



Reduce, Reuse & Recycle Production Equipment Solutions

Innovation for a Sustainable World

SCREEN Sustainability Forum - SEMICON Europa 2025

SCREEN Semiconductor Solutions Co., Ltd.

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Agenda

- Background

- Environmental impact of semiconductor industry

- Reduce

- Chemicals → flow rate reductions

- UPW → Intermittent flows, idle/trickle flow reductions/recycle

- SPM → higher temp H_2SO_4

- Electrical Energy savings → DT-3000 optical bake

- Exhaust → SU-3400 and SS-3200

- Reclaim & Recycle

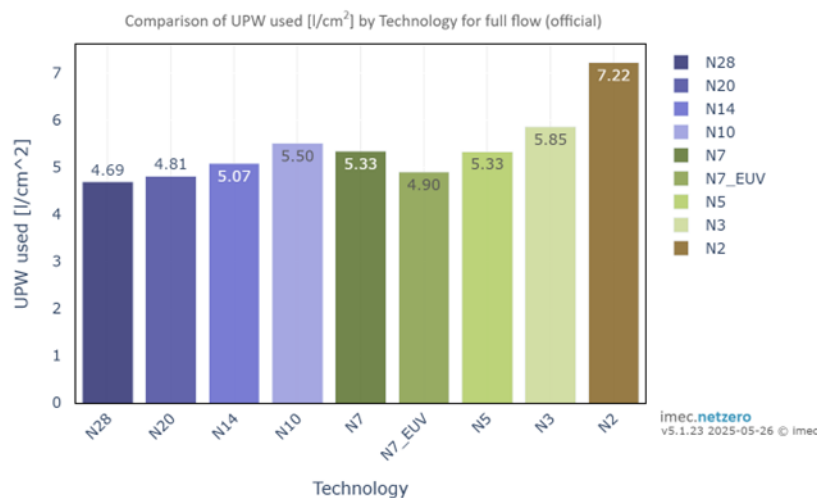
- H-UPW → H-UPW recycle unit

- SPM → SPM reclaim/reuse

- IPA waste → recovery and concentration

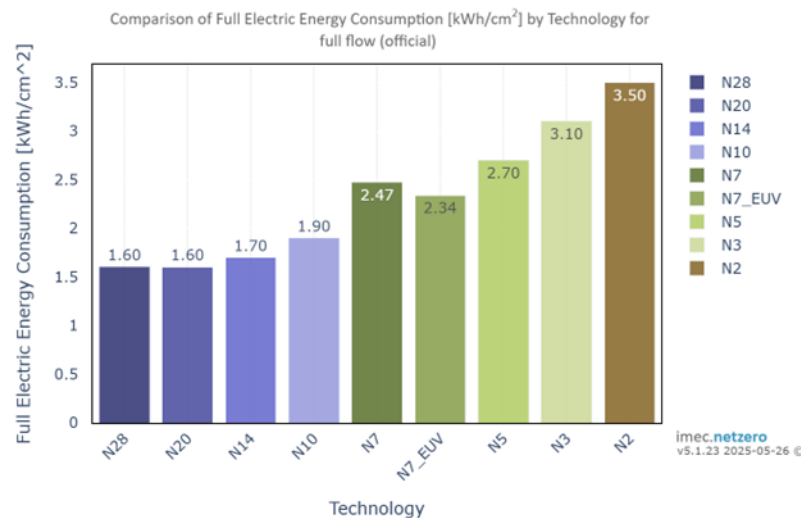
Environmental impact in semiconductor manufacturing

Water



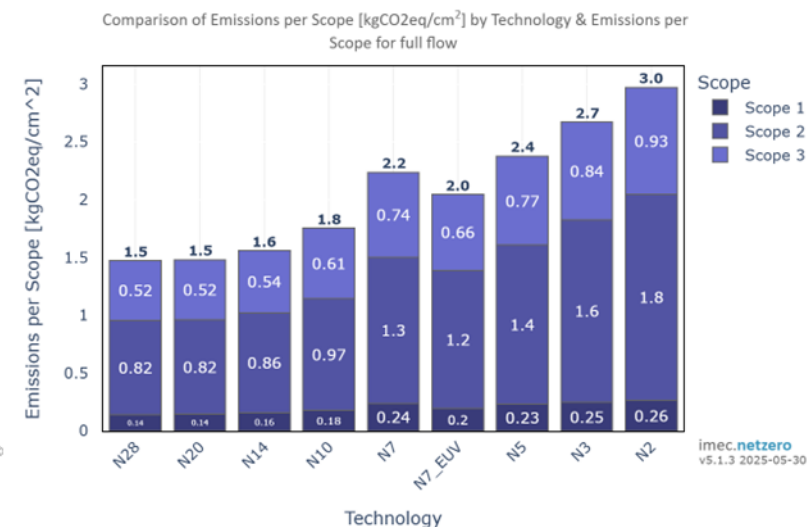
total UPW usage in l/cm² of 300mm wafer for full process flows

Electricity



total electricity usage in KWh/cm² of 300mm wafer for full process flows

CO₂eq



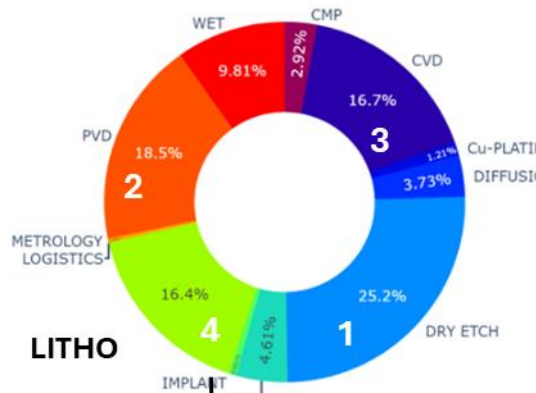
total GHG (CO₂eq) in KWh/cm² of 300mm wafer for full process flows

