CYMER
An ASML company

# Sustainability & Availability Improvements from Light Source Technology Enhancements

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# Presentation Agenda

- **Net Zero 2040 Commitment**
- Cymer Light Sources Introduction
- Cymer Sustainability Initiatives
- Gas Reduction
- Neon Recapture
- Helium Elimination
- Power Efficiency
- Water Use & Reduction
- Long Life Modules + Reuse
- Reducing cost of ownership
- Summary

# Cymer Net Zero 2040 Commitment

**Cymer is committed, as part of ASML, to reach net zero greenhouse gas emissions from product use by 2040**

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# Cymer Light Source

- World leader in lithography light sources that are used to pattern semiconductor chips
- Division of ASML one of the world's leading manufacturers of chip-making equipment


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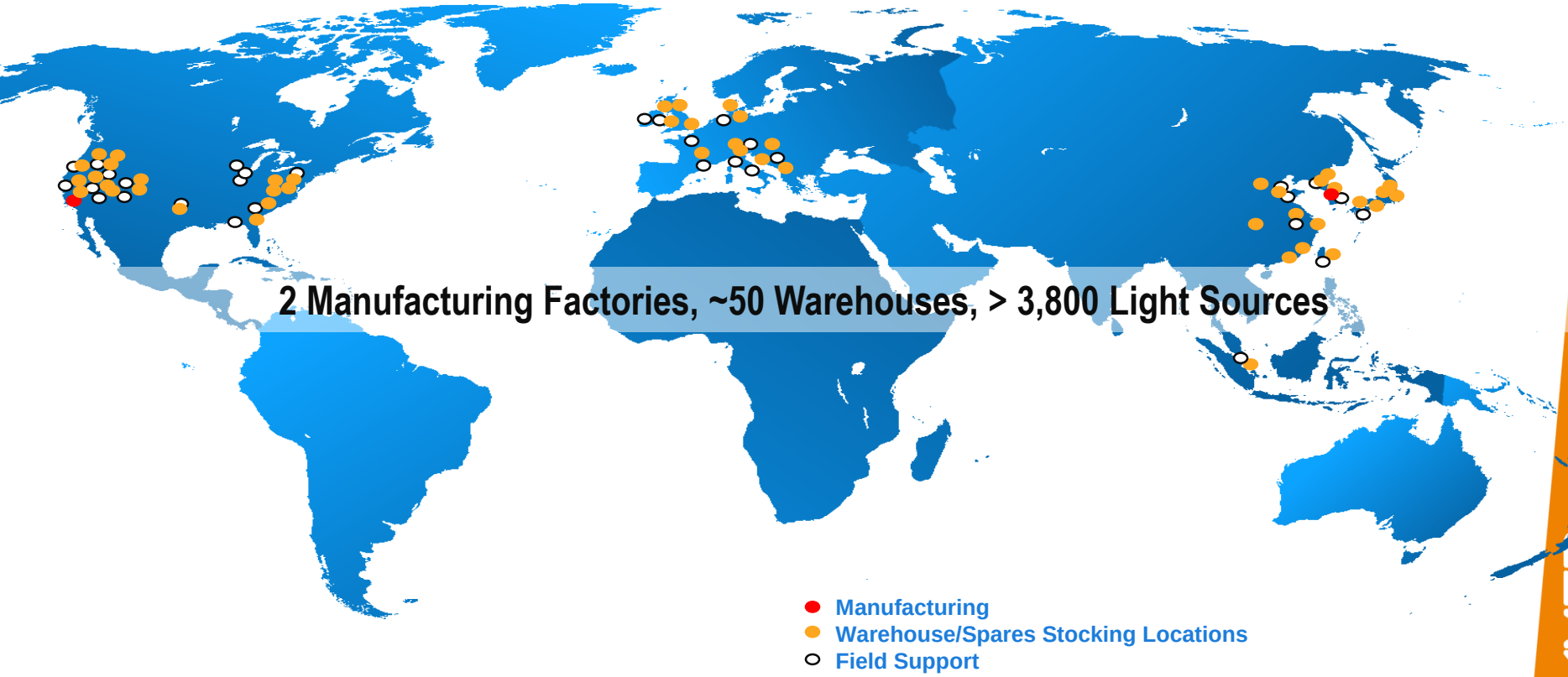
# Global sales, service and support



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# Cymer Sustainability Initiatives

