

Ethernet in Sustainability



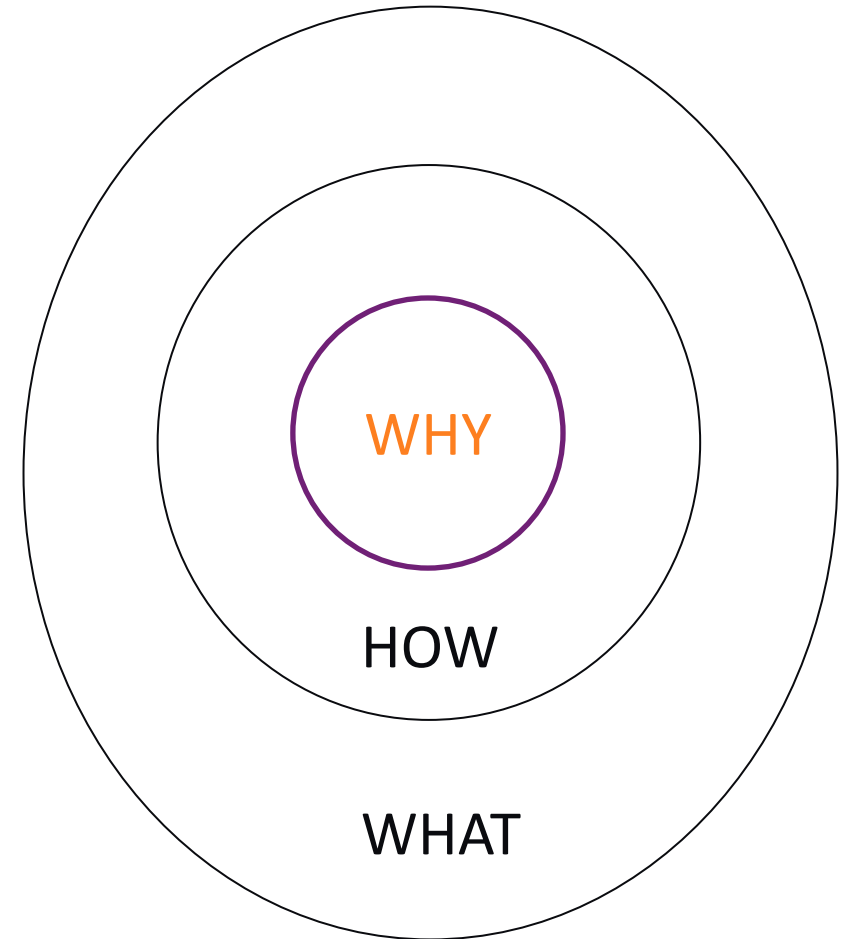
A Leading Provider of Smart, Connected and Secure Embedded Control Solutions



SMART | CONNECTED | SECURE

Agenda

- **Update of COP 26 in sustainability**
- **Green power system**
- **Power saving & management**



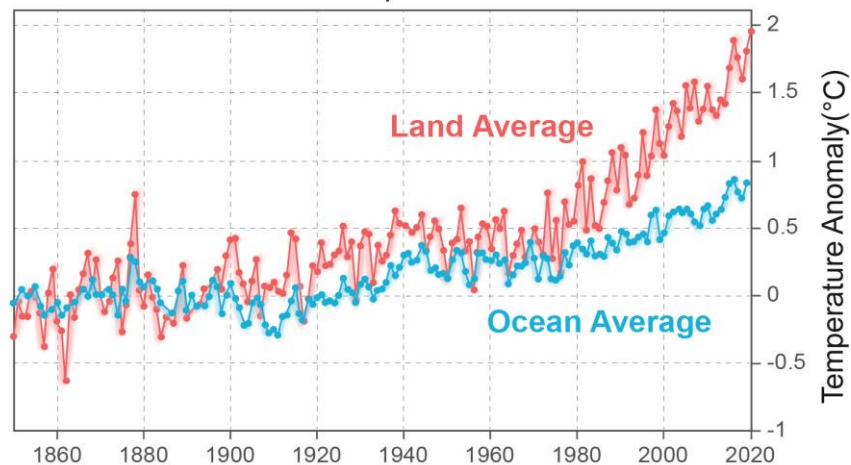
WHY

Global Warming Is Driving Polar Bears Toward Extinction, Researchers Say (Published 2020)



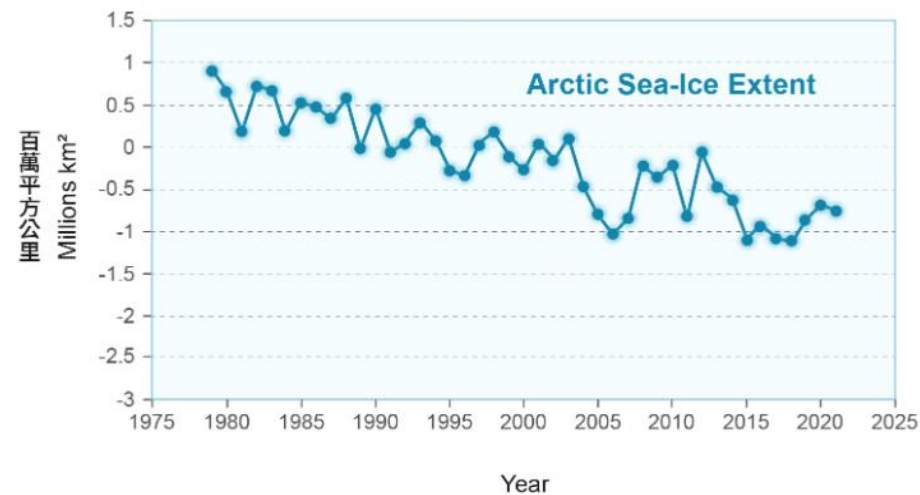
資料來源:
The New York Time July 20,2020

Land and Ocean Temperatures 1850 - 2020



資料來源:Berkeley Earth

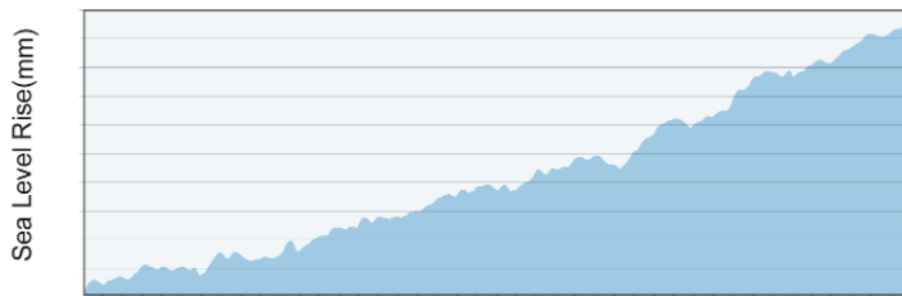
...in Arctic, sea ice shrinks



Sea level rise

地球的海平面，每年上升3.3公釐(3.3mm)