Courtesy from Emily Gallagher @imec, Generated by <https://netzero.imec-int.com/> on 2025-05-30

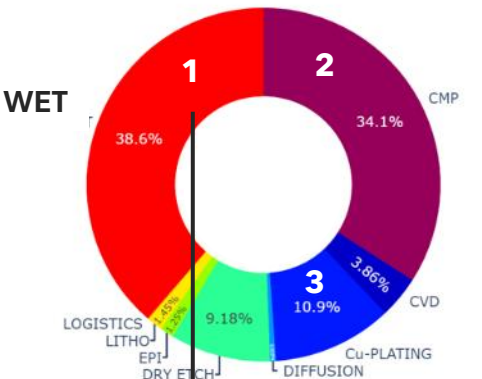
High impact areas in semiconductor processes

N5

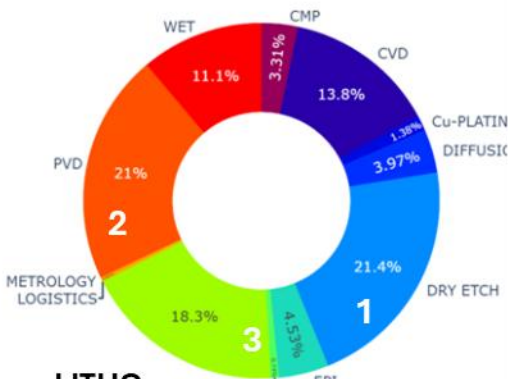
Scope 1 + 2 total emissions



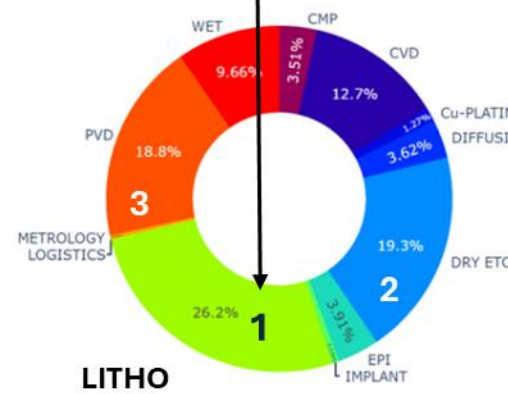
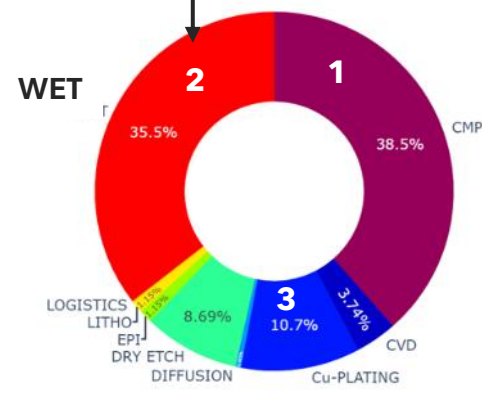
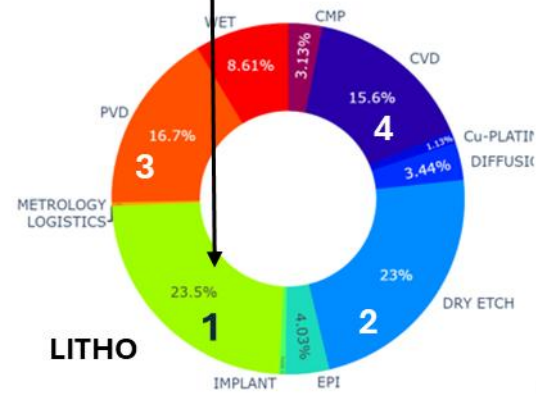
UPW usage



Full electric energy consumption



N3



Focus on Energy/Emissions for Litho and Water Use for Wets

Environmental impact of semiconductor industry



Semiconductor manufacturing is highly water-intensive

- Average facility using up to 40 million liters of UPW per day
- Wet etch tools use ~42% UPW in fab

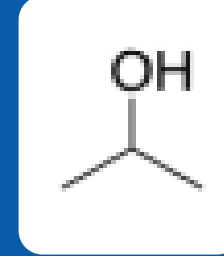


Water, electricity and CO₂eq per wafer manufactured has increased as technology becomes more advanced



Sulfuric acid has a large impact on the cost of chemicals and the environmental.

- One of the most widely used chemicals in the fab
- Up to 90% of facility acid load



Organic solvent use

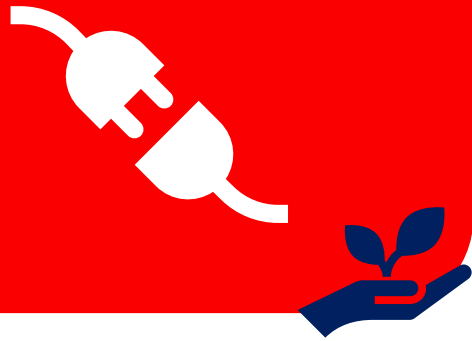
- IPA is the most widely used solvent
- HVM facility can use up to 6 million liters IPA/year



Reduction of the environmental load from a SMRE perspective

- Sustainability goals

**Reduce POWER
consumption**



**Lower temperature hot plate
processes**

**Reduce WATER
consumption**



**Develop recycle and reuse
technologies**

**Recycle
CHEMICALS**



**Develop reduce/reuse methods
for high volume chemicals**

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 - H-UPW → H-UPW recycle unit

