Clean, dispatchable power with hydrogen combustion and thermophotovoltaics

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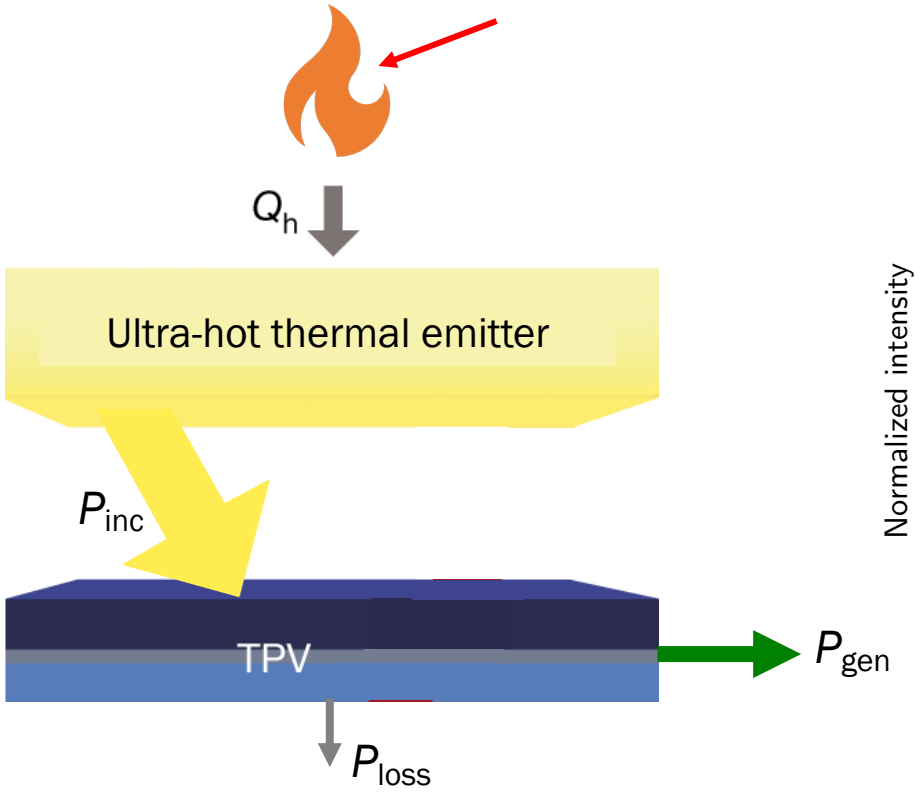
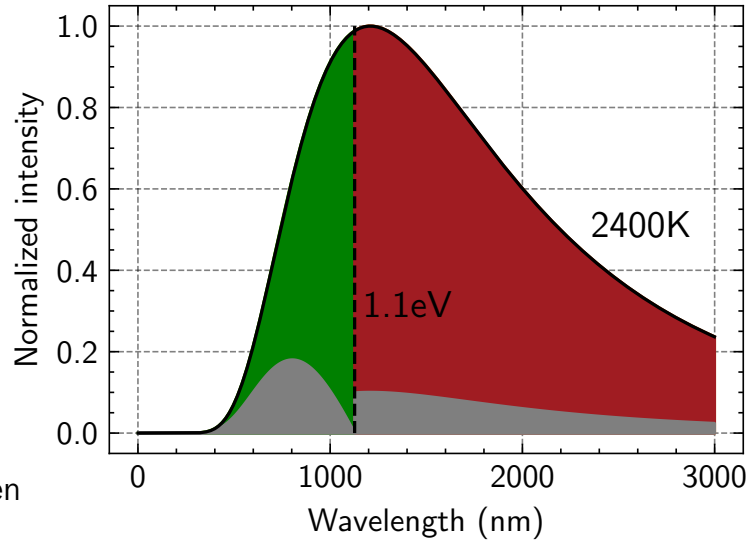
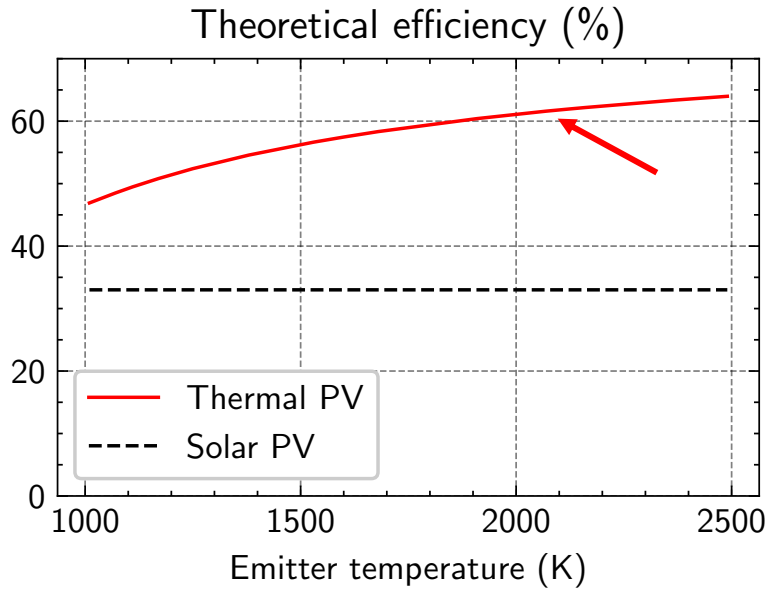
Solar panels are clean but not dispatchable