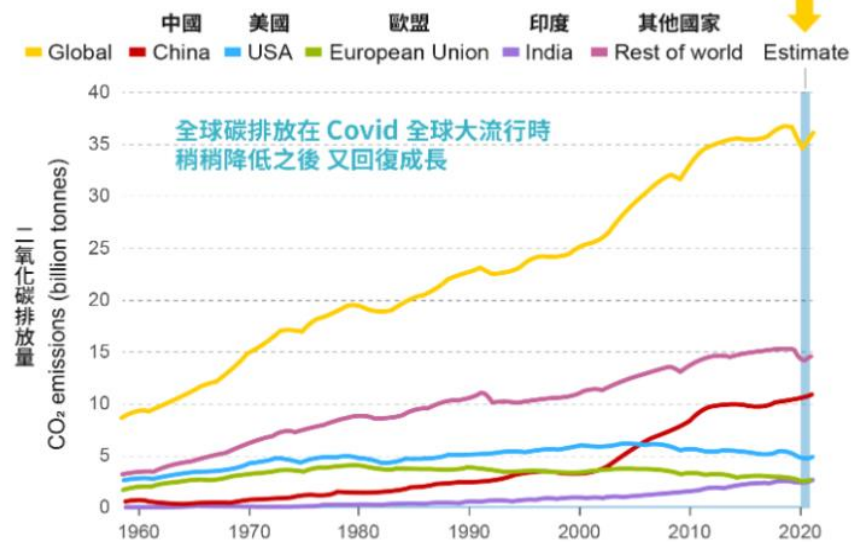
A rise at an average of 3.3 mm per year



Date 1993-2020

資料來源:GCOS

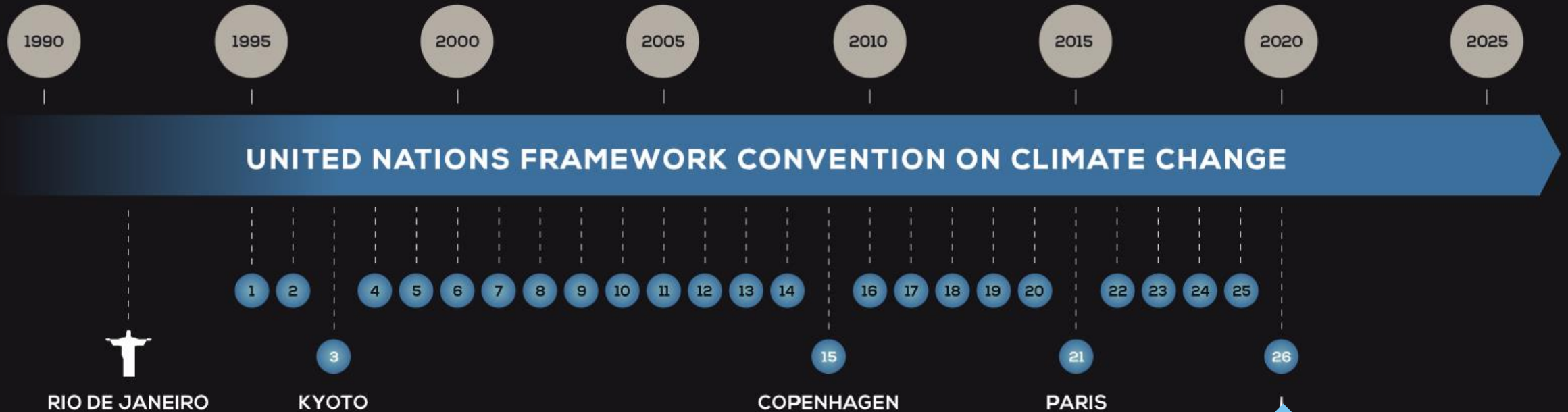
資料來源:EUMETSAT OSI SAF v2p1 (Lavergne et al., 2019)