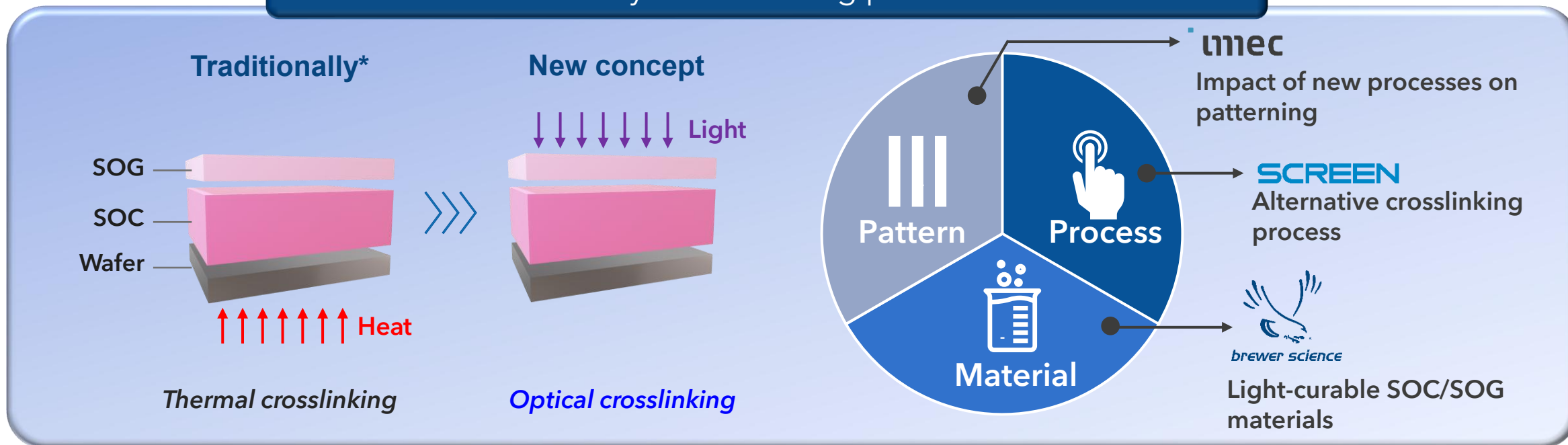
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Introduction to optical crosslinking

- A joint effort towards more sustainable track processes

Alternative underlayer crosslinking processes & materials

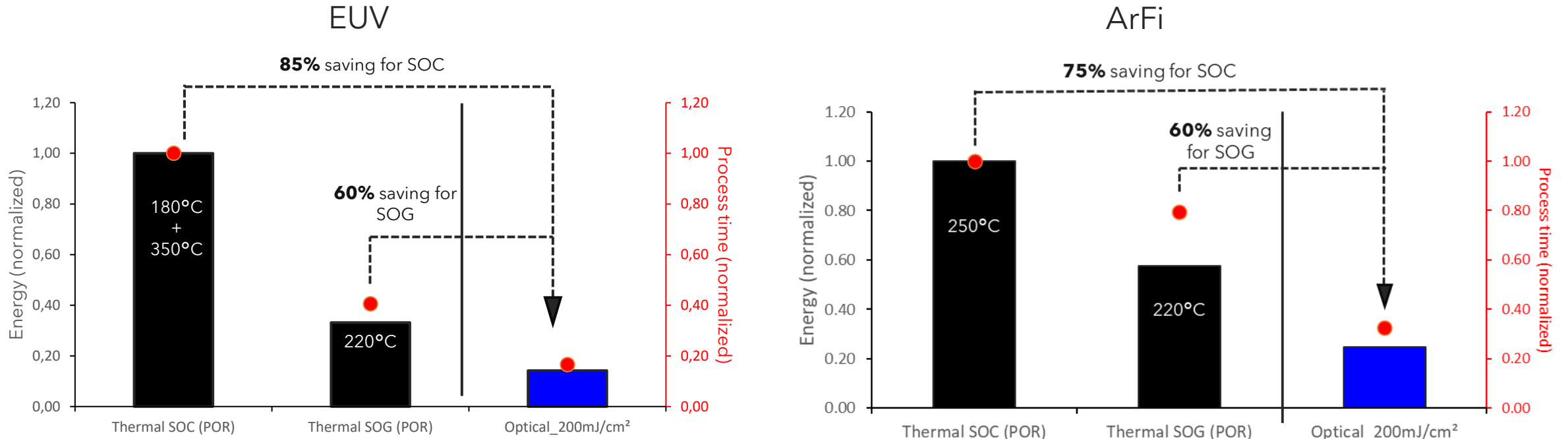


- * i) Due to the high temperatures required, the baking of underlayer materials is one of the **top track energy consumers**
- ii) Some applications **require low temperature processing**
Example: Lithographic baking and cooling steps can induce **warp** of **glass wafers**
(used for new optical applications)