*Delivering Cost Reduction & Reduced Consumption*



## Electricity

Power for discharge and system control

## Long life modules & Reuse

Discharge and optical modules

## Water

Used for cooling of laser components

## Gas

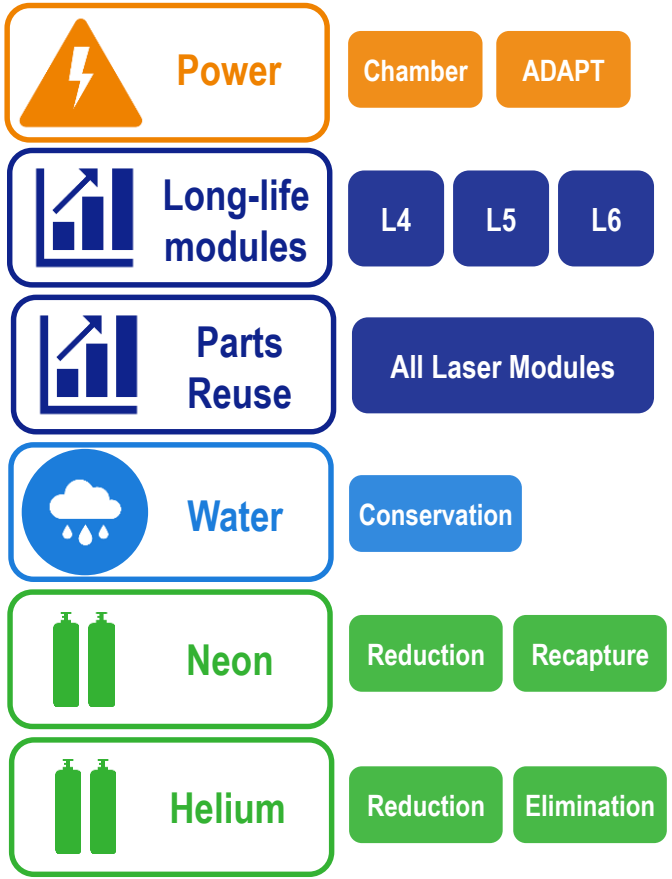
Helium as a purge gas, Neon gas mixtures to fuel discharge

Cymer is committed to reducing the chipmaker operating costs, environmental footprint, and business continuity risks by delivering sustainability solutions

# Sustainability and Cost Reduction Initiatives

Cost savings from reduced operational expense and increased availability

Protection against supply continuity, price spikes, and increased business continuity



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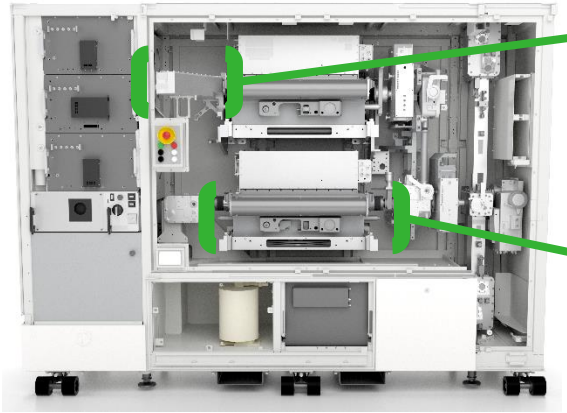
# Green Technology: Gas Reduction



**Helium** is used as a because of its high thermal stability for the line narrowing module (LNM) for ELS 7010 and XL series

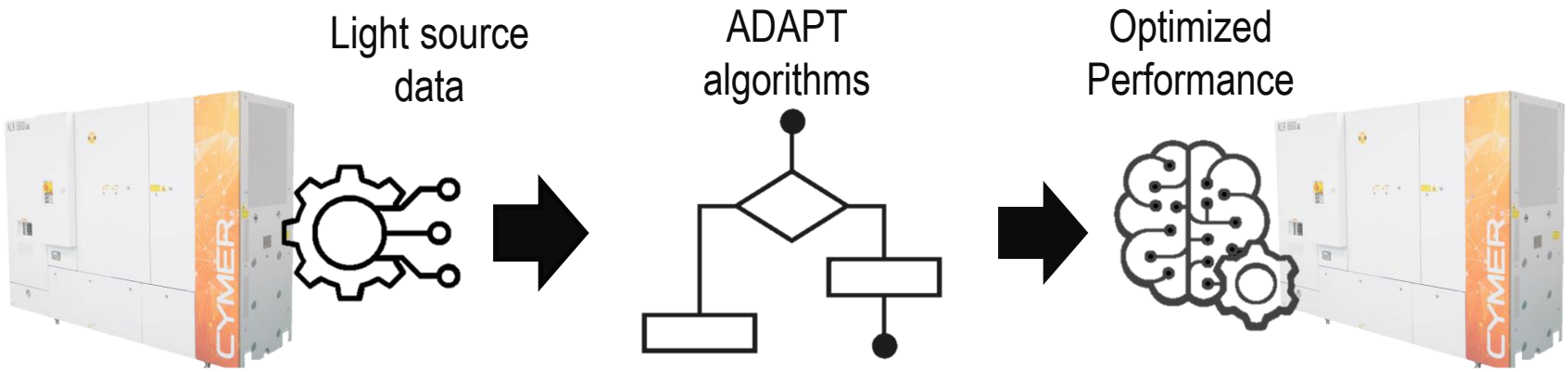
**Neon** gas mixtures are used to fuel the discharge

