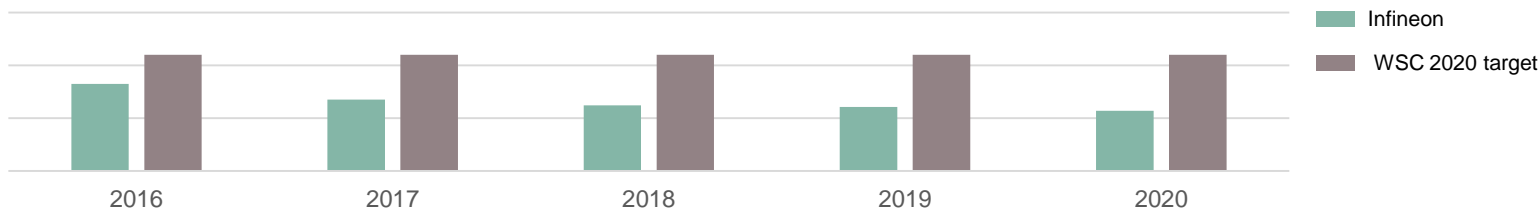
# Infineon will become carbon-neutral by 2030

## 70% CO<sub>2</sub> emissions reduction target in 2025 (Scope 1 and 2 emissions)

1. Avoiding direct emissions and further reducing energy consumption
2. Purchasing green electricity with guarantees of origin for unavoidable emissions
3. Compensate the smallest part by certificates that combine development support and CO<sub>2</sub> abatement

Abatement of Perfluorinated Compounds (PFC's)<sup>1)</sup> is one of the most important measures avoiding direct emissions.

## Normalized PFC emissions rate in tons of CO<sub>2</sub> equivalent per square meter wafer



Historically, Infineon's normalized emission rate has been below WSC 2020 target of 2.2 in tons of CO<sub>2</sub> per square wafer

<sup>1)</sup> Namely perfluorinated and polyfluorinated carbon compounds, sulfur hexafluoride (SF<sub>6</sub>) and nitrogen trifluoride (NF<sub>3</sub>)

# Infiniteon is voluntarily committed towards international standards and local societies



## Infiniteon is continuously balancing social, ecological and economic aspects in its decision-making

- Infineon joined the **UN Global Compact** in 2004 and voluntarily committed to the Ten Principles
- We support the **UN Sustainable Development Goals (SDGs)**
- We implemented the **UN Guiding principles on Business and Human Rights** in our activities
- We disclose our performance in our Sustainability Report, prepared in accordance with the „**GRI<sup>1</sup> Standards**“

## CSR at Infineon comprises our voluntary commitment in the areas of:



Business  
Ethics



Human Resources  
Management and  
Human Rights



Occupational  
Safety and  
Health



Environmental  
Sustainability



CSR Supply Chain  
Management



Corporate  
Citizenship

<sup>1)</sup> Global Reporting Initiative

# Pathway to Carbon Neutrality will drive demand for green and energy-efficient products

## USA

Copenhagen Accord: US emissions reduction target of 17% below 2005 levels by 2020

2020: The US exit Paris agreement

2035: Biden aims for an emissions-free power sector by 2035

2045: Carbon Neutrality Target, California

2045-2050: GHG Neutrality Target, Montana

Biden aims for zero emissions by 2050

## EU

Key targets for 2020

- 20% less greenhouse gas
- 20% EU energy from renewables
- 20% improvement of energy efficiency

**EU 32.5% energy efficiency target for 2030**  
(under review)

2035: Carbon Neutrality Target Finland

2045: Carbon Neutrality Target Sweden

**55% Reduction of EU greenhouse gas emissions by 2030**

2040: Carbon Neutrality Target Austria

EU aims to be carbon neutral

## China

2005: mandatory goal of **20% reduction of energy intensity** between 2006 and 2010