A new concept for crosslinking the SOC & SOG materials is introduced

Energy savings with EUV and ArFi litho

- Energy consumption and process time during crosslinking process

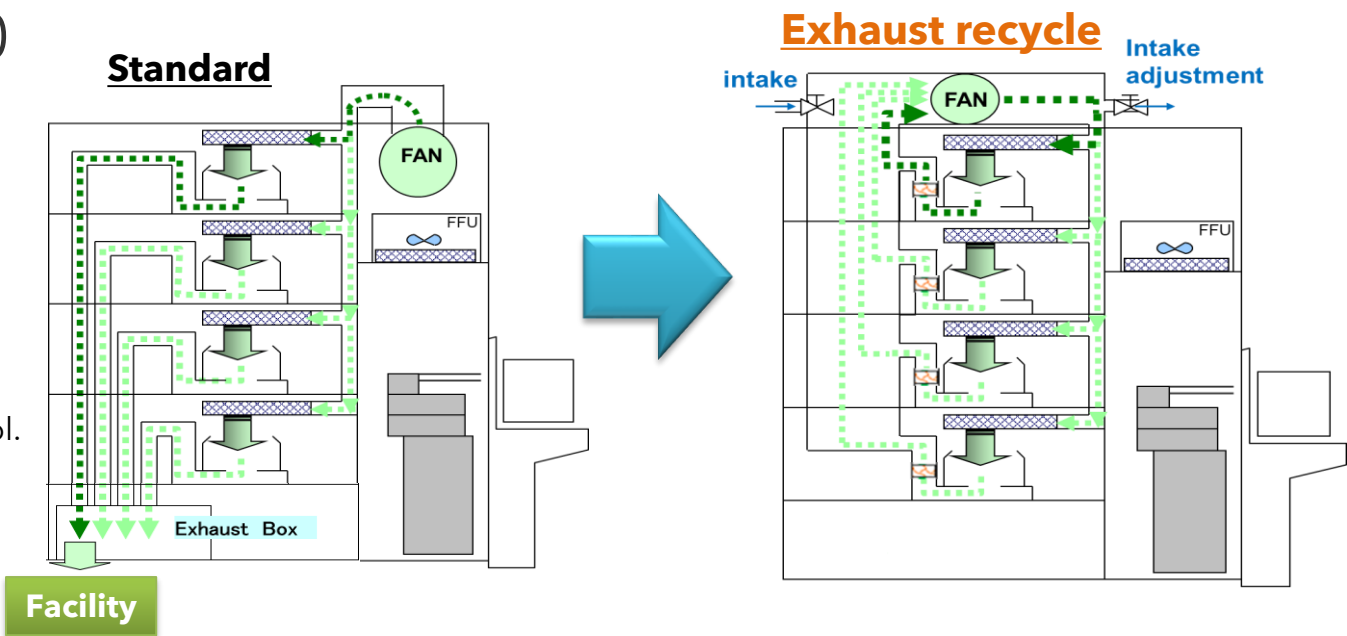


Light-curing as an energy-efficient alternative for thermal underlayer processing in ArF immersion lithography, SPIE 2025

**Optical crosslinking leads to significant savings of energy and process time,
without compromising litho performance**

Exhaust recycle on SS-3200

- Install additional duct.
 - *UPW tool only
 - *Modification is not possible
 - *Installation is limited to new tool.

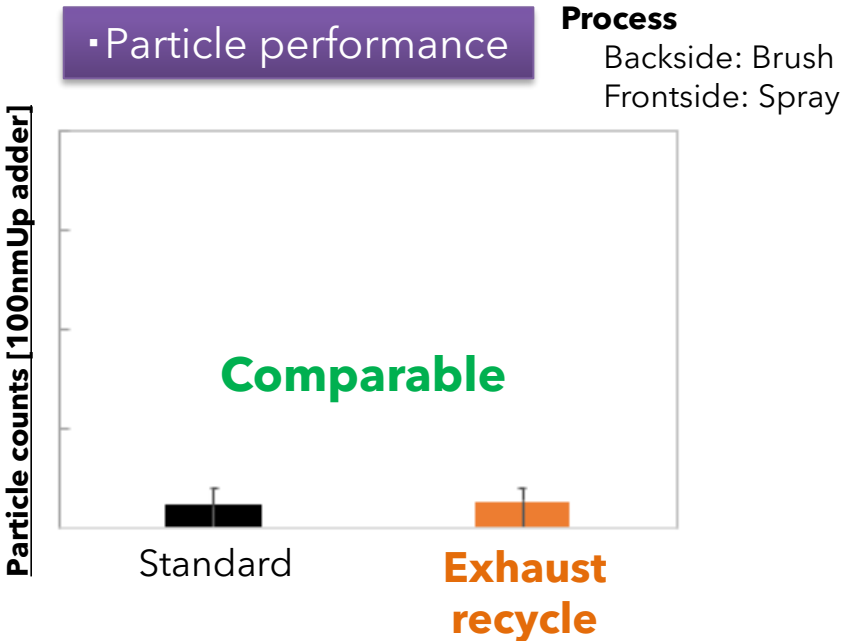


- Reduce chamber exhaust utility.

	Standard	Exhaust recycle
Total exhaust [m³/min]	16	0
Annual power consumption* [kWh]	30,000	0

*Numerical value obtained by our calculation formula.
It is not a number that commits to the reduction effect.

- Energy conversion factors (Semi S23):0.0037kWh/m3
- Running condition = 24h x 365 days x 95%