Clean	Emits CO_2
Solid state	Rotating machinery
Intermittent	Dispatchable

Thermophotovoltaics (TPV) has the best of both worlds



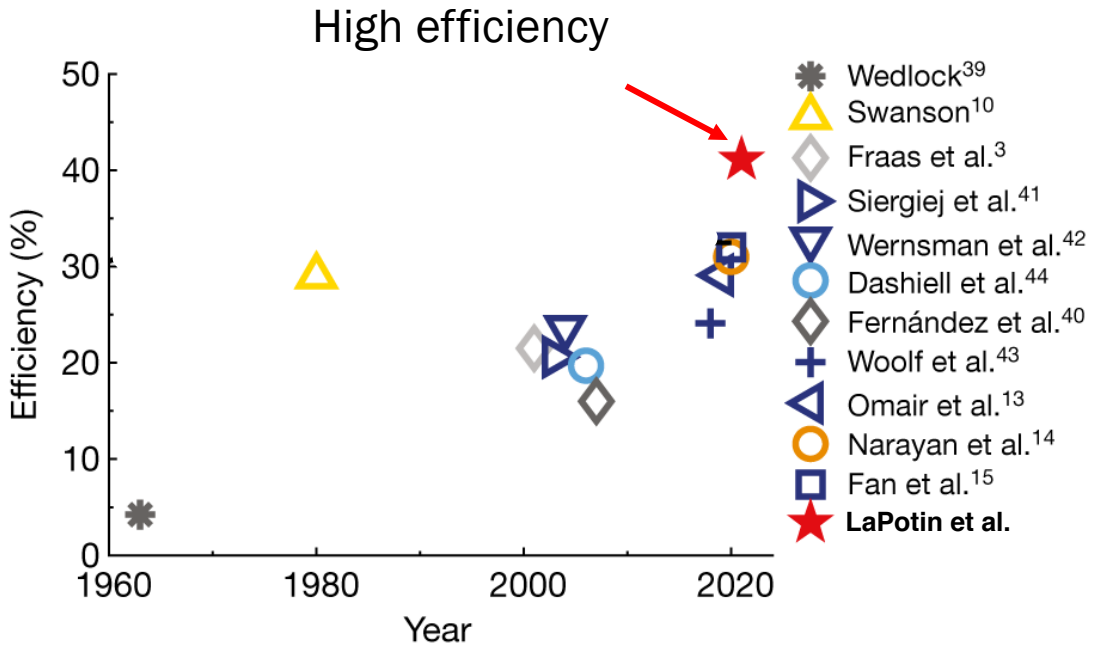




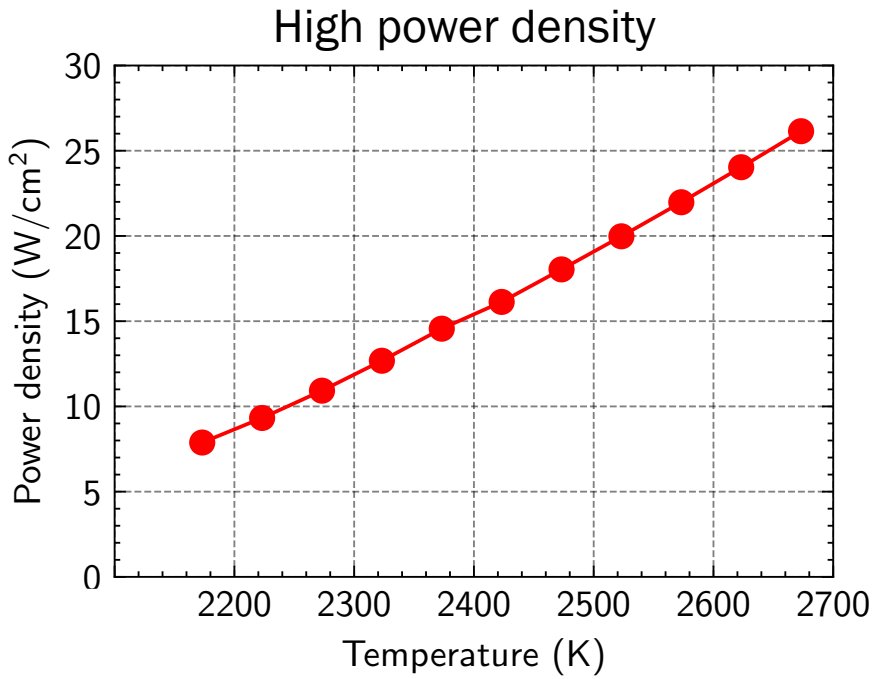