2015: Goal to **cut of energy intensity by 15% from 2016 to 2020**

Update 2019: lowered to 13%

Soon: **5 year plan** 2021-2025 sustainable goals expected

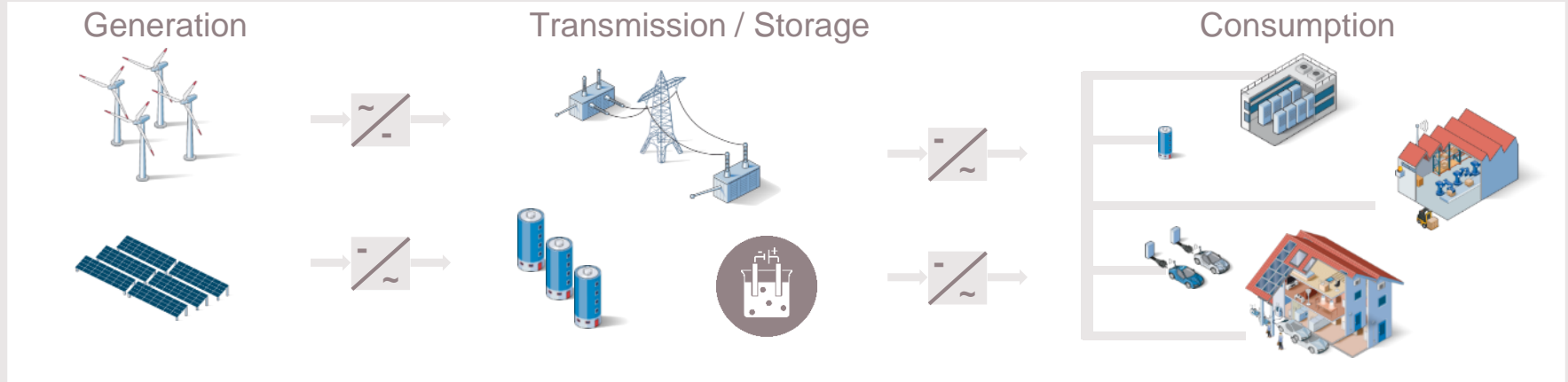
2020: China drops Energy Efficiency Targets amid Covid-19 Crisis

China targets carbon neutrality



# Electricity will become the most important energy carrier of the 21<sup>st</sup> century – we are shaping the electrical energy chain

## Infineon offers semiconductors throughout the electrical energy chain



### Renewable energy

- › Wind energy
- › Photovoltaic energy

### Stable and efficient supply

- › HVDC (high-voltage direct current)
- › Smart grid
- › Battery storage
- › Hydrogen energy storage

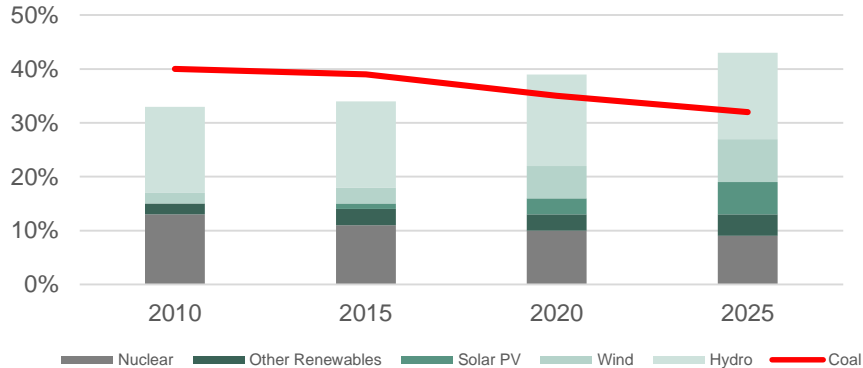
### Efficient use – Making more out of less