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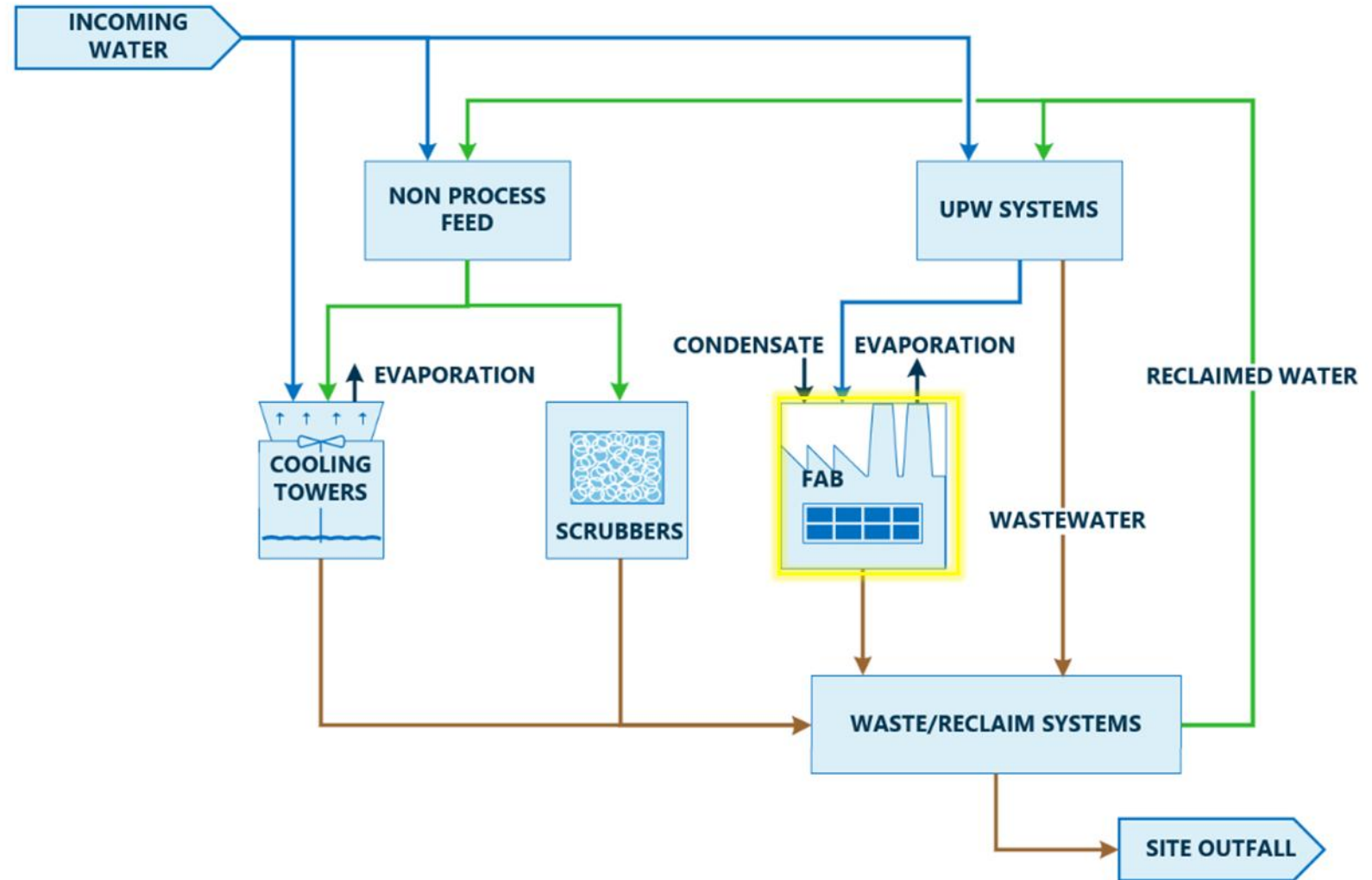
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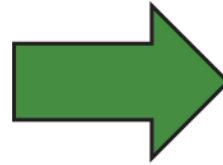
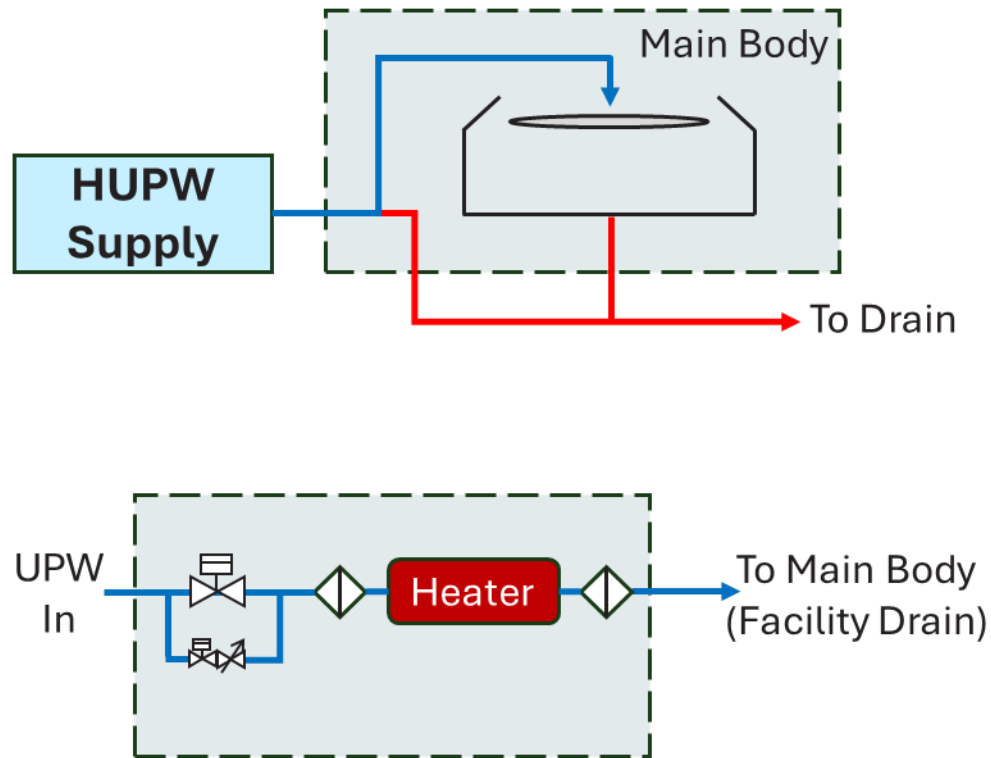
How will we achieve water reduction goals?

- Fabs are facing external and internal pressures to save water
 - Freshwater scarcity
 - Escalating water costs
 - ESG Commitments
- Tool OEM companies can help fabs save water by quantifying how changes impact sitewide sustainability