- Bi-mix: Ar/Ne, Kr/Ne
- Tri-mix: $Ar/F_2/Ne$, $Kr/F_2/Ne$

Reduce Neon gas usage and completely remove the need for Helium

# Green Technology: ADAPT

## *Automated Data Analysis and Performance Tuning*



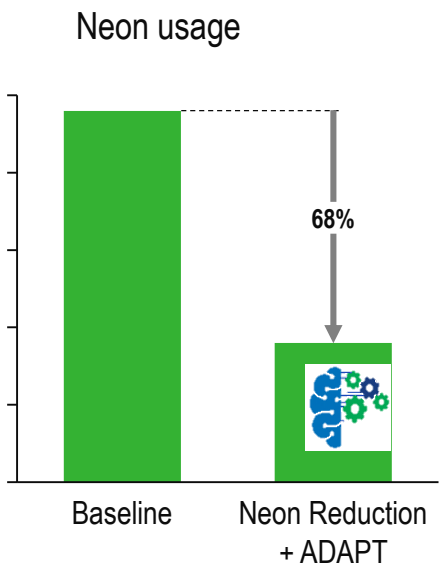

ADAPT takes todays light source that simply reports data

Applies machine learning via algorithms

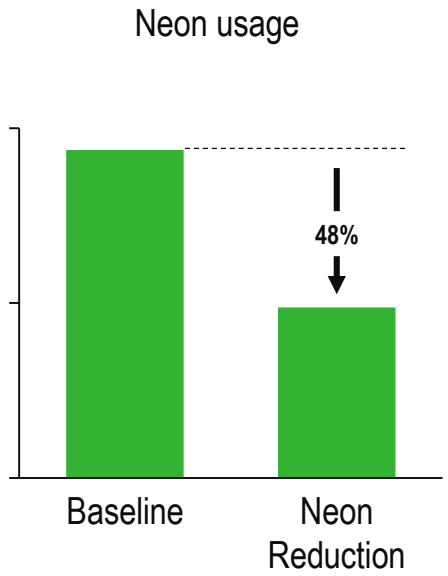
To transform the light source into an intelligent machine

# Green Technology: ArF/KrF Neon Reduction

## ArF Neon reduction and savings




## KrF Neon reduction and savings




>60% reduction of Ne usage with Reduction + ADAPT

Recapture & Reprocessing Ensures Price Stability, Supply Continuity

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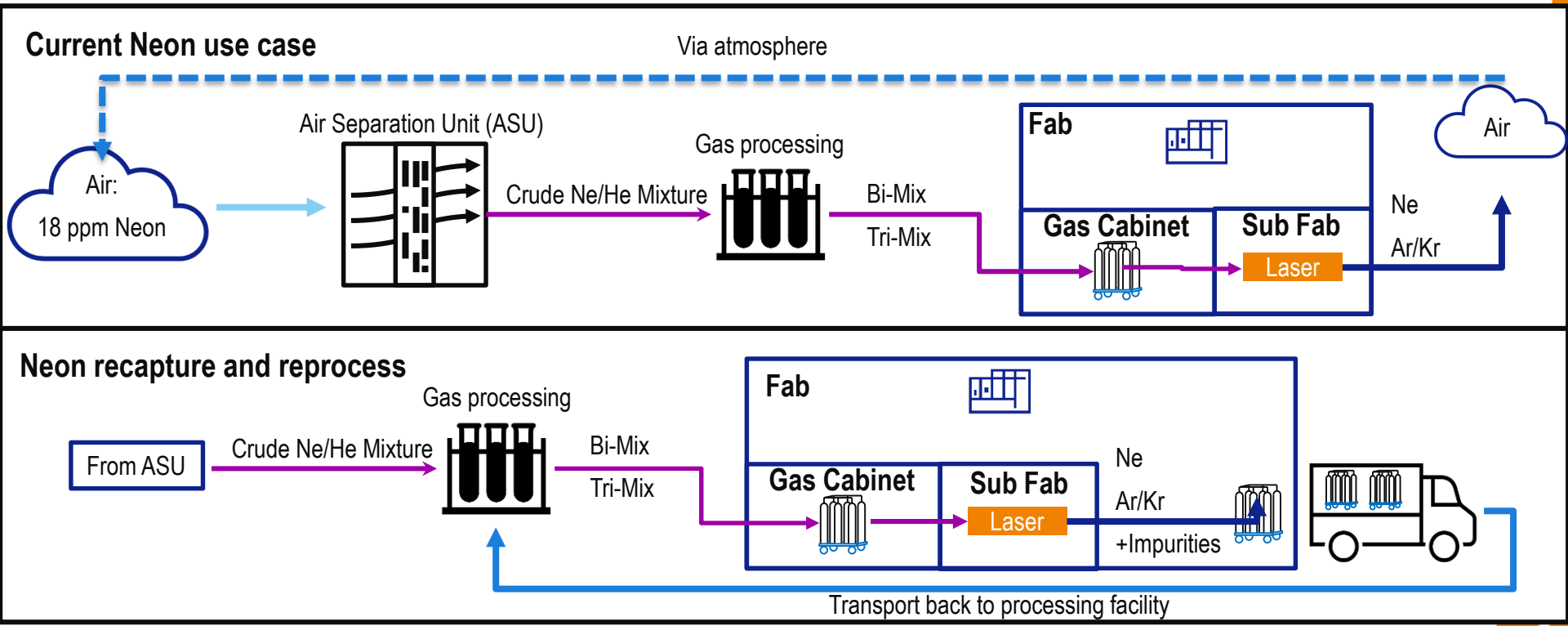
# Neon Recapture