- › Data center
- › Industrial applications
- › Electro-mobility
- › Smart home

# Renewables are on track to supply more power globally than coal by 2025

## Increasing renewable share in global electricity supply\*

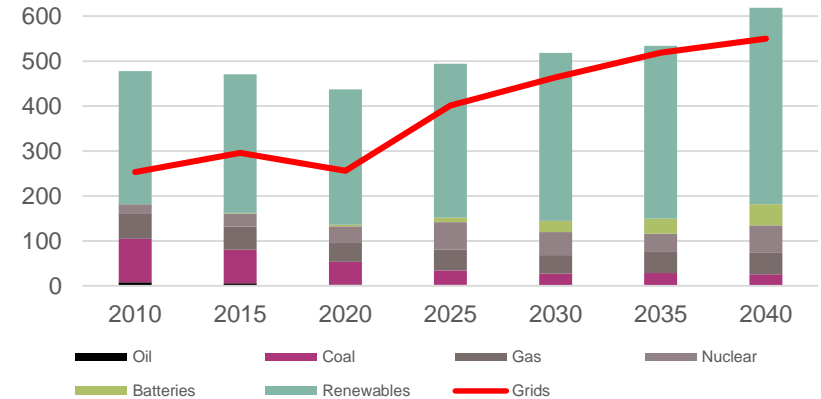
Renewables, nuclear and coal shares of global electricity supply in the Stated Policies Scenario, 2010-2030



- › Renewables are on track to supply more power globally than coal by 2025

## Global power sector investment\*

[USD bn (2019)]



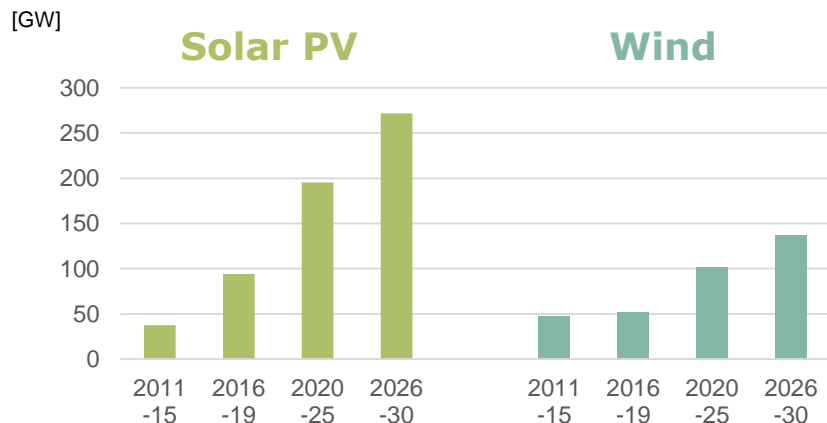
- › Investment in renewables recovers quickly
- › Grids capture a growing portion of total investment to modernize and digitalize power systems

\* Source: International Energy Agency (IEA): *World Energy Outlook. 2020*; pages 223, 225.



# We are the #1 semiconductor enabler of renewable energies

## Average annual solar PV and wind capacity additions



Source: World Energy Outlook 2020, Average annual solar PV and wind capacity additions in the Sustainable Development Scenario to 2030 p. 109

## All leading renewable energy players are our customers\*

### PV inverter<sup>1)</sup>

- 1 | Huawei
- 2 | Sungrow
- 3 | SMA
- 4 | Power Electr.
- 5 | Solar Edge
- 6 | ABB
- 7 | TMEIC
- 8 | Sineng Electric
- 9 | Growatt
- 10 | Ginlong

### Wind<sup>2)</sup>

- |                    |   |
|--------------------|---|
| ✓ 1   Vestas       | ✓ |
| ✓ 2   SGRE         | ✓ |
| ✓ 3   GE           | ✓ |
| ✓ 4   Goldwind     | ✓ |
| ✓ 5   Enercon      | ✓ |
| ✓ 6   Nordex Group | ✓ |
| ✓ 7   Envision     | ✓ |
| ✓ 8   Mingyang     | ✓ |
| ✓ 9   United Power | ✓ |
| ✓ 10   Suzlon      | ✓ |

\* Infineon is serving the top-10 of each category but not necessarily as a sole supplier.

