



ENVIRONMENTAL SUSTAINABILITY THROUGH COLLABORATION

Semicon Europa Nov2022



Market drivers



AI

High spec CPUs
Power management(heat)
Autonomous vehicles
Gaming



5G Network

Infrastructure, 5G phones
6G coming (2030)
5G phones will increase by 1.9B in the next 5 years and overtake 4G shipments in 2023



Cloud Computing

Edge computing, server farms,
increased memory, power
management (heat),
security (encryption)



Super Computing

Finance, defence, data mining,
Bitcoin, medical, climate
change modelling, IoT,
Security (encryption)



IoT

Server farms, consumer
electronics, signal
processing



Gaming

Consoles, computers,
screens,
VR headsets



Medical

Implants, remote diagnosis/
monitoring



Automotive

EV charging, EV power
management, autonomous
vehicles, in-car
infotainment, sensors



Industrial

Industry 4.0, virtual reality
*Smart factories,
connected machines,
machine data*

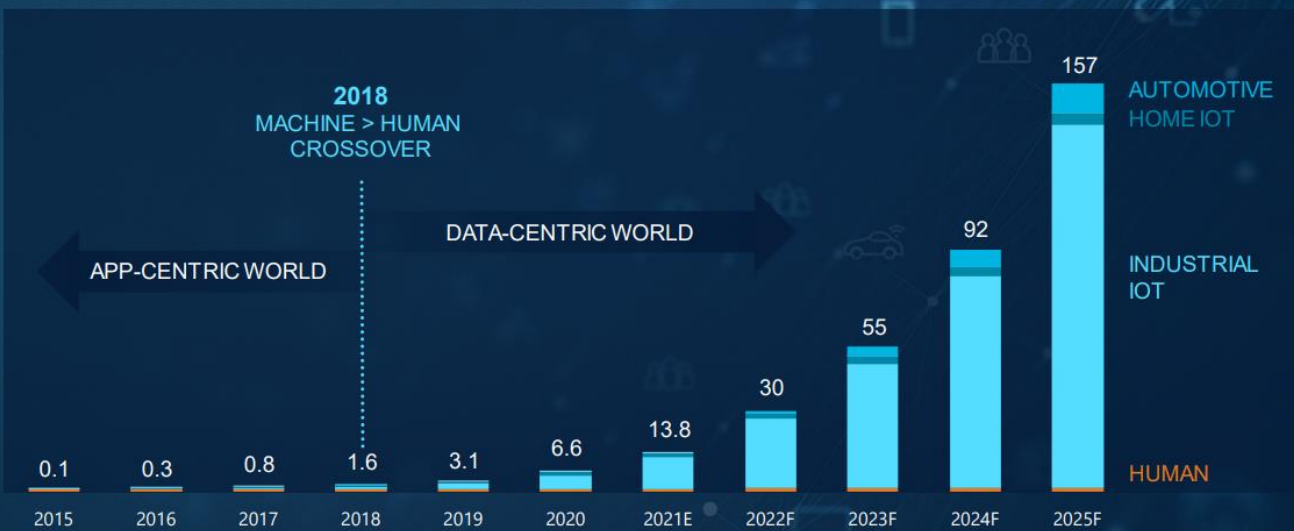


Work from home

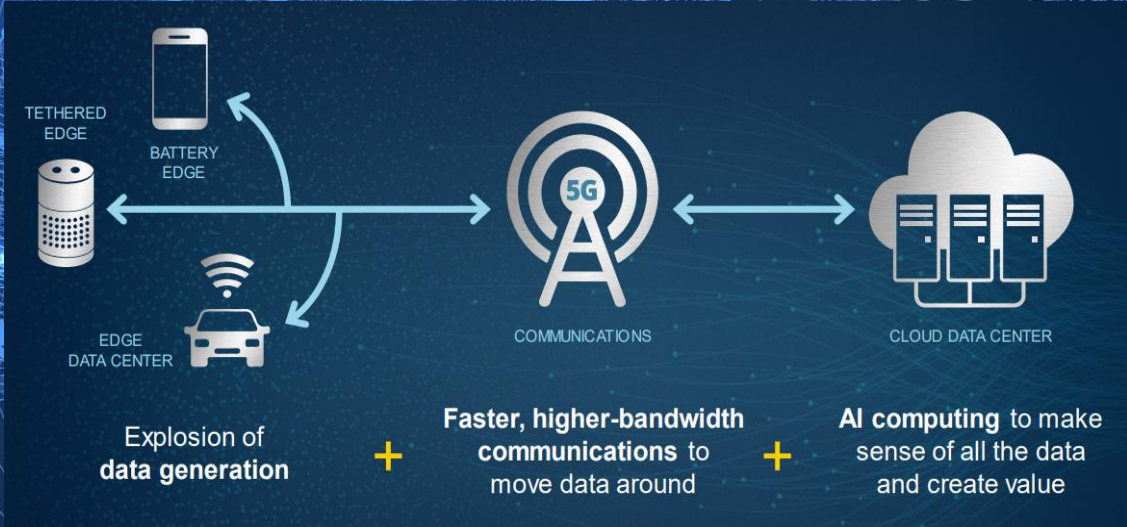
Servers, laptops, tablets,
screens

The data revolution

Data Generation By Category (ZB)



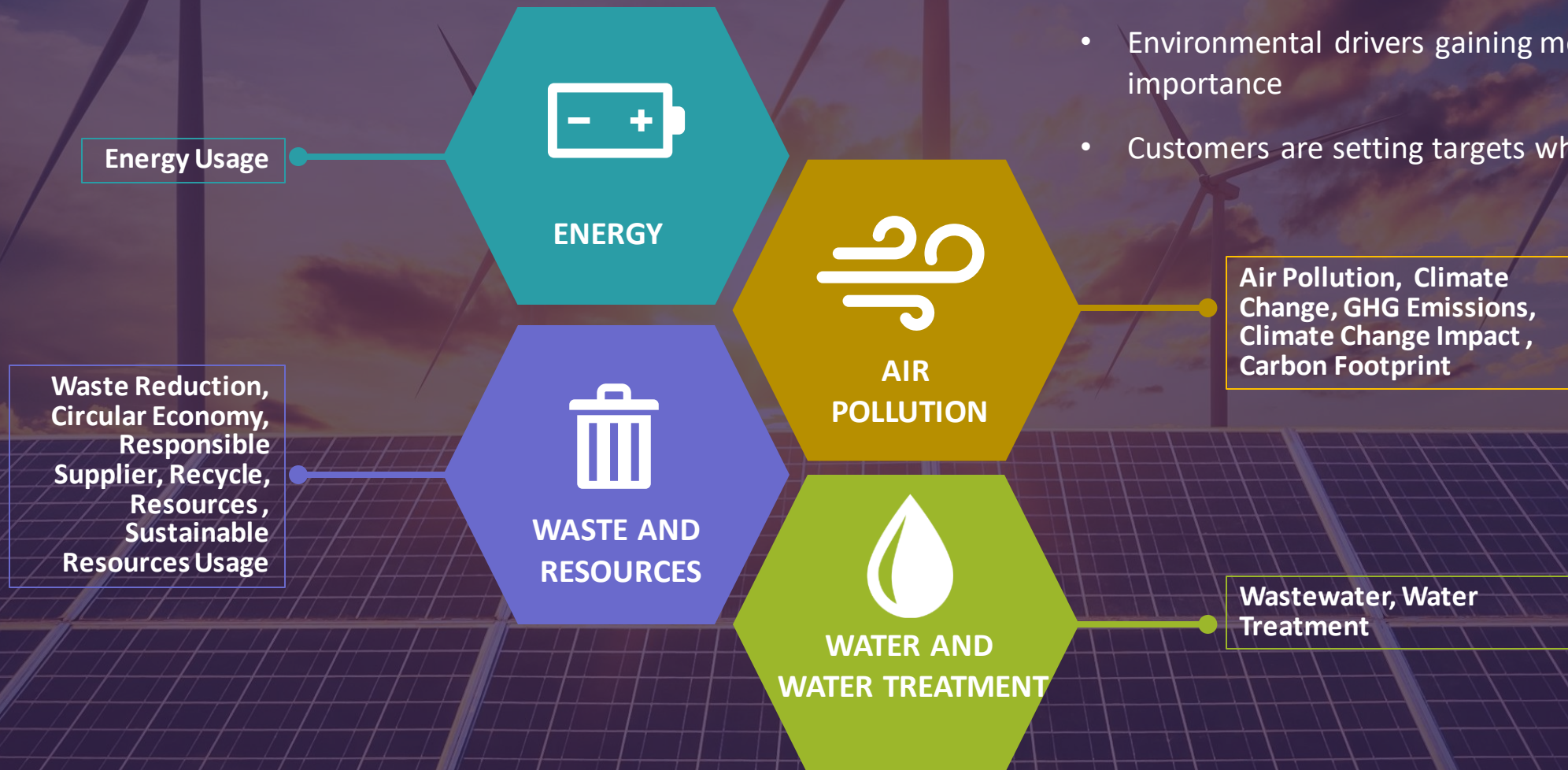
- Semi market growth is no longer limited by human consumption
- Multiple parts of the market are reliant on one another (connected)
- Silicon content is growing as everything gets 'smarter'