<u>2 Challenges</u>

1. How do you make efficient TPV cells?
2. How do you generate the heat source?

Our lab set the world record for TPV efficiency

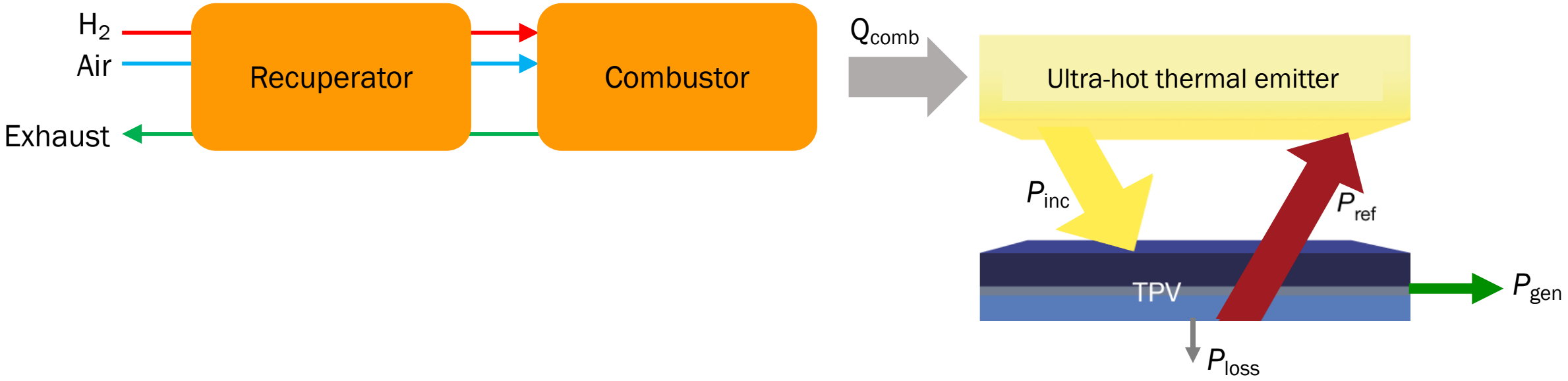


LaPotin et al. *Nature* (2022)