Source: 1) by shipped capacity in MW: based on or includes content supplied by IHS Markit, Technology Group: *PV Inverter Market Tracker – Q3 2020*. October 2020.

2) WoodmacKenzie: *Wind Turbine OEM Market Share*. November 2020

## Enabling Technologies



- > Reduces system size
- > Reduced power losses up to 50% compared to a traditional IGBT



- > Increased lifetime of power products
- > Highest reliability and performance

# Infineon serves all applications in the field of renewable energy

## Onshore



- › Application: full converter and partial/DFIG\* converter-based wind turbine
- › Output: 1 MW – 6 MW
- › Power semi content: €2,000 - €3,250 per MW

## Offshore



- › Application: full converter-based wind turbine
- › Output: 3 MW – 14 MW
- › Power semi content: €3,250 - €3,500 per MW

## HVDC\*\*



- › Application: HVDC\*\* - VSC\*\*\*
- › Output: 100 MW – 4 GW
- › Power semi content: €5,200 - €18,000 per MW

## String inverter



- › Application: residential, commercial and utility-scale PV plants
- › Output: 1 kW – 200 kW
- › Power semi content: €2,500 – €5,000 per MW

## Central inverter

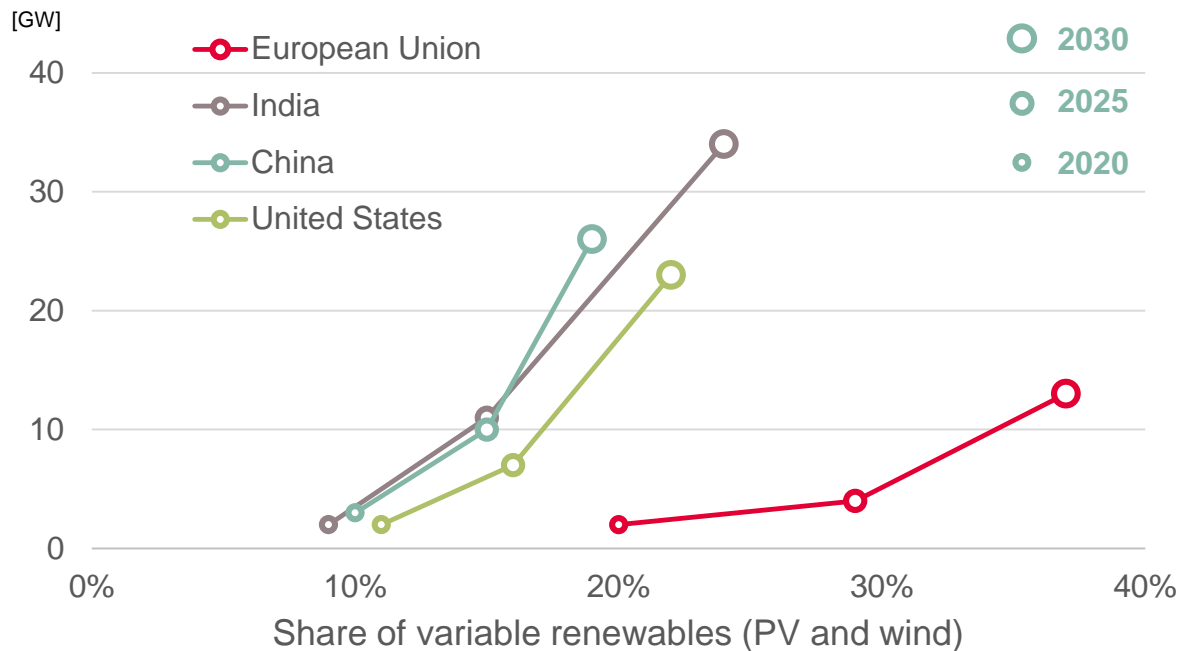


- › Application: utility-scale PV plants
- › Output: 600 kW – 1,250 kW
- › Power semi content: €2,000 – €3,000 per MW

\*DFIG = doubly-fed induction generator; \*\* HVDC = high-voltage direct current transmission; \*\*\* VSC = voltage-source converter

# Energy storage is essential to further deploy decentral and renewable energy generation

## Battery storage capacity and share of variable renewables<sup>1)</sup>



Source:

1) World Energy Outlook 2020, p. 248; variable renewables consist of solar and wind energy.