Semi content per unit	2015	2020	2025F
HIGH END SMARTPHONE	\$100	\$170	\$275
AUTO (GLOBAL AVERAGE)	\$310	\$460	\$690
DATACENTER SERVER (CPU + ACCELERATOR)	\$1,620	\$2,810	\$5,600
SMARTHOME (GLOBAL AVERAGE)	\$2	\$4	\$9

Infographics source: AMAT (8 Sep 21)
One zettabyte is equal to one sextillion bytes or 10²¹ (1,000,000,000,000,000,000) bytes

Our challenges and opportunities



- Reviewed materiality and CSR reports from top semiconductor companies
- Environmental drivers gaining momentum and importance
- Customers are setting targets which we are tracking

SBTi - Semiconductors and Semiconductors Equipment

- Our industry needs to commit to Science-Based Targets
- We can only make a truly material difference together

Companies with targets set*

Advanced Micro Devices, Inc

Analog Devices, Inc.

ASE Technology Holding, Co., Ltd.

ASML Holdings

KYOCERA Corporation

Lam Research Corporation

Nanya Technology Corporation

Navitas Semiconductor Ltd.

Renesas Electronics Corporation

ROHM Co., Ltd.

SCREEN Holdings Co., Ltd.

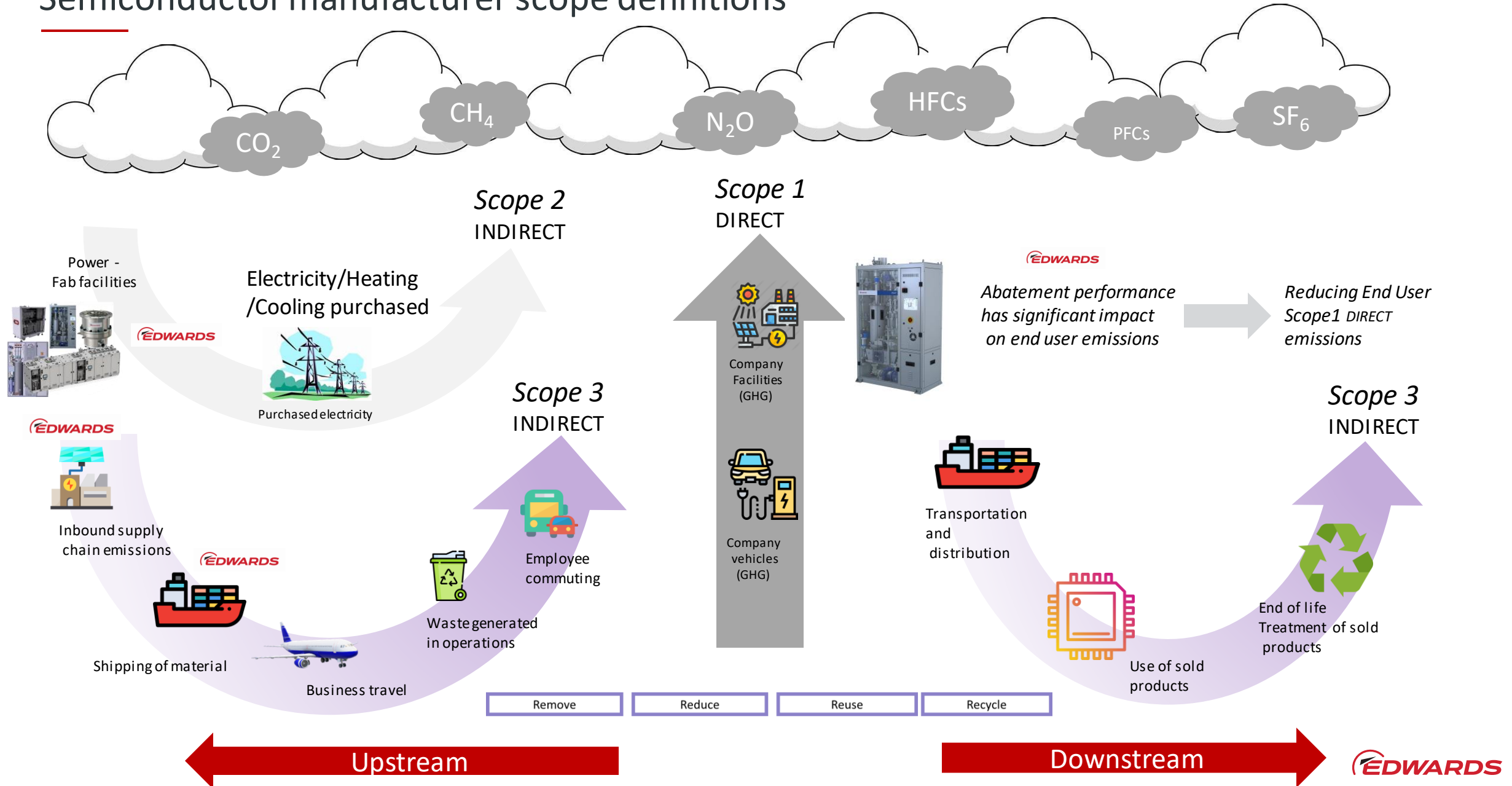
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STMicroelectronics NV