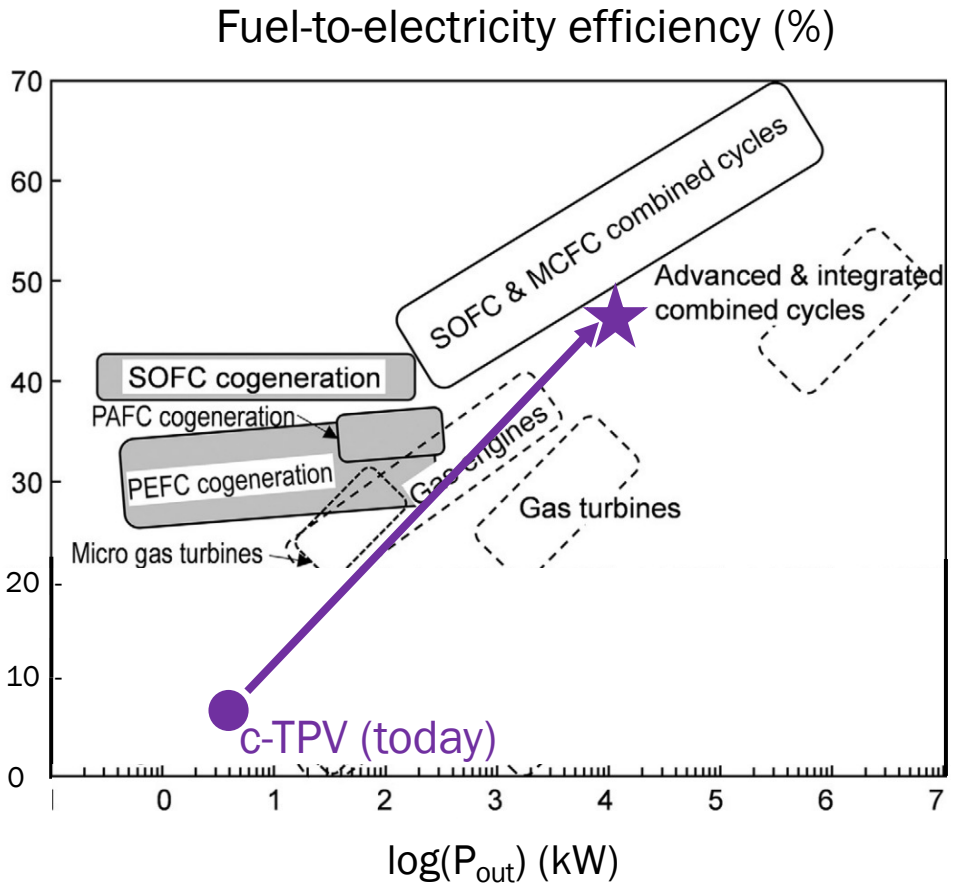


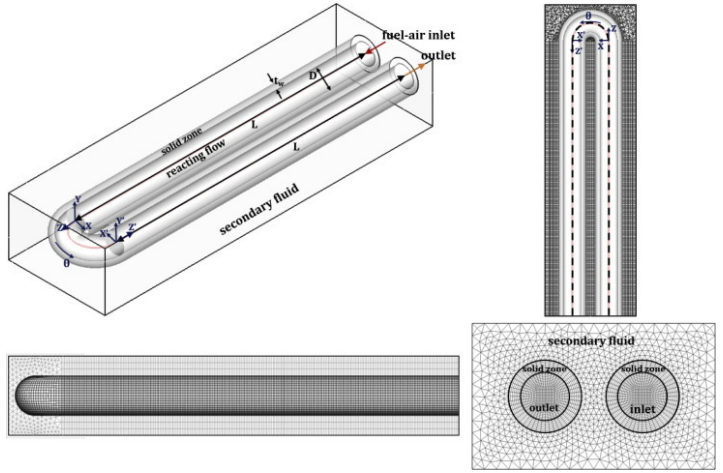
Challenge #1: Can we make high-efficiency TPV cells? ✓