## Recapture and Reprocessing Process Flow




**90% exhaust gas could be recaptured and reprocessed**
**Gas quality and supply security can be guaranteed**

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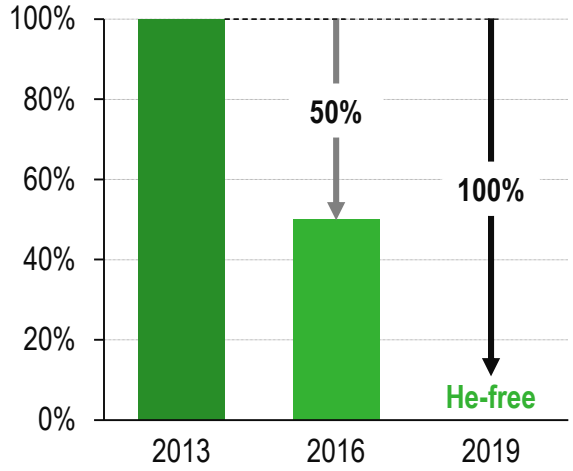
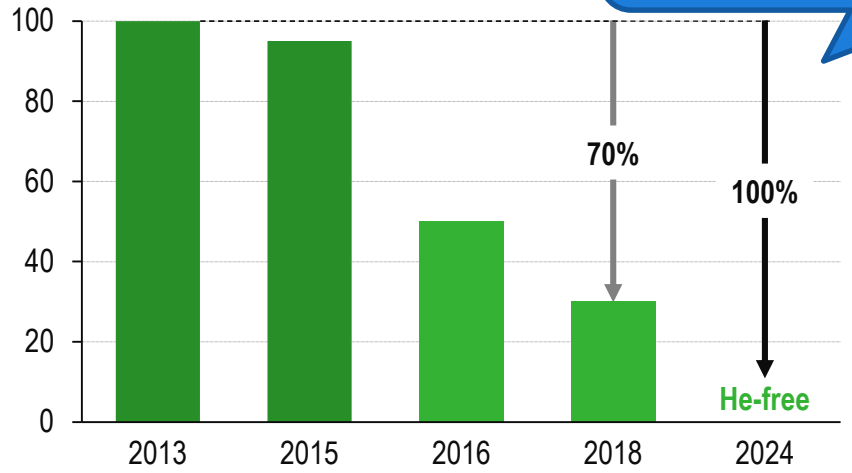
# Green Technology: Helium Elimination

Note that He free is already available for certain ArF laser models. Release for all ArF models to be complete 2024

KrF Helium usage (%)




ArF Helium usage (%)




Released multiple solutions to reduce and completely remove the need for Helium

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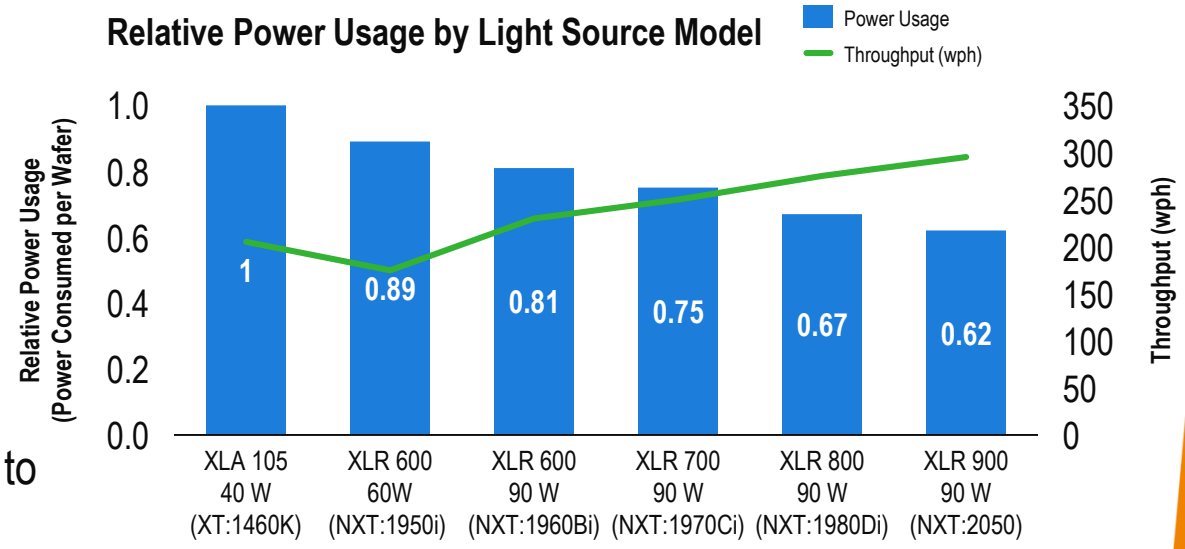
# Green Technology: ArFi Power Efficiency Improvement