資料來源:Nature 雜誌

HOW

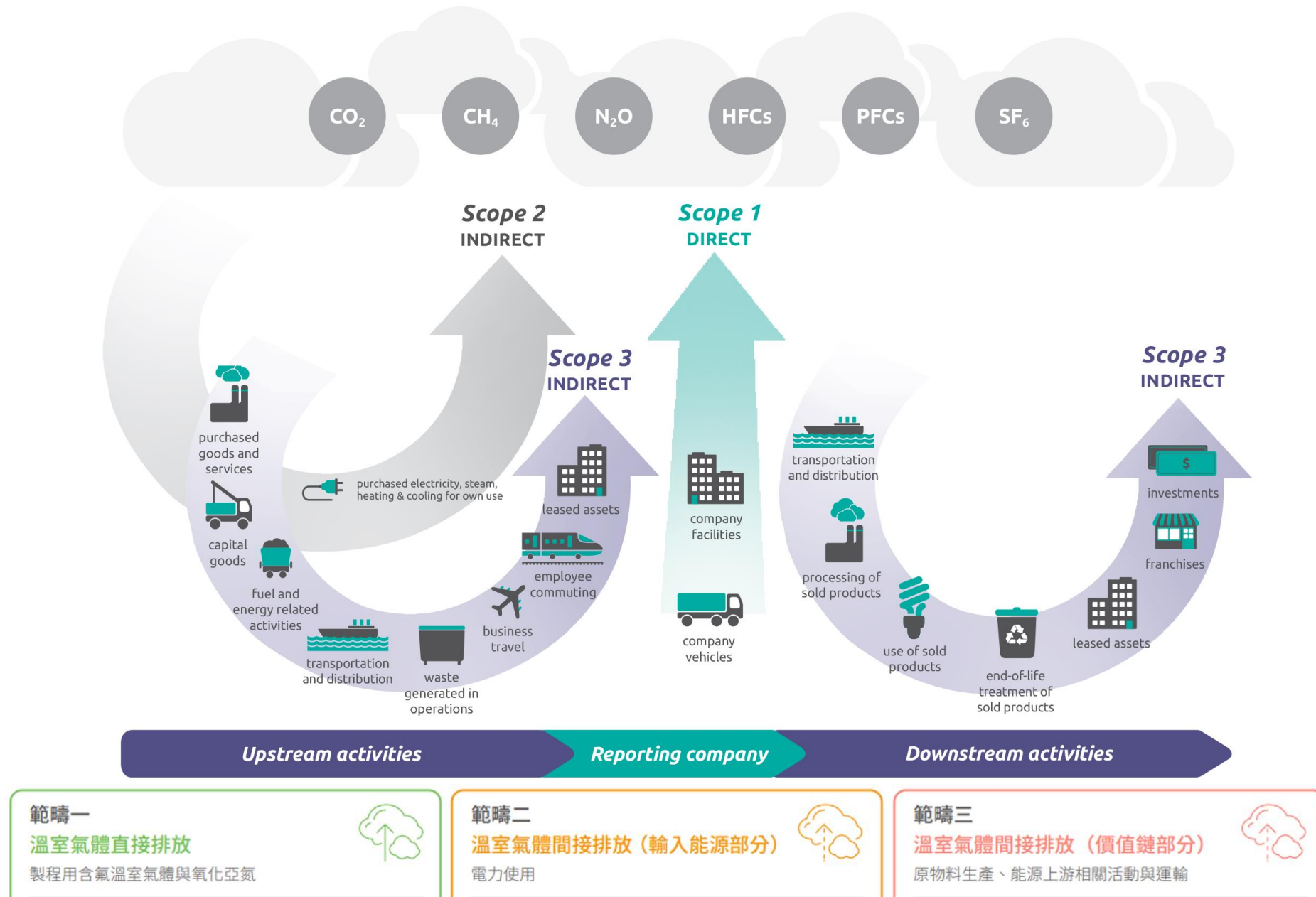
UN Climate Summits History



資料來源 <https://eciu.net/analysis/infographics/un-climate-summits>



COP 26 Emission Characteristic



資料來源 : <https://taise.org.tw/post-view.php?ID=300>

Microchip Confidential and Proprietary



Glasgow Climate Pact (COP26)

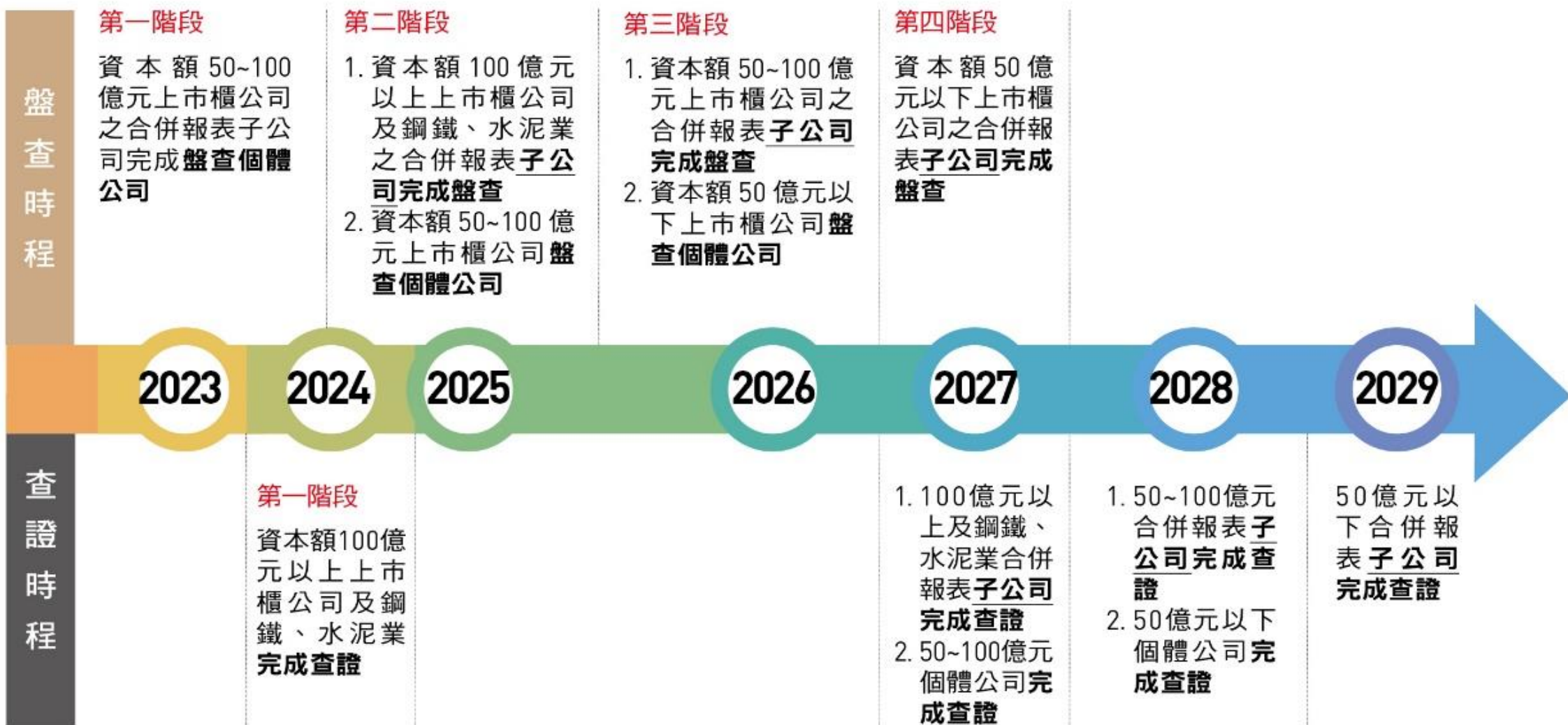
- 全球甲烷承諾
- 淨零金融聯盟
- 森林與土地利用宣言
- 突破倡議
- 零碳車承諾
- 綠色航運承諾
- 企業領袖提出改造與融資承諾
- 全球著眼 2030 中期減排目標：「2050 淨零碳排」

ESG Status Update

- **Europe CBAM milestone , 2023 and 2027**
 - **2023 ~2025 : 試行期間, 不須CBMA憑證 , 只交報告(含範疇1/2/3)**
 - **2026 : 正式實施, 須CBMA憑證 及申報 (含範疇1/2/3)**
- **Apple calls on global supply chain to decarbonize by 2030**
- **《氣候變遷因應法》三讀通過 @2023**

圖1

時程規劃



資料來源：金管會



台灣電力公司
Taiwan Power Company

110年06月 繳費通知單(繳費憑證)
Jun. 2021 Electricity Bill (Payment Receipt)

105020

台*市*化*路*2*巷*弄*1*2*

Greenflation: Inflation caused by increased capital investment to comply with climate objectives: demand increase of critical material and resources necessary to the energy transition (lithium, cobalt, nickel, graphite and manganese) unmatched by supply.

綠色通膨：為符合氣候目標而增加資本投資引起的通貨膨脹：能源轉型所需的關鍵材料和資源（鋰、鈷、鎳、石墨和錳）的需求增加，這是供應無法比擬的

NT 100, 300 or 3000 per ton of CO2 emission ???