Using hydrogen as the heat source provides clean power

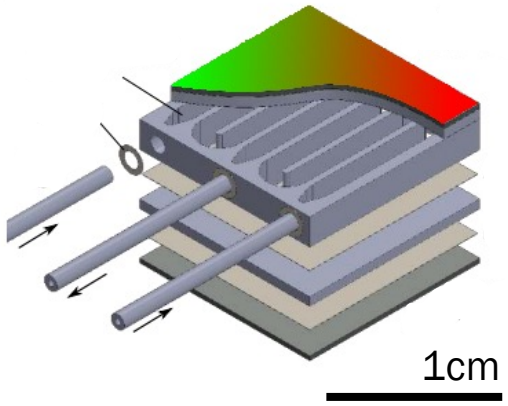


Existing c-TPV devices have low efficiency



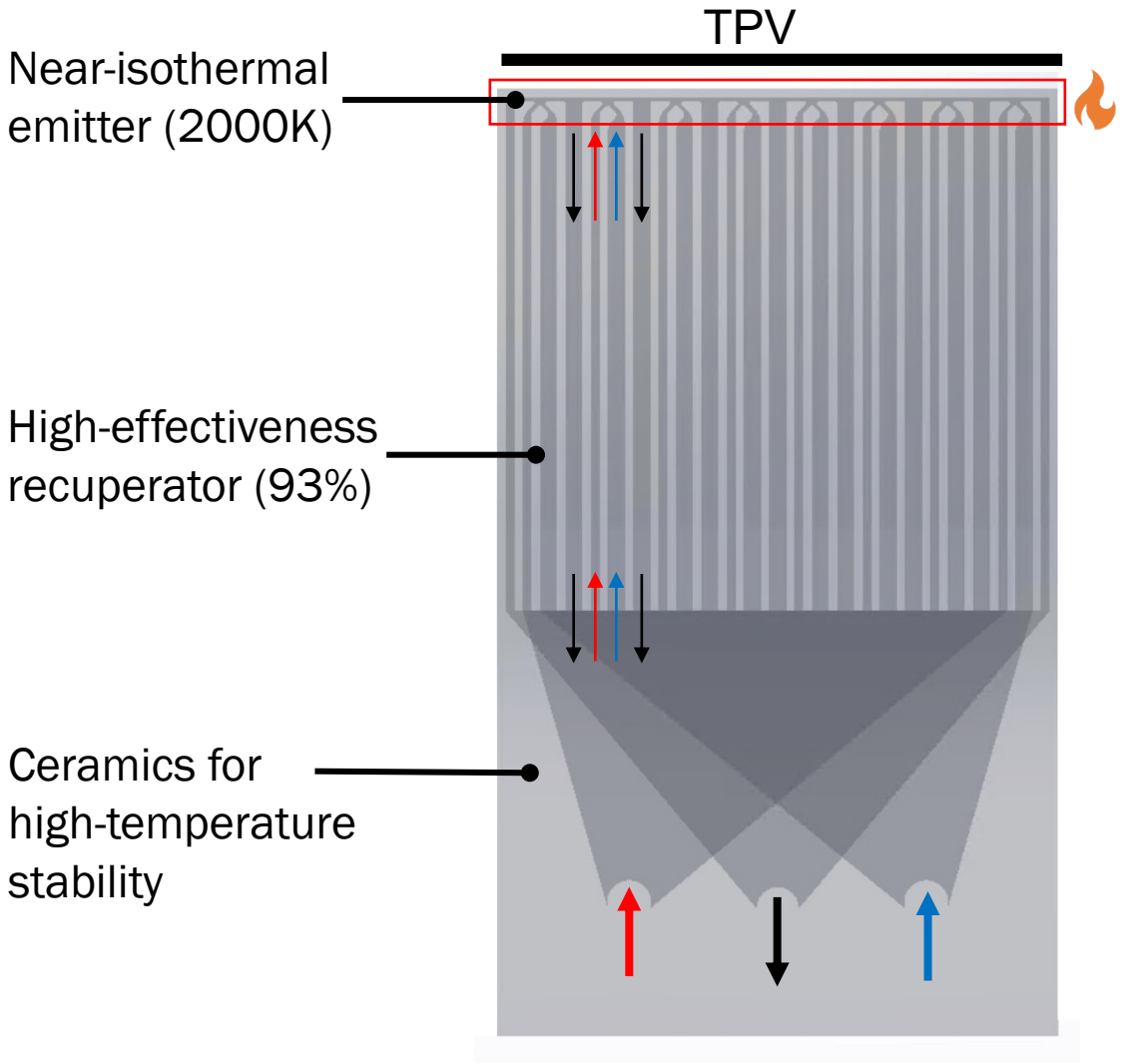