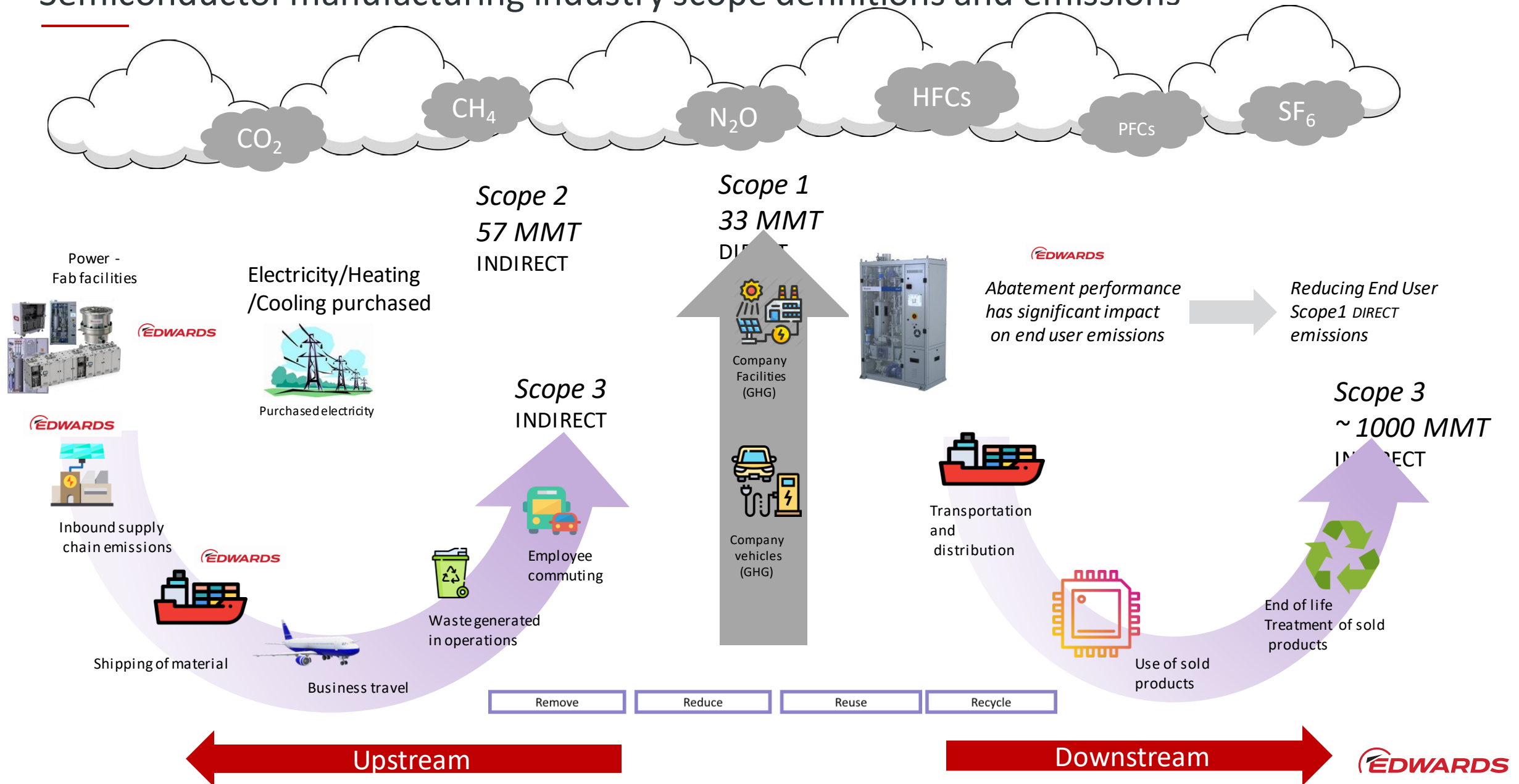
United Microelectronics Corporation

*Those declared in SBTi as semiconductor sector-based
As of November 2022

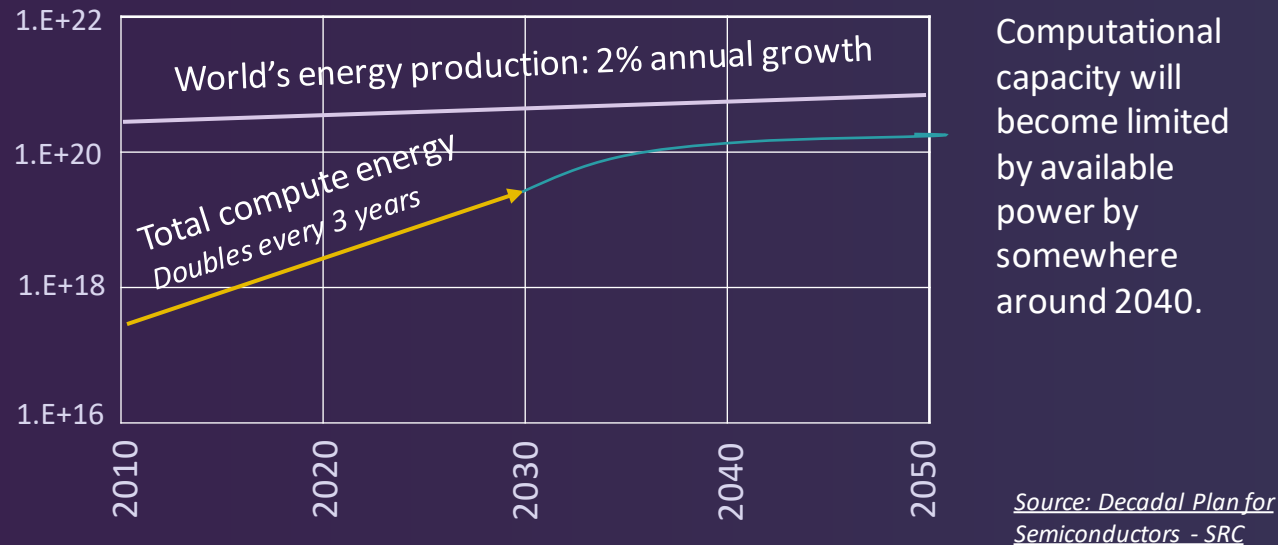
Semiconductor manufacturer scope definitions



Semiconductor manufacturing industry scope definitions and emissions



Energy efficiency and move to renewable energy is critical



- New information strategies, including software and hardware that consume less power are, needed.
- Equipment that can produce semiconductors with a lower carbon footprint
- Decarbonisation of the grid at a faster rate than energy usage will increase

Power cuts in Ireland due to energy intake by data centres?