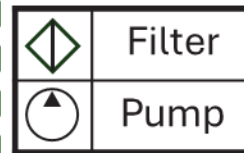
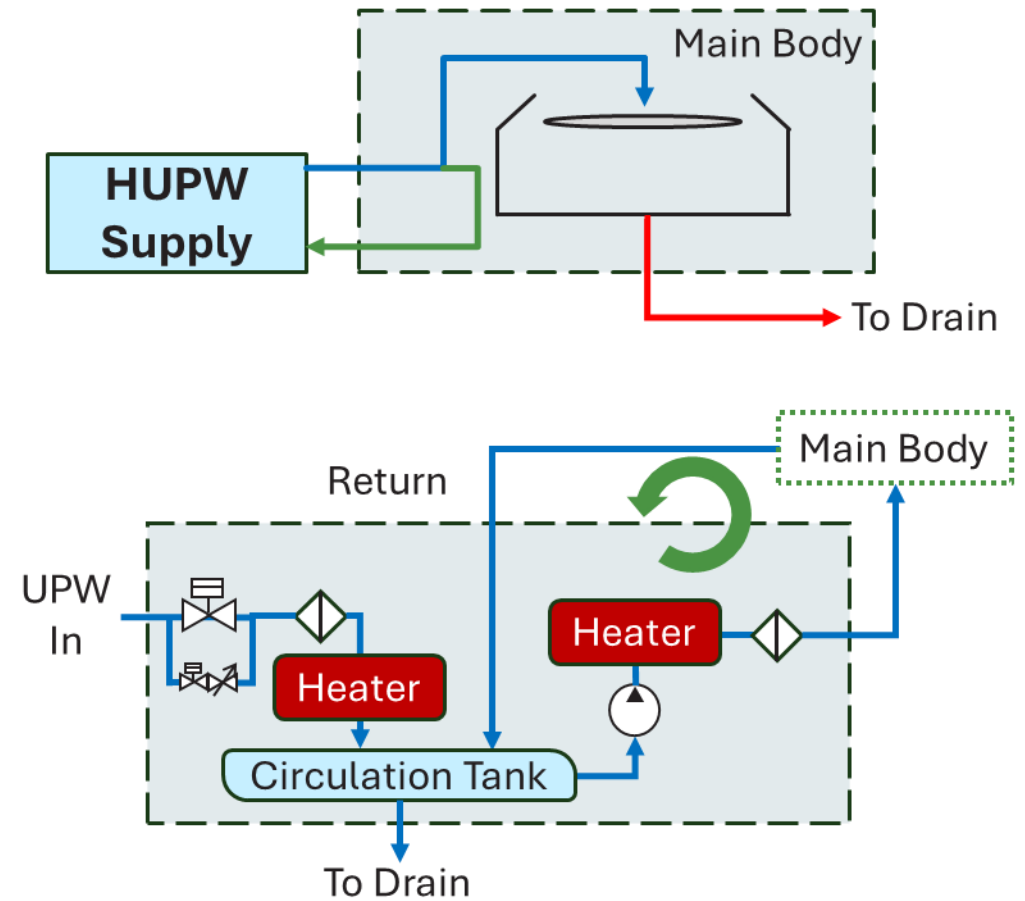