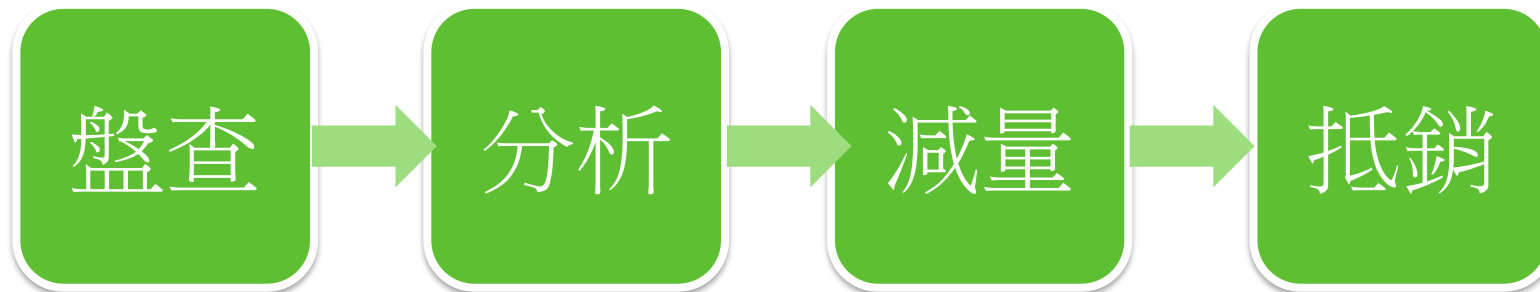
其他資訊 Other Info.

輪流停電組別	A
饋線代號	SP61
每度燃料成本	1.2031 元
本期碳排量	38 公斤
每度繳交再生基金	0.0018 元

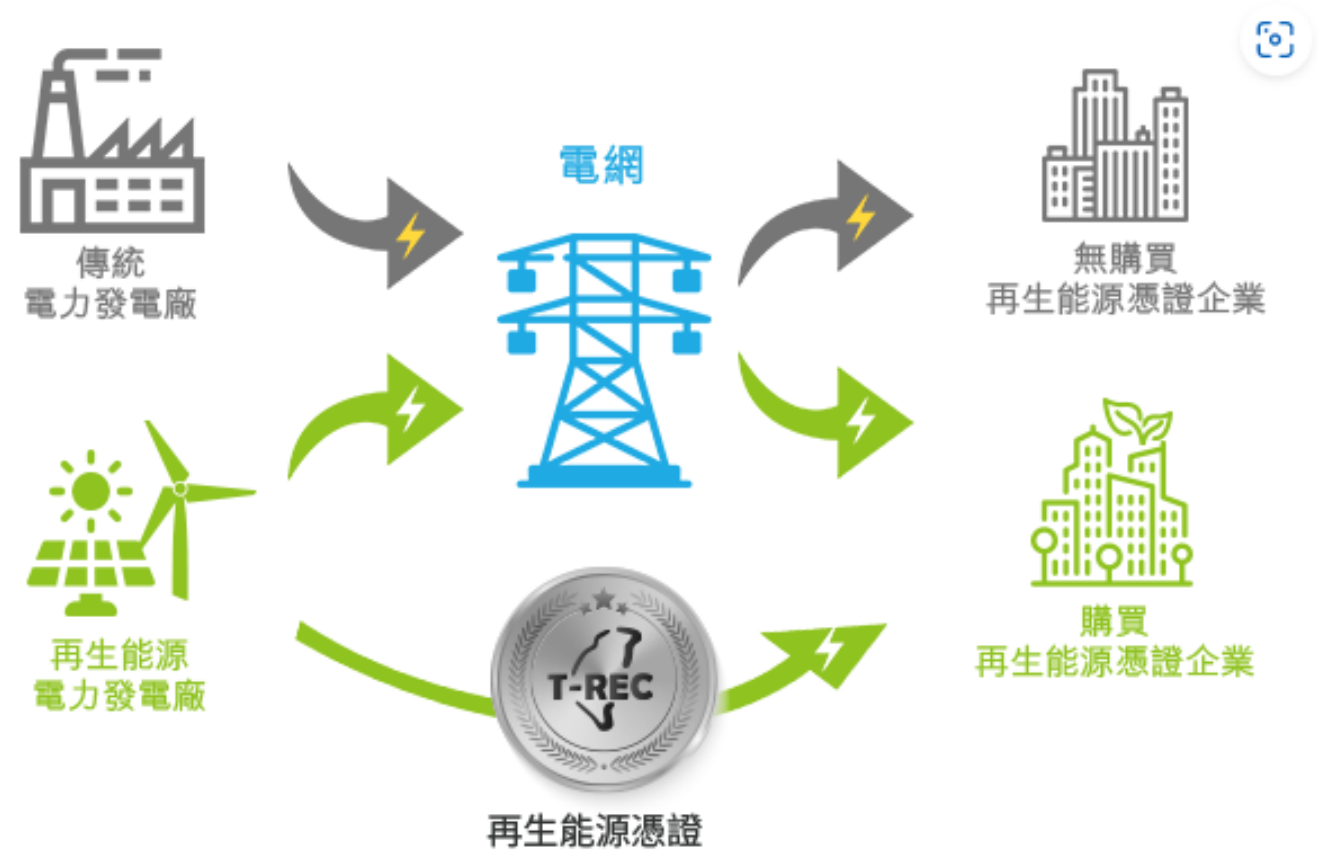
110年1月起，電子帳單優惠減收金額調升為10元！

碳權 (Carbon Credit)

- 京都議定書(COP 3) ... Now COP 26 (蘇格蘭格拉斯哥)
- 碳權是基於全球淨零排放目標而誕生的機制，對大量排碳的企業設定碳排上限，進行以量制價。
- 企業努力減碳，讓碳排放低於上限，這才有「碳權」額度可以賣給其他人；若企業碳排放超出上限，就需要購買其他人多出來的碳權來達成減碳目標。
- 台灣企業要進行碳權交易，可至行政院環保署的溫室氣體減量與抵換管理機制，提出減碳認證申請，或發布販售碳權的資訊。