2) Infineon estimate

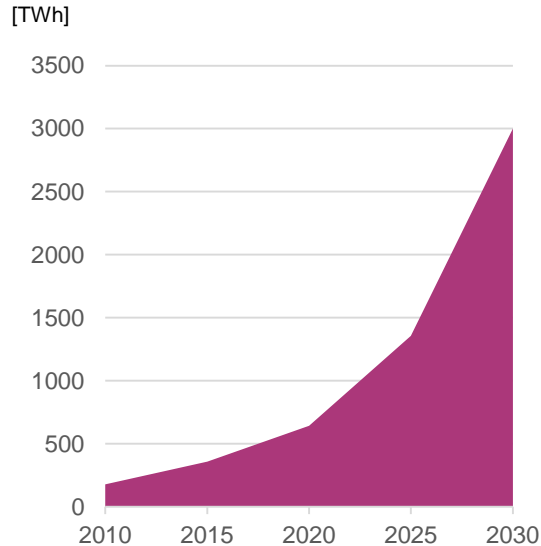
## Key drivers

- › **Decentralization** of power generation
- › **Peak shaving** of energy generation and energy consumption
- › **Limited capacity** and flexibility of today's grids
- › **Reduction of standby cost** of fossil power plants

~€3,200 of power semiconductor content per MW of installed energy storage capacity<sup>2)</sup>

# Exponential growth of data requires data centers to become more energy efficient

## Exponential growth of energy demand for data centers worldwide\*



Sources:

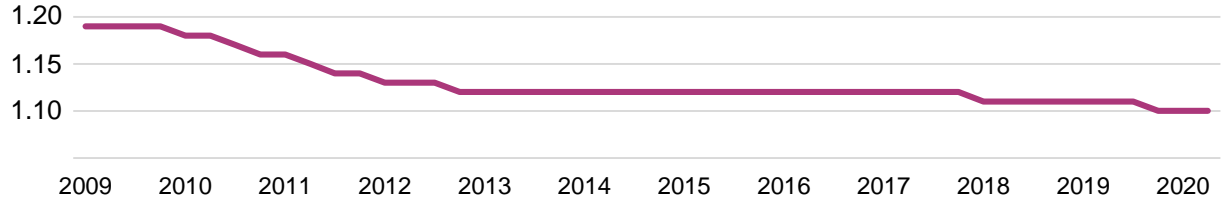
\* A. Andrae, T. Edler: *Challenges* 6, 117–157 (2015)

\*\* Google: Google Data Center PUE performance

\*\*\* United States Data Center Energy Use Report, June 2016; All calculations are based on the overall data center server power consumption of US data centers as given in this report, and savings are in comparison to a silicon alternative solution; EIA Electric Power Monthly August 2018 (average for US, industrial segment); Global warming potential of selected electricity sources, IPCC 2014

## Data centers have continuously improved their Power Usage Effectiveness (PUE), but at a slowing pace\*\*

Example: Google Data Center PUE performance, Trailing twelve-month (TTM) PUE development



## New semiconductor materials like GaN allow for further energy efficiency increases\*\*\*

If every very U.S. data center was using CoolGaN™ then ...