- Cymer has improved energy efficiency ratio since the first generation of ArF lightsources through its dual chamber (MOPA) technology
- Chamber and ADAPT technologies further contribute to efficiency increase by reducing power consumption

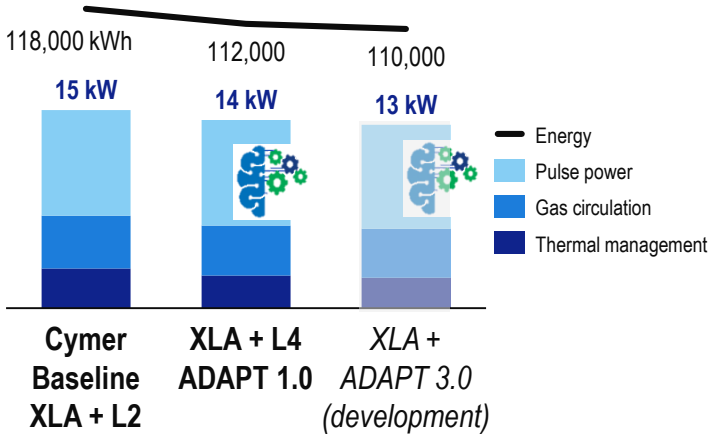



Light source output improving without increasing power consumption

# Green Technology: ArF Dry (XLA) Energy Usage Reduction

- ADAPT reduces power consumption by modulating the temperature and gas circulation control
- ~6000kWh annual savings per laser
- In addition, the fab electrical requirement for chilled water is reduced

**Average power and annual energy consumption**




>5% energy savings via chamber improvement and ADAPT

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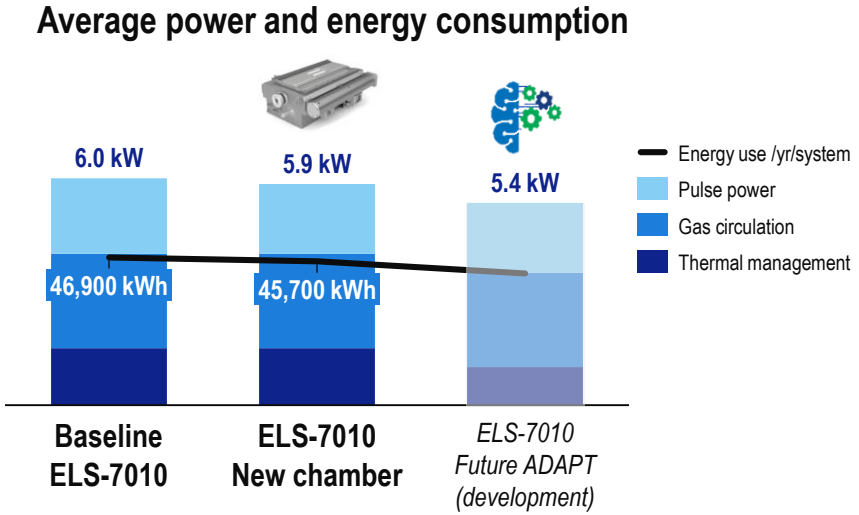
# Green Technology: KrF Energy Usage Reduction

- New long-life chamber reduced power consumption via lower Voltage
- Energy reduction from chamber results in ~1200kWh annual savings per laser
- **Future ADAPT** technologies will continue extending savings