Hot UPW recycle

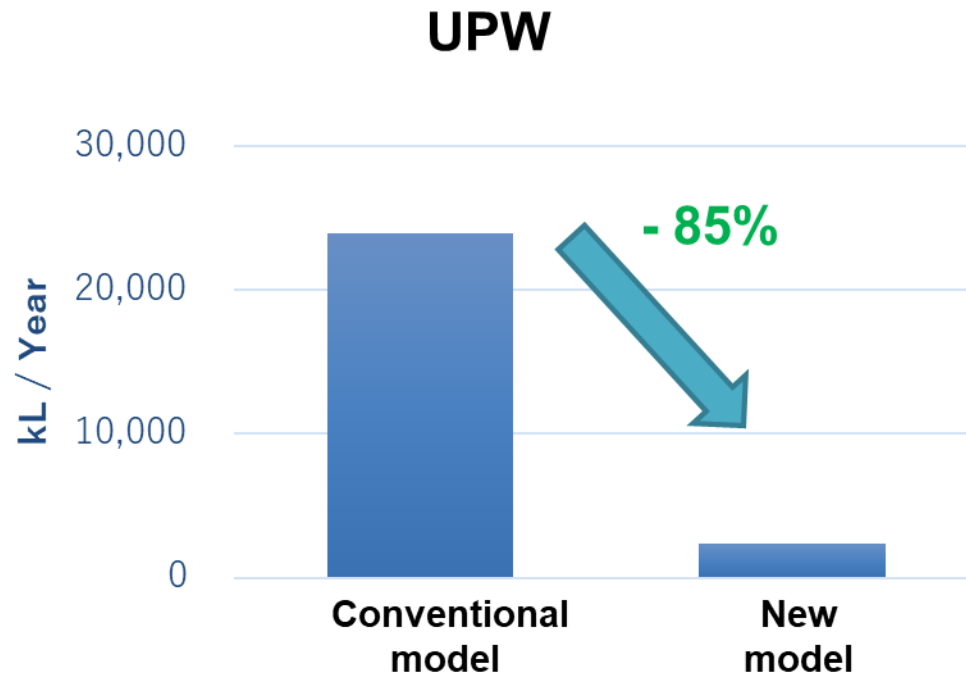
Single Pass



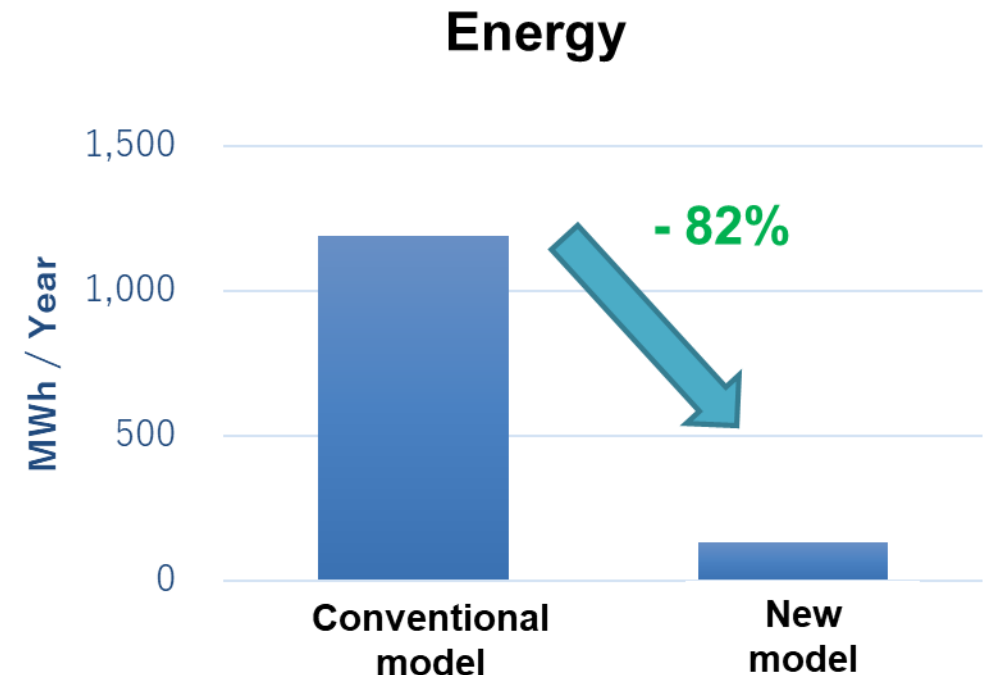
Recycle



Hot UPW recycle reduces UPW & energy consumption



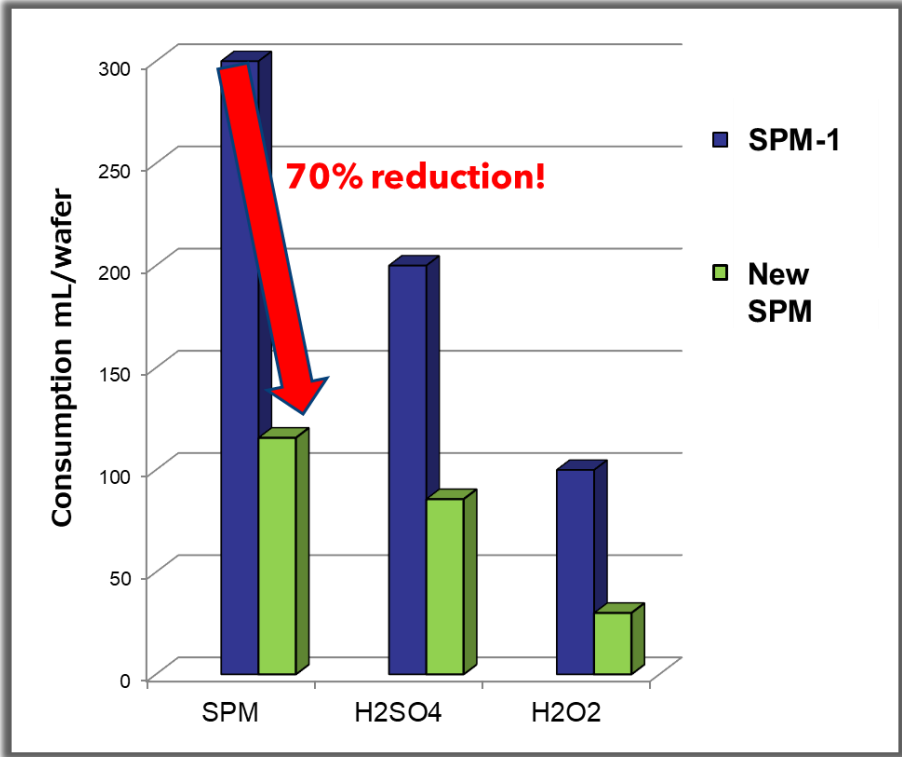
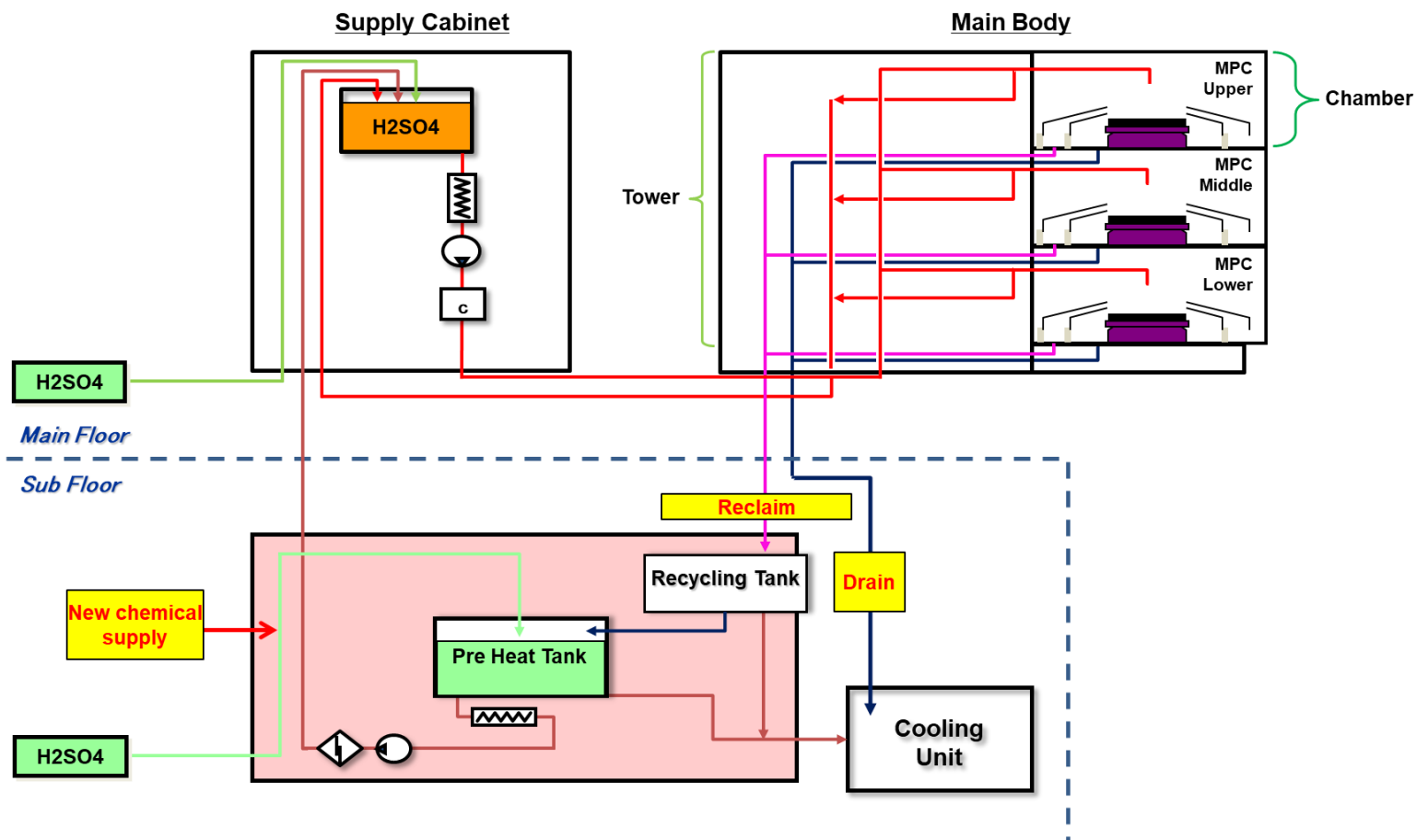
**UPW usage >
Reduced by 20,000 kL/year**