EirGrid has come out with figures which show how much power data centers are consuming. In the past four years alone, EirGrid has seen demands of power increased by approximately 600GWh just from data centers, which is the equivalent of adding 140,000 households to the grid every year.

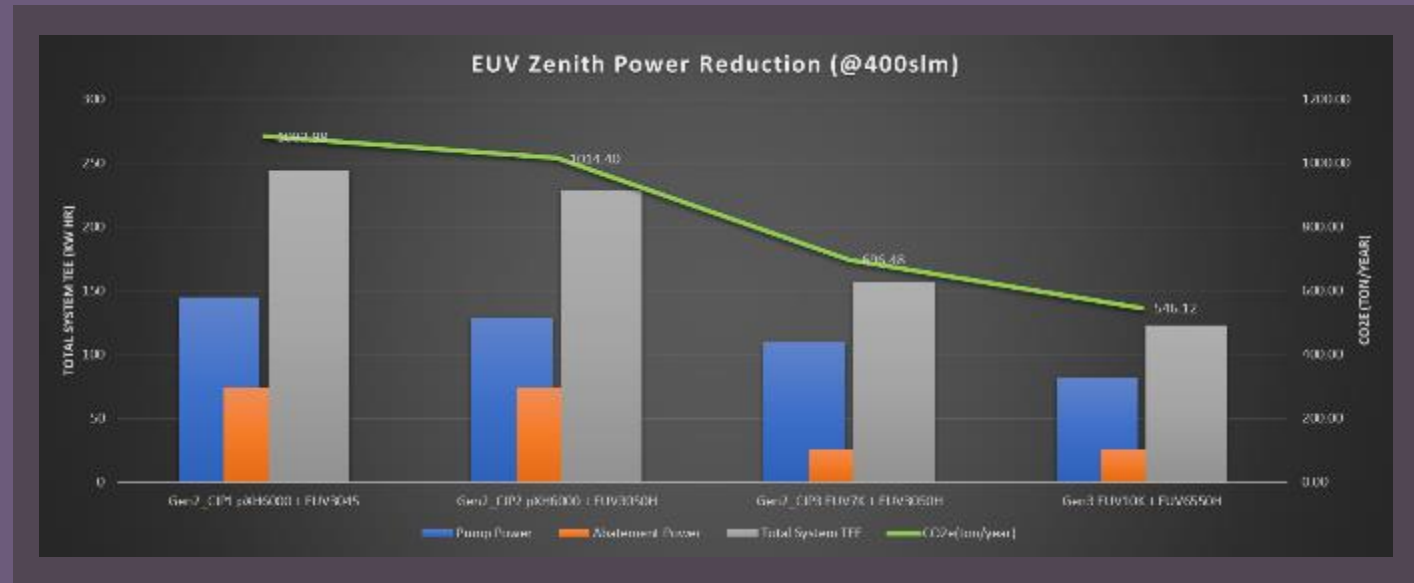
Reduction in semiconductor fabrication emissions



- Edwards abatement performance has significant impact on end user factory GHGP emissions.
- Preventing nearly 19 million (2021) tonnes of CO₂e emissions at our customers' facilities each year - equivalent to the annual electricity used by nearly four million US' homes¹
- Technology partnership in recycling technologies can further enhance the reduction of GHGP emissions.
- Current projects around H₂ for EUV and Kr/Xe for etch
- Collaboration and partnership essential for successful technology deployment

EUV next generation - Reducing Customers' Environmental Impact

- Continued pump and abatement development contributing to a **49.6% reduction** in energy consumption from 1st Gen to current Gen Systems.
- Through technology lead development EUV systems have decreased CO2e by **536 Tons per system per year**.
- H2D replacing current gas fired abatement product saving **65% on energy consumption managing H2** exhaust gas.
- Energy saving validation completed and preferred **'green HVM configuration'** available for chip manufacturers.
- Future Hydrogen recycling (**HRS**) to provide further reductions recovering H2 directly from EUV systems to customer tools.