~8% less energy use via chamber improvements and ADAPT

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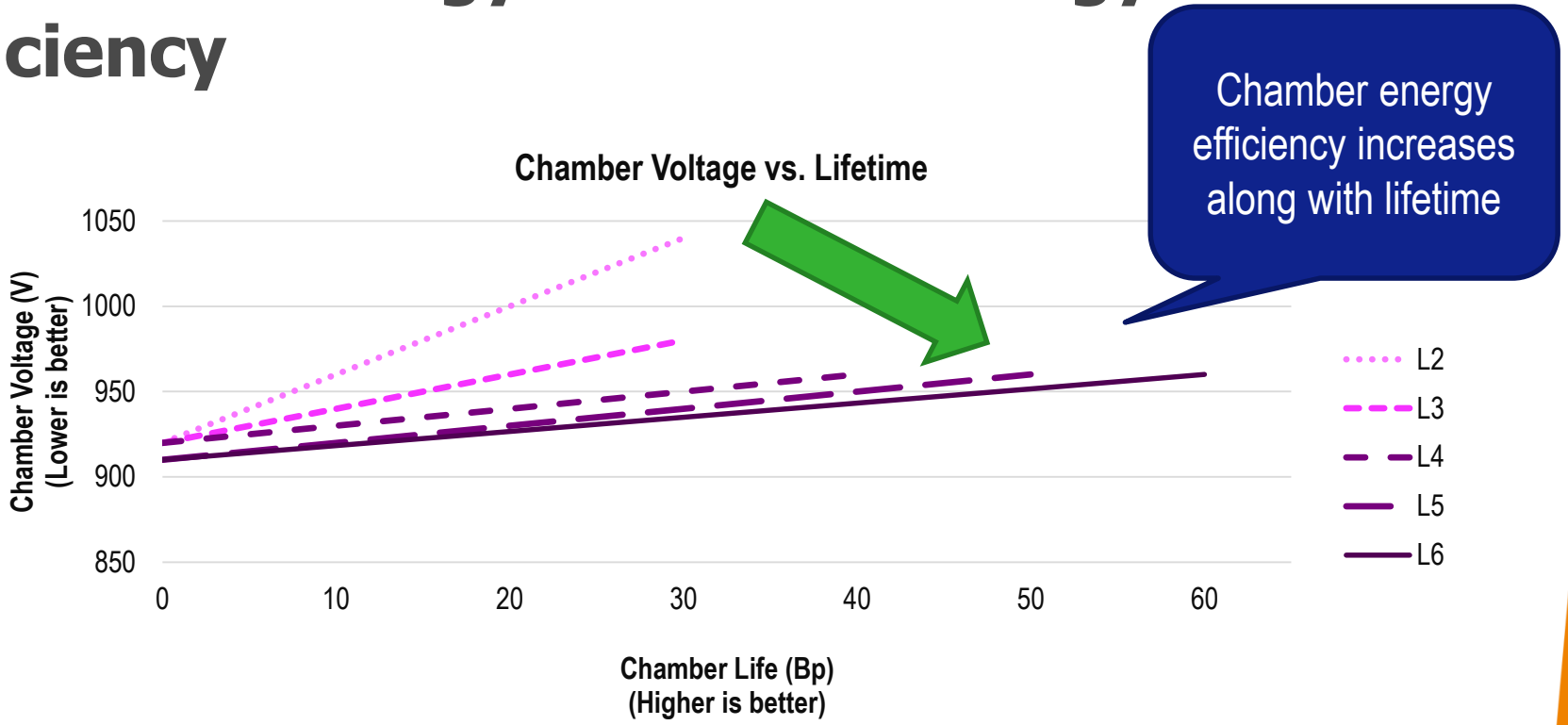
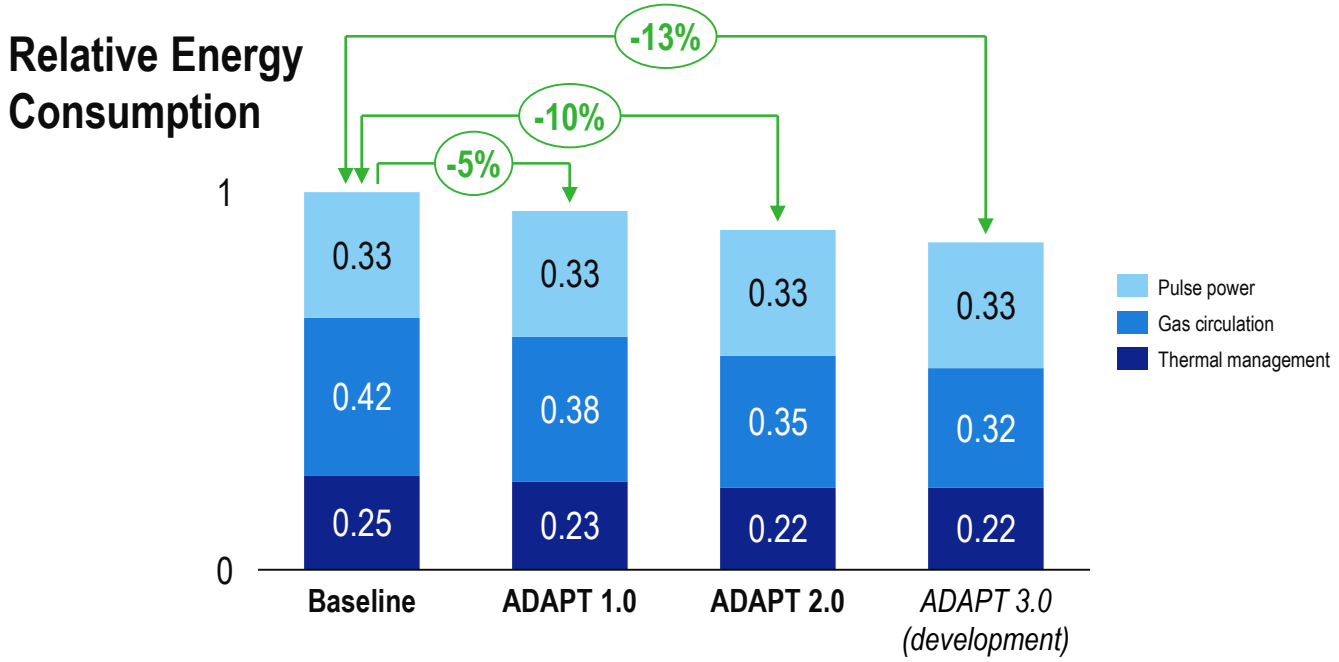
# Green Technology: Chamber Energy Efficiency