**Power consumption at 60°C H-UPW >
Reduced by 900 MWh/year**

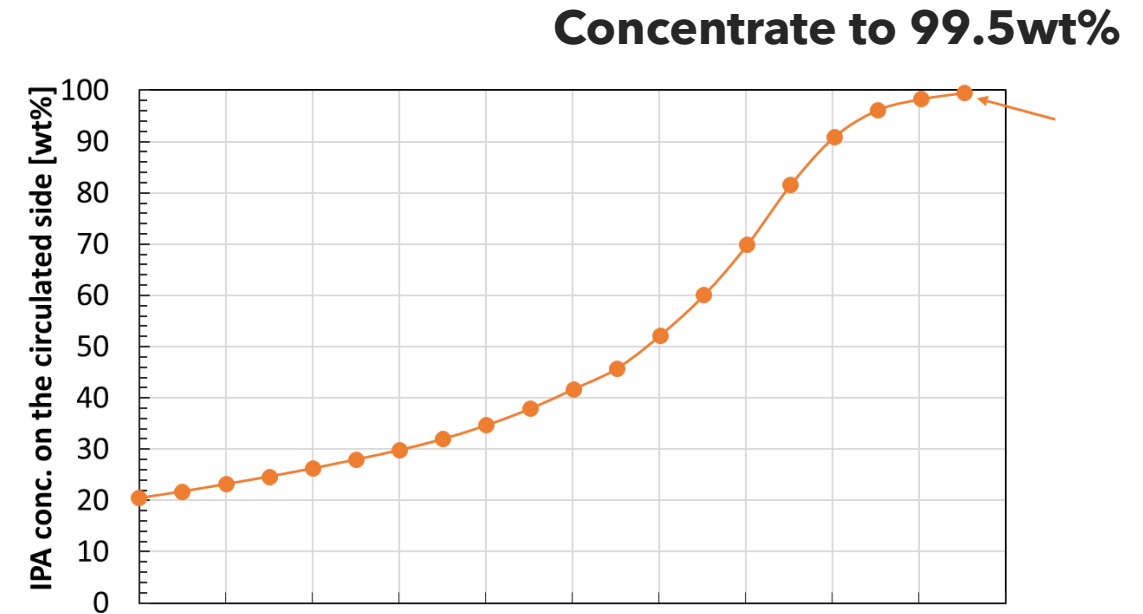
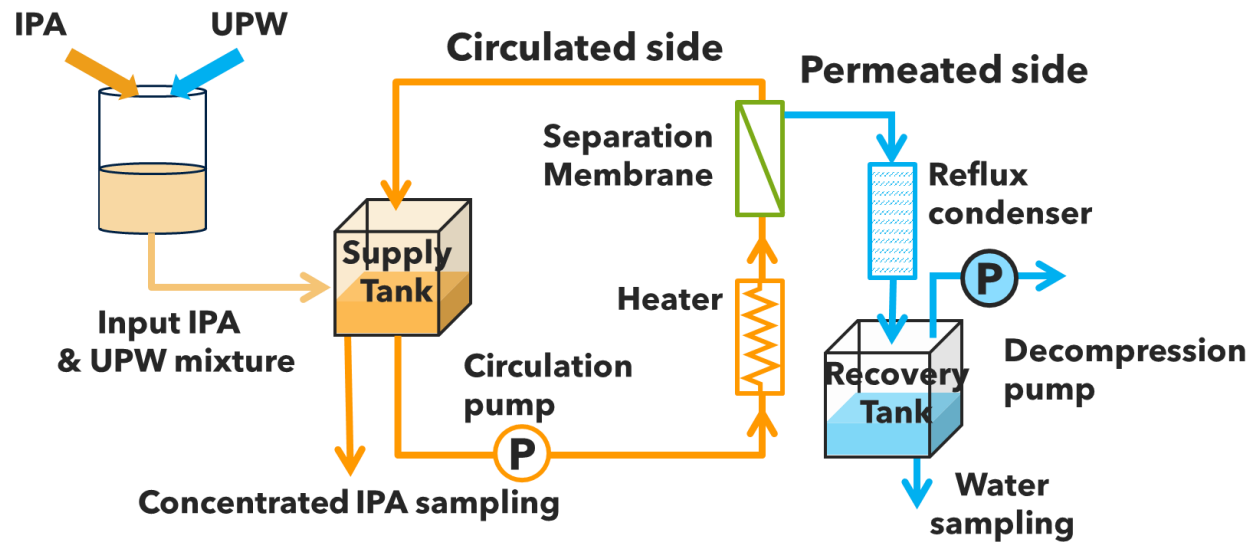
Reduction of Process Chemicals and Energy Use in Single-Wafer Process Applications, SEMICON Europa SCREEN Tech Forum, 2023

Reduction of SPM by reclaim/reuse



Reduction of Process Chemicals and Energy Use in Single-Wafer Process Applications, SEMICON Europa SCREEN Tech Forum, 2023

IPA & UPW separation technology



Reduction of Organic Wastewater via IPA and Water Separation Using Pervaporation, SPCC 2025

Simplifies disposal and enables circularity

Innovation for a Sustainable World