... **4bn kWh saved**



... **2m tons of CO<sub>2</sub> emissions less per year**

# Digitalization will help to optimize energy consumption of Smart Buildings

**Within total worldwide electricity consumption, residential buildings make up 29%\***

**“Sensorification” and digitalization of a smart home can save 30% – 50% of energy\*\***

## Biggest energy consumers in US homes:



Space cooling **16%**



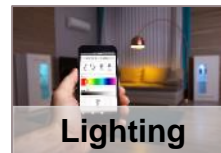
Space heating **15%**  
Water heating **12%**



Refrigeration **6%**



Lighting **5%**



Smart thermostats

Remote control

Occupancy sensors

Smart power supply

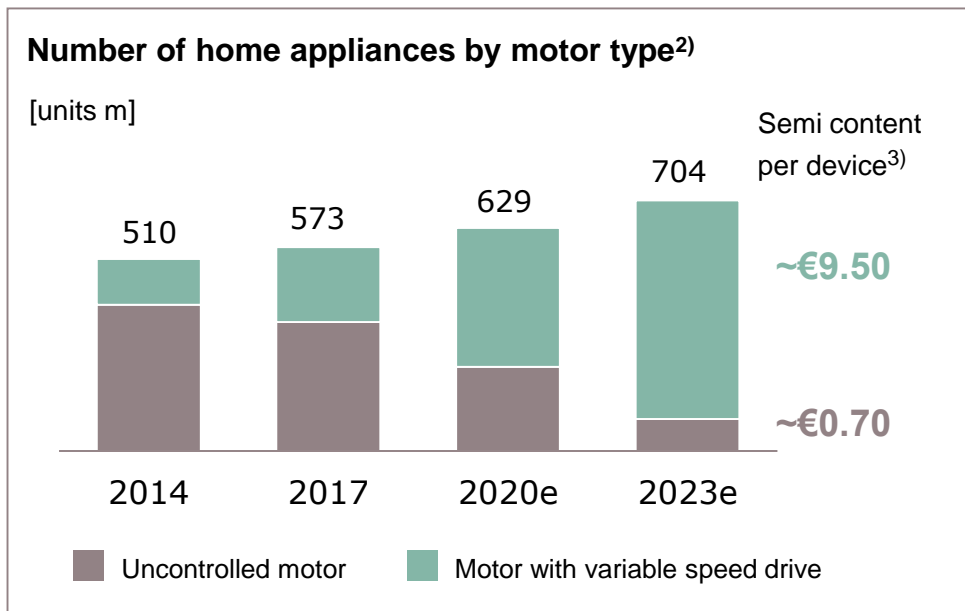
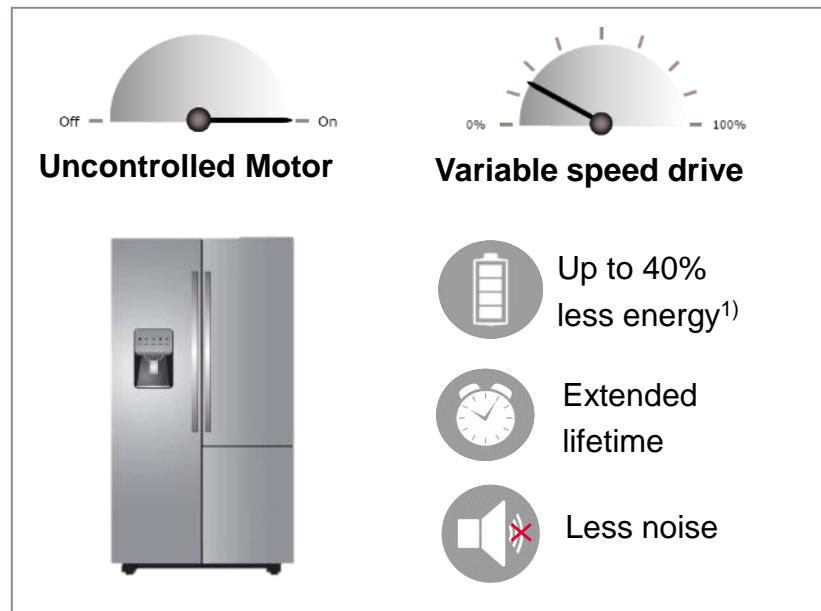
Variable Speed drives