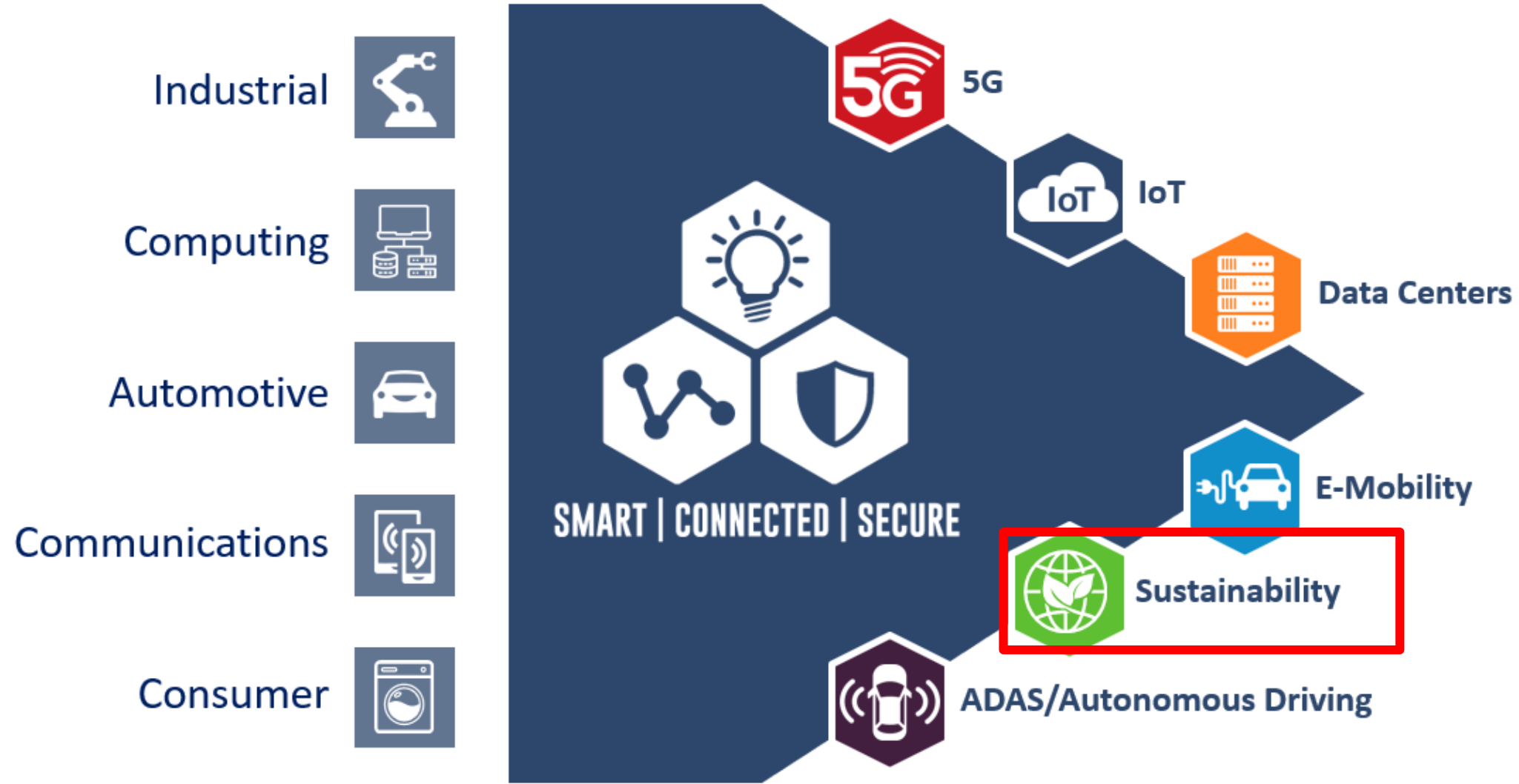
Taiwan , T-REC



*台灣再生能源憑證
資料來源：國家再生能源憑證中心

WHAT

Sustainability solution from Microchip



Sustainability solution from Microchip



CoreFFT v8.0

CoreFFT supports the following FPGA families.

- PolarFire®
- PolarFire SoC
- SmartFusion® 2
- IGLOO® 2
- RTG4™

SiC Portfolio: 700V – 3.3 kV

Product Family	Packaging
Die	
Discretes	
Modules	
Gate Drivers	

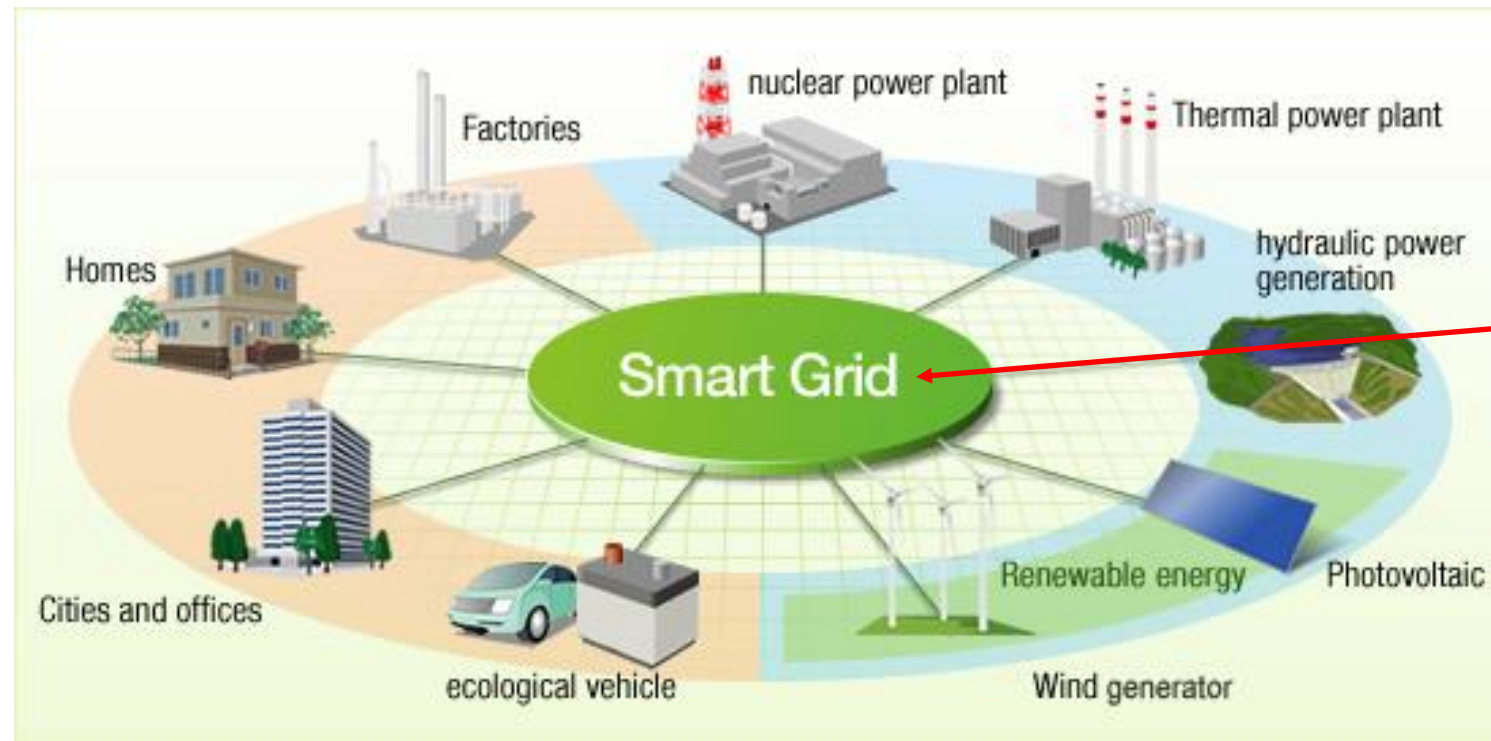
開源 (make more money)