Chamber energy efficiency increasing with each generation

# Green Technology: ADAPT Energy Savings




ADAPT enabling power savings of >10%

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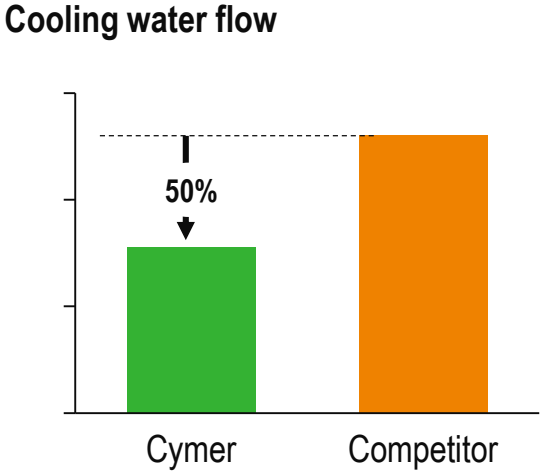
# Green Technology: Efficient Water Use & Reduction

- Cooling water is used to dissipate heat from the chambers
- Cymer's ArFi chamber technology uses **efficient heat exchange technology** in addition to ADAPT's algorithm for thermal management




50% less cooling water use than the competitor

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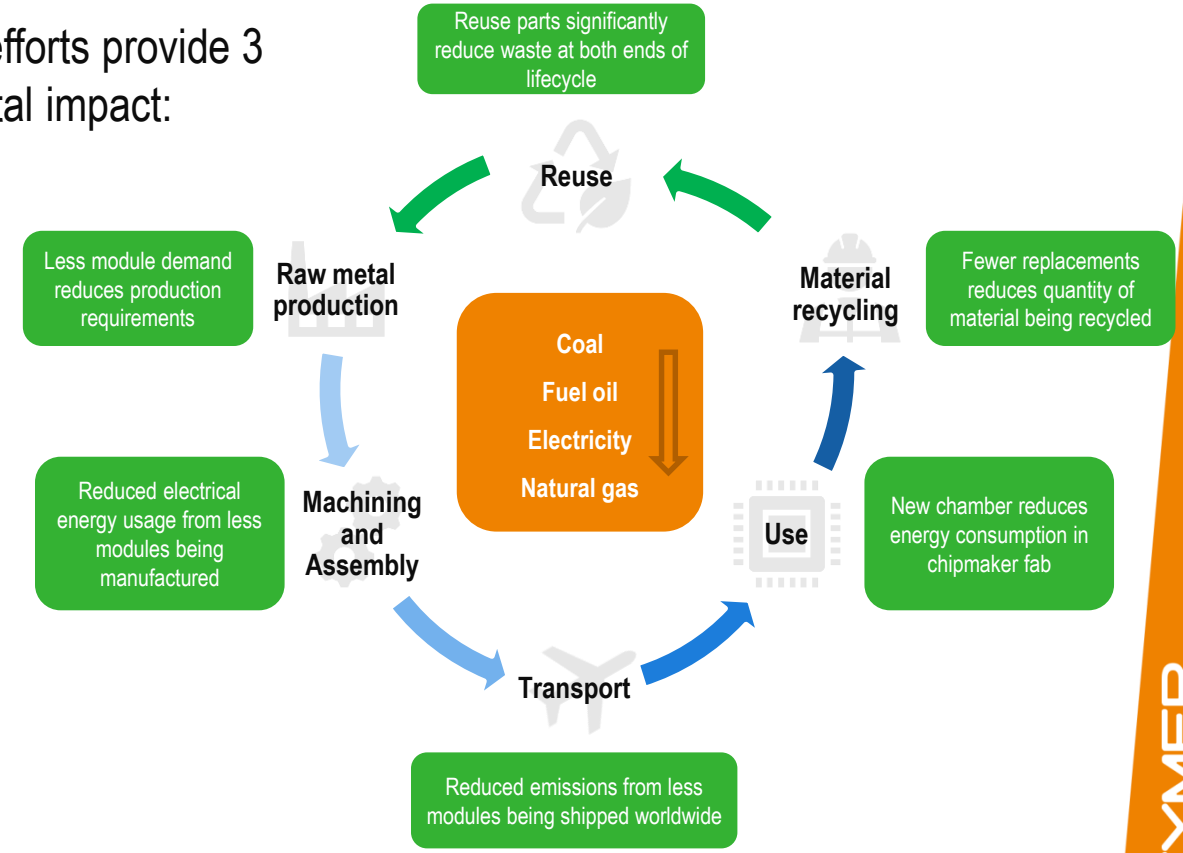
# Green Technology: Long Life Modules + Reuse