EUV System	% Change TEE
Gen2_CIP1 pXH6000 + EUV3045	-
Gen2_CIP2 pXH6000 + EUV3050H	6.3%
Gen2_CIP3 EUV7K + EUV3050H	35.7%
Gen3 EUV10K + EUV6550H	49.6%



*Figures calculated on a 400slm process flow.

Hydrogen recovery and recycling from EUV Lithography tool

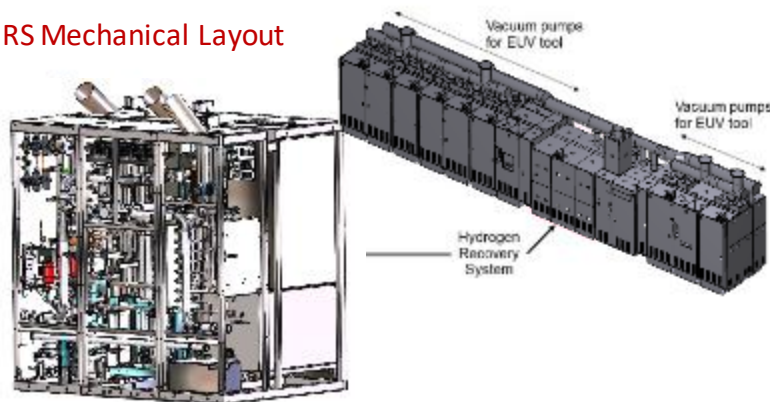
- Hydrogen is used in large quantities in EUV lithography
- Recycling
 - *Reduces risks from supply continuity and transportation*
 - *Reduces the total energy and carbon footprint of the EUV lithography process*
- Edwards has developed a recycling system to integrate with the Edwards EUV vacuum and abatement system

- Trial at imec under the *Sustainable Semiconductor Technologies and Systems (SSTS)* programme

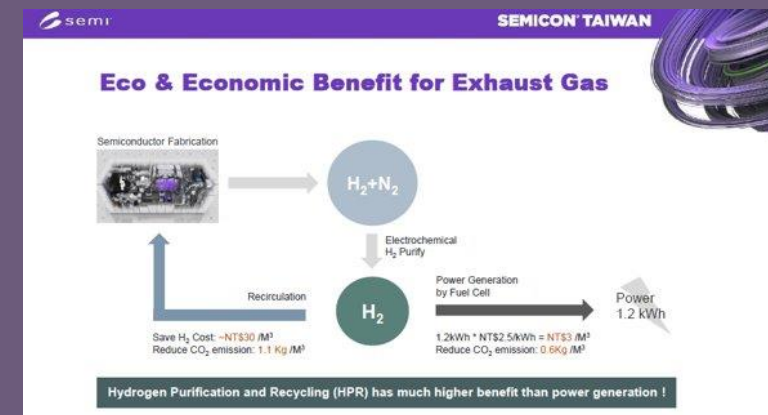
H2 supply chain is challenging



HRS Mechanical Layout



Strategic requirement for recycling



The strategic importance of semiconductor



US President Joe Biden pledged in February to secure the United States' "critical" chip supply chains.

Loeb/AFP via Getty Images

USA

US Chips Act: \$250 billion of government investment to increase global competitiveness in critical industries.

Approximately \$52 billion is to fund semiconductor research.

July 2022

EU

EU Chips Act – the European Commission has set a goal of producing 20% of the world's microchips in Europe by 2030. In addition to €30bn of public investments already foreseen, the Act will enable more than €12bn in additional public and private investment by 2030.

ING Research, Feb 2022

South Korea's version of a Chips Act passed by the National Assembly on 11 Jan 2022. 6-10% corporate tax break for facility investment and 30-40% tax credit for research and development. (\$ figures not published.)
Korea Herald, Feb 2022



South Korea is going all out to bolster its critical semiconductor industry

China

China has incentives to offer tax exemption to companies producing chips made with between 28nm and 65nm processes for the first five years, followed by up to 50% in corporate tax breaks for the next five years. The \$1.4 trillion chip drive supports Beijing's goal to meet 70% of domestic semiconductor needs by 2025

Korea Herald, Feb 2022

Collaborating for an environmentally sustainable future



- Set your Science-Based Targets
- Join forces to influence governmental policy to decarbonise the grid
- Through collaboration we can stop climate change!



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