綠電 (Green/renewable Energy)

Energy Generation, Storage and Distribution

Smart Grid Applications

- Smart grid is a power grid that provides high-quality power service and maximizes energy use efficiency by making the power grid intelligent and advanced by utilizing electricity and information and communication technology.
- Technology : Network / Sensor / Metering / Monitoring / HMI/1588/IGBT/SiC/TSN



- Network
- Sensor
- Metering
- Monitoring
- HMI

圖片來源 : <http://www.utilisave.com/blog/why-smart-grids-are-the-smart-move/>

New Power Distribution Topology (Distributed Generator)

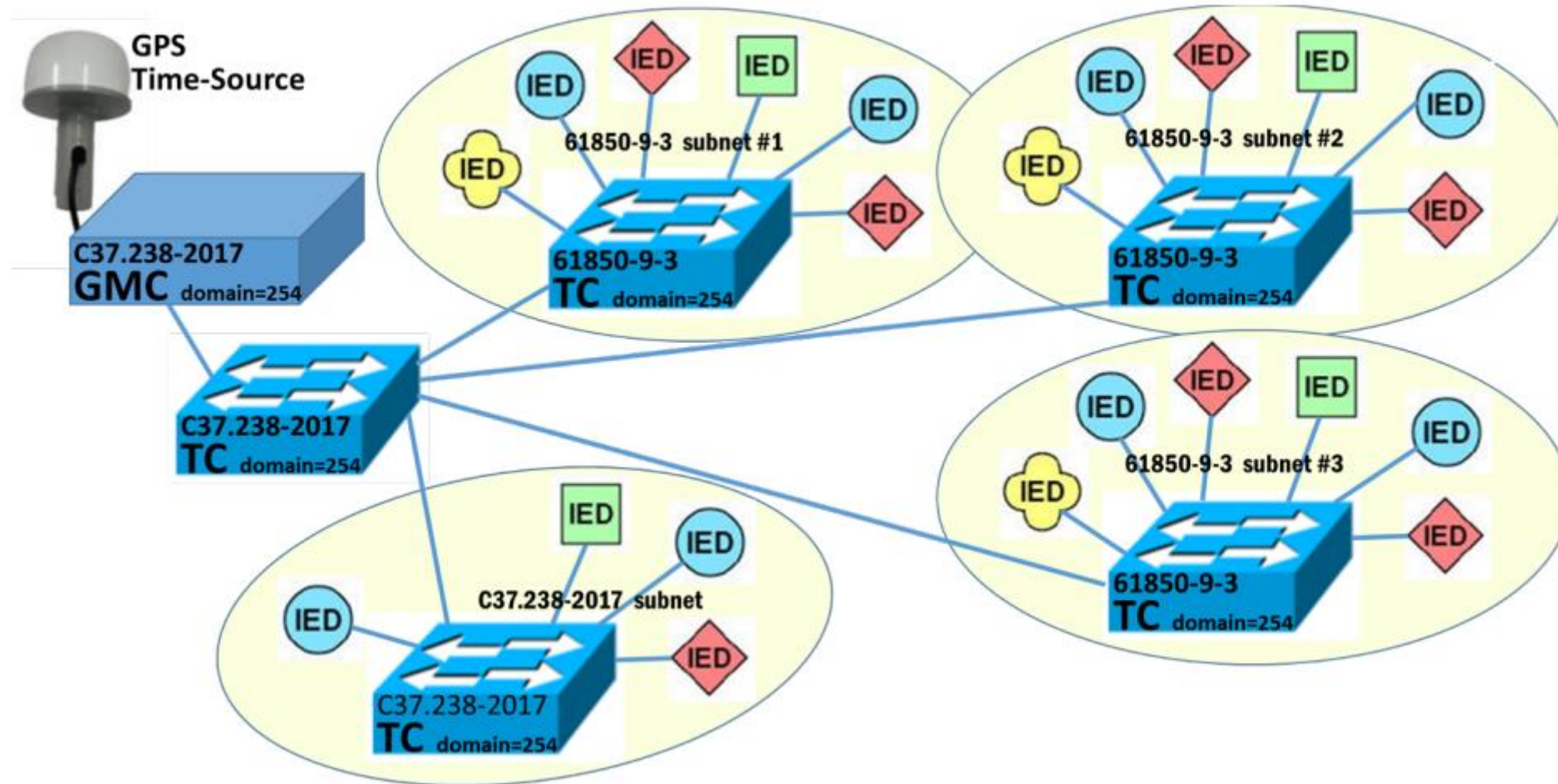


資料來源: <https://speakerdeck.com/learnenergy/zhi-hui-wei-dian-wang-ji-shu-yan-fa-xian-kuang-zhang-yong-rui-zu-chang>

Issue Need to Take Care in DG

- **LVRT**
 - **Low Voltage Ride Through**
- **Islanding Operation and Anti-Islanding Protection**
- **HVDC Transmission**
 - **High Voltage Direct Current**

IEEE 1588 Power Profile IEEE Std C37.238



資料來源 https://tsapps.nist.gov/publication/get_pdf.cfm?pub_id=925940

DG (distributed generator)

PV/Wind farm (Zero emission) for operational management

- LVRT (Low voltage ride through) , Reactive power injection when fault (STATCOM)
 - **Ethercat or IEEE1588**
 - **IGBT/SiC**
 - **FPGA/DSP**
- HVDC converter (MMC)
 - **IEEE1588**
 - **IGBT/SiC**
 - **FPGA/DSP**
- Islanding Protection
 - **DSP**
 - **1588**
 - **SiC/IGBT**

節流(Spent less)



Power management and saving

Power Management

- **Energy-detect power down** → Check PHY Link status
- **Software power down** } → Suspend/resume via register setting (MDC/MDIO)
- **Chip power down** }
- **Energy Efficient Ethernet** → Enabled by Default, partner need support EEE
- **Wake on LAN (idle+ PME)** → **CPU power saving**