\* Source: EIA, International Energy Outlook 2019; International Energy Agency (2017). Digitalization & Energy. October 2017; U.S. Energy Information Association (EIA), Annual Energy Outlook 2020, January 2020; Infineon estimate

\*\* Source: International Energy Agency (2017). Digitalization & Energy. October 2017; Exponential Roadmap 1.5 Future Earth; Grözinger et al., IEA Digitalization and Energy; The Atmospheric Fund (2019): Smart Thermostats – Technology Assessment and field test findings in multi-unit residential buildings; Infineon estimates

# Variable speed drives are an example of how home appliances can become more energy-efficient using our products

**~95 % of the environmental impact of home appliances occurs during their usage;  
variable speed drives reduce their energy consumption**



Source:

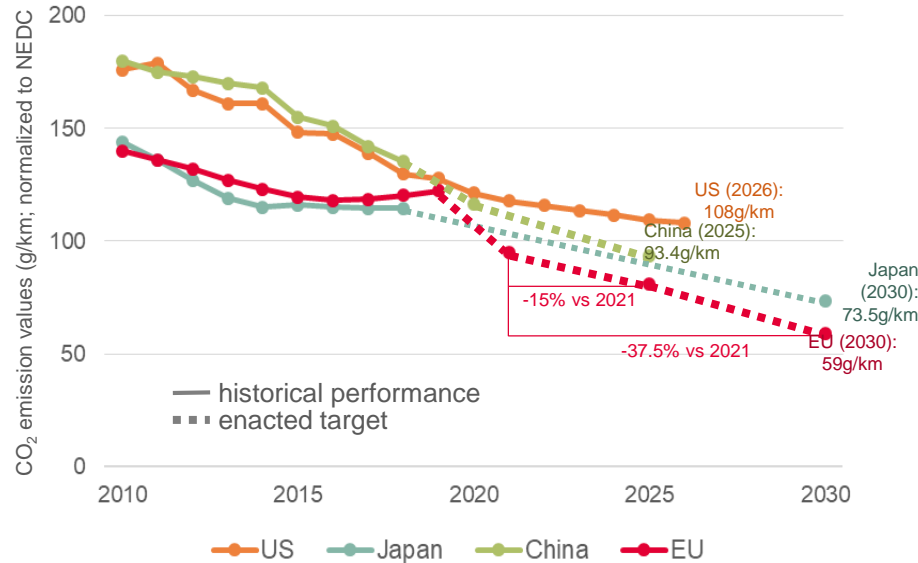
1) Compared to devices without inverter

2) Source: based on or includes content supplied by IHS Markit, Technology Group, "Home Appliance Database: All Devices and Associated Electronics", May 2019

3) Infineon estimate for a typical aircon

# The EV market is witnessing strong growth driven by more stringent legal guidelines, demanding significant infrastructure investment

## Passenger car CO<sub>2</sub> emission development and regional regulations



Source: The International Council on Clean Transportation (ICCT): *Passenger vehicle fuel economy*. May 2020.

## Infineon offers power semiconductor solutions for all types of charging stations

### Most common power ranges of DC charging systems



20 kW  
(~\$40 - \$90 Si / SiC - based semi-content)\*



50 kW  
(~\$100 - \$300 Si / SiC - based semi-content)\*



150 kW  
(~\$300 - \$900 Si / SiC - based semi-content)\*



350 kW  
(~\$1,500 - \$3,000 Si / SiC - based semi-content)\*

- › Highest efficiency is key while charging for hours: less cooling efforts; more compact designs

\* Infineon estimates for a charging pole



There are further emerging applications developing which promise a positive environmental contribution and future business

## E-Aviation



## E-Marine



## Hydrogene



# Summarizing, our products and innovations help to mitigate climate change



**#1 semiconductor enabler of  
renewable energies**



**We contribute a CO<sub>2</sub> reduction  
of more than 54 million tons**



**We increase energy efficiency  
and reduce electrical losses**



**Infineon will become  
carbon-neutral by 2030**

# Disclaimer

## Disclaimer

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