Technology improvements & reuse efforts provide 3 main benefits to reduce environmental impact:

1. Cymer reuse applies to ~45% of laser parts, reducing resources needed for new manufacturing & waste at end-of-life

2. Improved design in new modules increases overall system wall-plug efficiency (input to output power ratio)

3. Longer replacement interval means reduced service events and their associated environmental impact

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# Cymer Reclaim Part Weight Analysis

The analysis includes reuse in fabricated part weight, annual average based actual module completions

| | Annual Avg (Mod Count) | Reclaim/module (Avg) (lbs) | Reclaim Total (Avg) (lbs) |
|---|---|---|---|
| **SSPPM** | 1,092 | 24 | 28440 |
| **Chambers** | 2,349 | 280 | 839440 |
| **Optics** | 3,286 | 18 | 65016 |

- Cymer annual reuse average is 423,154 kg in fabricated Aluminum parts
  - ***This is roughly equal to the weight of 11 New York City subway cars***

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- Cymer's re-use of Aluminum also equates to an off-set of ~8M kg of $CO^2$ released into the atmosphere
  - ***This is enough gas to fill 7,956 hot air balloons (1 Ton of CO2 gas can fill one 500 cubic meter hot air balloon)***

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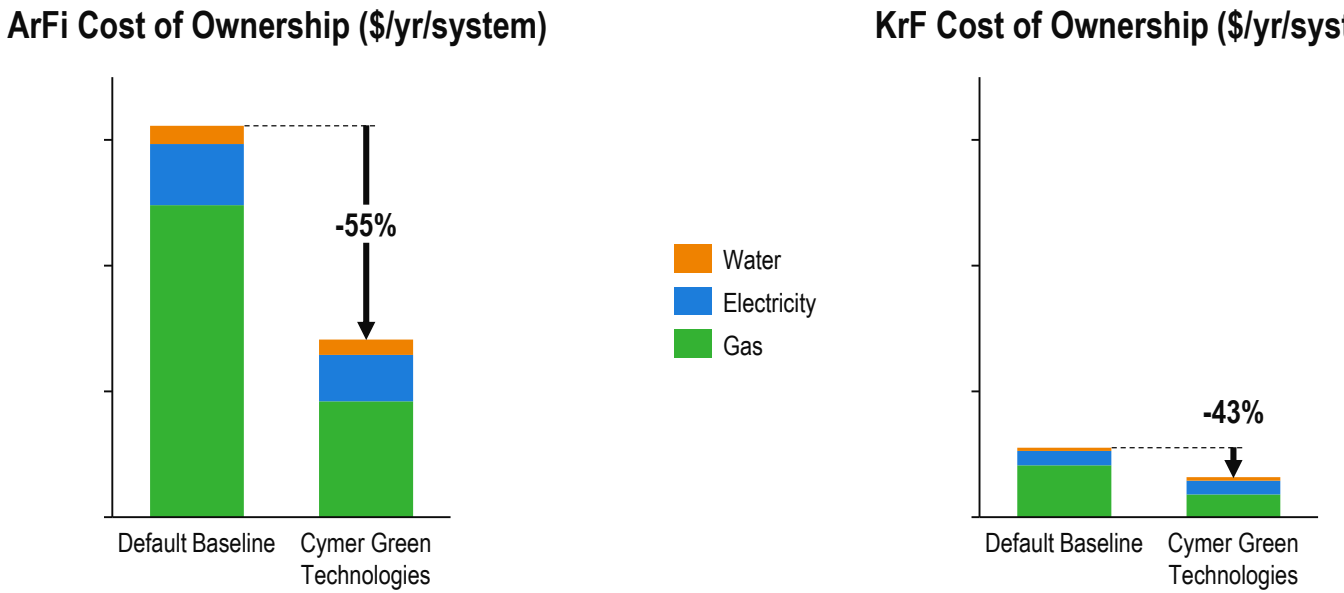
# Sustainability: Reduces Cost of Ownership




~55% reduction in **ArFi** facility CoO
~43% reduction in **KrF** facility CoO

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- Cymer is committed to reach net zero greenhouse gas emissions from product use by 2040
- Cymer is committed to reducing the chipmaker operating costs, environmental footprint, and business continuity risks by delivering sustainability solutions
- Cymer Technology Roadmap continues to meet and exceed Sustainability goals

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