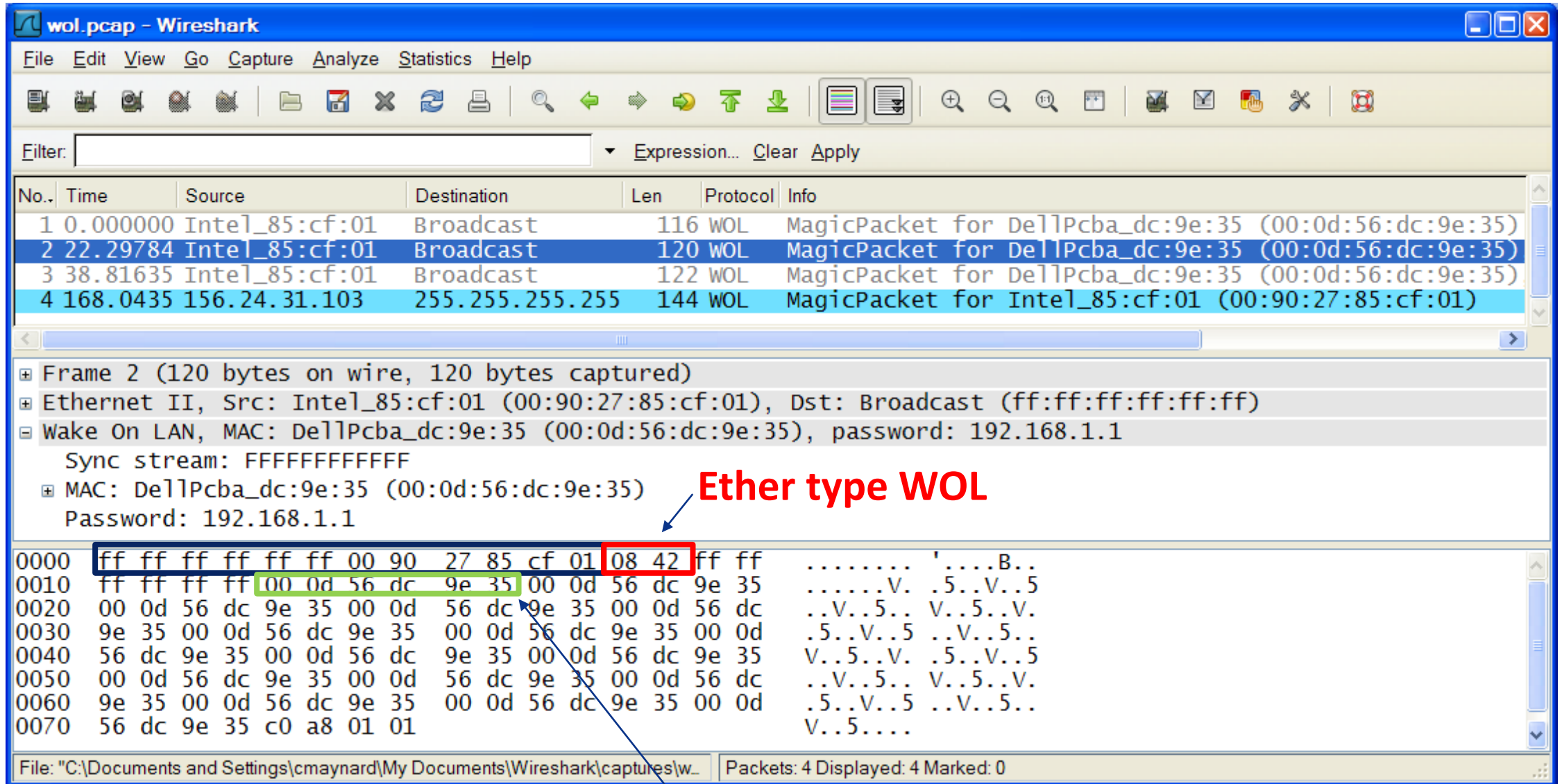
Note: Software functions controlled by external SOC

Recommended Single Port Ethernet PHYs

								
Product	KSZ8081	KSZ8091	LAN8742A	LAN8740A	KSZ8061	KSZ9031	KSZ9131	VSC8541
Bandwidth	10Base-T/100Base-TX					10/100/1000Base-T		
Interface	MII/RMII		RMII	MII/RMII		MII/RGMII/GMII	RGMII/RMII	GMII/MII/RMII/RGMII
Power	155mw (typical)	155mw (typical)	163mW (typical)	180mW (typical)	168mW (typical)	621mW (typical)	410mW (typical)	644mW (typical)
Temp Range	-40 to 85C	-40 to 85C	-40 to 85C	-40 to 85C	-40 to 85C	-40 to 105C	-40 to 105C	-40 to 125C*
Wake-on-LAN	No	Yes	Yes	Yes	No	Yes	Yes	Yes
EEE	No	Yes*See Errata	No	Yes	No	No	Yes	Yes
1588v2	No	No	No	No	No	No	No	Yes
Cable Diags	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Packages	24/32 VQFN 48/LQFP	24/32 VQFN 48/LQFP	24/QFN	32 VQFN 5x5	32 QFN/WQFN 5x5	48 QFN/VQFN 7x7 64 QFN 8x8	48 QFN/VQFN 7x7 64 QFN 8x8	68-QFN 8x8
MAC I/O Voltage	1.8 - 3.3V	1.8 - 3.3V	1.8 - 3.3V	1.8 - 3.3V	1.8 - 3.3V	1.8 - 3.3V	1.8 - 3.3V	1.5-3.3V
Cable Reach	120m	120m	150m	150m	160m	10/100 – 150m	10/100 – 150m	160-200m
						GigE – 120m	GigE – 130m	
10k Pricing	\$0.64	\$0.75	\$0.86	\$0.93	\$1.16	\$1.76	\$1.77	\$1.91
	KSZ8081RNACA	KSZ8091RNACA	LAN8742A-CZ	LAN8740A-EN	KSZ8061MNXI	KSZ9031RNXCC	KSZ9131RNXCC	LAN8840/Q2A
Voltage Regulator	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Special Features	Back-to-back mode for Copper repeater	Energy Efficient Ethernet (EEE)	AEC-Q100 available	AEC-Q100 available	AEC-Q100 available	AEC-Q100 available	EEE, Lower Power	SyncE, SOF, Alpha Pkg

* Junction Temperature

Magic Packet



The image shows a Wireshark capture of a Magic Packet. The packet list shows four packets, all of which are MagicPackets for DellPcba_dc:9e:35 (00:0d:56:dc:9e:35). The packet details pane shows the structure of the Magic Packet, including the Ethernet II header, the Wake On LAN MAC address, and the password. The packet bytes pane shows the raw data of the Magic Packet, with the target MAC address (00:0d:56:dc:9e:35) repeated 16 times.

Filter: Expression... Clear Apply

No.	Time	Source	Destination	Len	Protocol	Info
1	0.000000	Intel_85:cf:01	Broadcast	116	WOL	MagicPacket for DellPcba_dc:9e:35 (00:0d:56:dc:9e:35)
2	22.29784	Intel_85:cf:01	Broadcast	120	WOL	MagicPacket for DellPcba_dc:9e:35 (00:0d:56:dc:9e:35)
3	38.81635	Intel_85:cf:01	Broadcast	122	WOL	MagicPacket for DellPcba_dc:9e:35 (00:0d:56:dc:9e:35)
4	168.0435	156.24.31.103	255.255.255.255	144	WOL	MagicPacket for Intel_85:cf:01 (00:90:27:85:cf:01)

Frame 2 (120 bytes on wire, 120 bytes captured)

- Ethernet II, Src: Intel_85:cf:01 (00:90:27:85:cf:01), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
- Wake On LAN, MAC: DellPcba_dc:9e:35 (00:0d:56:dc:9e:35), password: 192.168.1.1
 - Sync stream: FFFFFFFFFFFFFFFF
 - MAC: DellPcba_dc:9e:35 (00:0d:56:dc:9e:35)
 - Password: 192.168.1.1

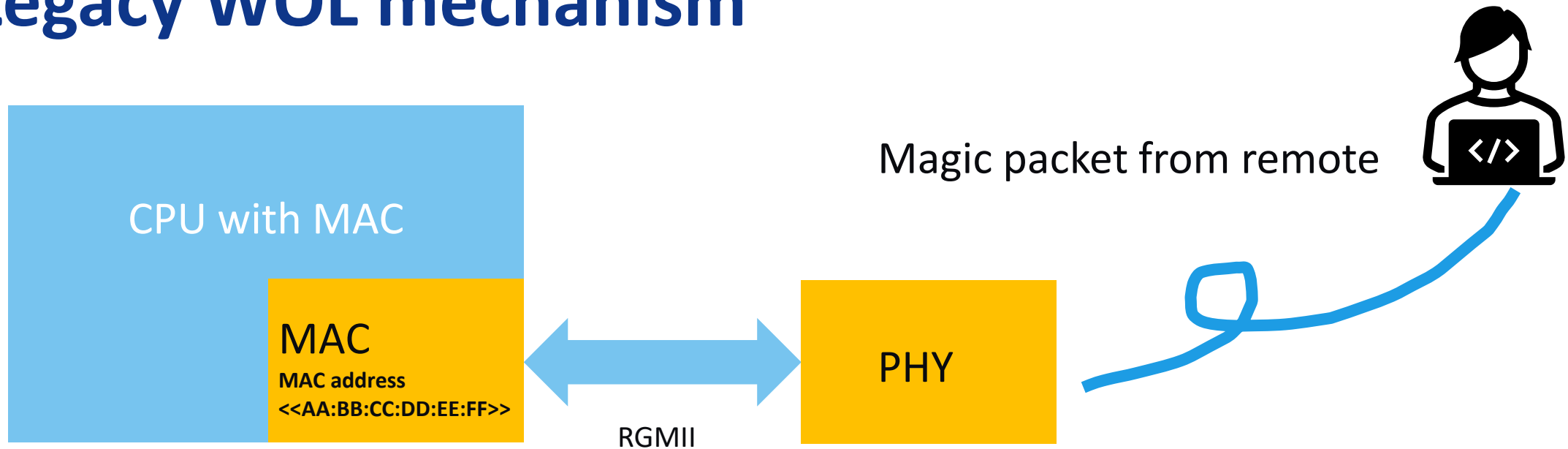
0000 ff ff ff ff ff ff 00 90 27 85 cf 01 08 42 ff ff '....B..
0010 ff ff ff ff 00 0d 56 dc 9e 35 00 0d 56 dc 9e 35V. .5..V..5
0020 00 0d 56 dc 9e 35 00 0d 56 dc 9e 35 00 0d 56 dcV..5.. V..5..V..
0030 9e 35 00 0d 56 dc 9e 35 00 0d 56 dc 9e 35 00 0d5..V..5 ..V..5..
0040 56 dc 9e 35 00 0d 56 dc 9e 35 00 0d 56 dc 9e 35 V..5..V. .5..V..5
0050 00 0d 56 dc 9e 35 00 0d 56 dc 9e 35 00 0d 56 dcV..5.. V..5..V..
0060 9e 35 00 0d 56 dc 9e 35 00 0d 56 dc 9e 35 00 0d5..V..5 ..V..5..
0070 56 dc 9e 35 c0 a8 01 01 V..5....

File: "C:\Documents and Settings\cmaynard\My Documents\Wireshark\captures\w... Packets: 4 Displayed: 4 Marked: 0

Ether type WOL

Target MAC address repeat 16 times

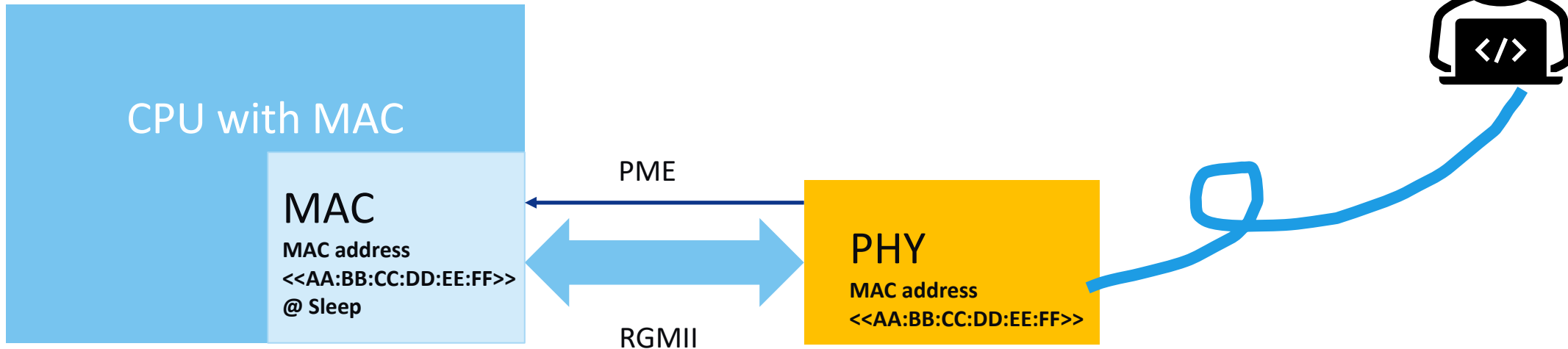
Legacy WOL mechanism



- Legacy WOL, MAC in CPU need keep awake in order to check if the incoming packet is magic packet or not
- CPU need keep awake because MAC need keep awake to recognize magic packet

PHY WOL mechanism

Magic packet from remote



- PHY WOL, MAC in CPU will copy the MAC address and set control register into PHY. Then CPU/MAC can enter deep sleep mode
- PHY need keep awake (Sentinel) in order to process if the coming packet is a magic packet or not
- Once Magic packet recognized, PHY will send an interrupt to wake CPU up, CPU resume to work

Thanks , Q&A