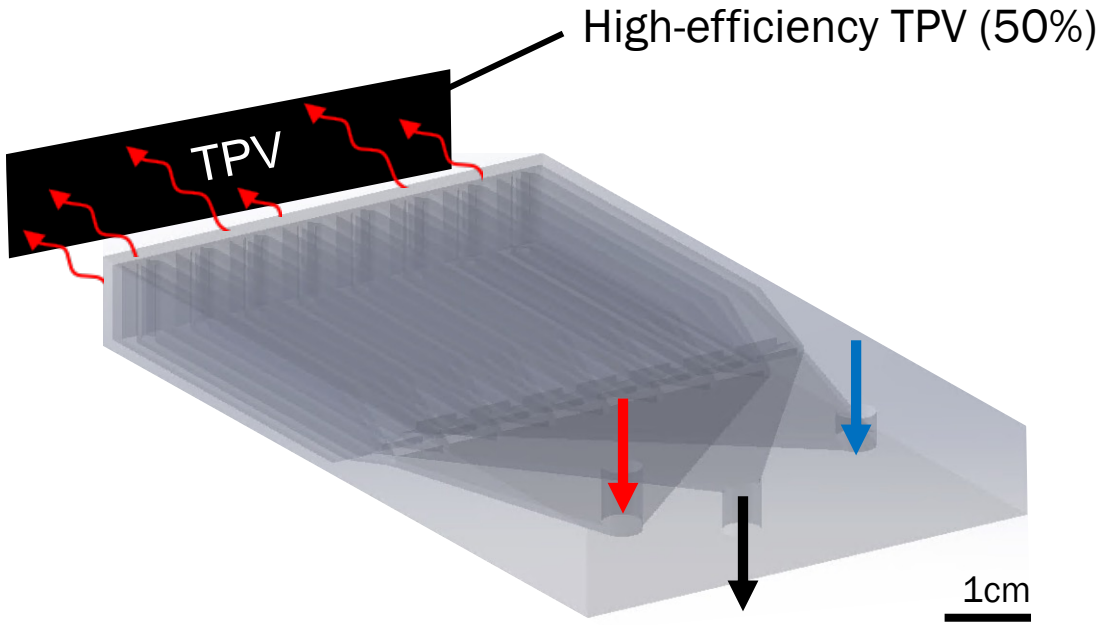
Poor recuperation
= low combustion efficiency



Small scales
= high heat loss

Novel combustor design to couple with TPV





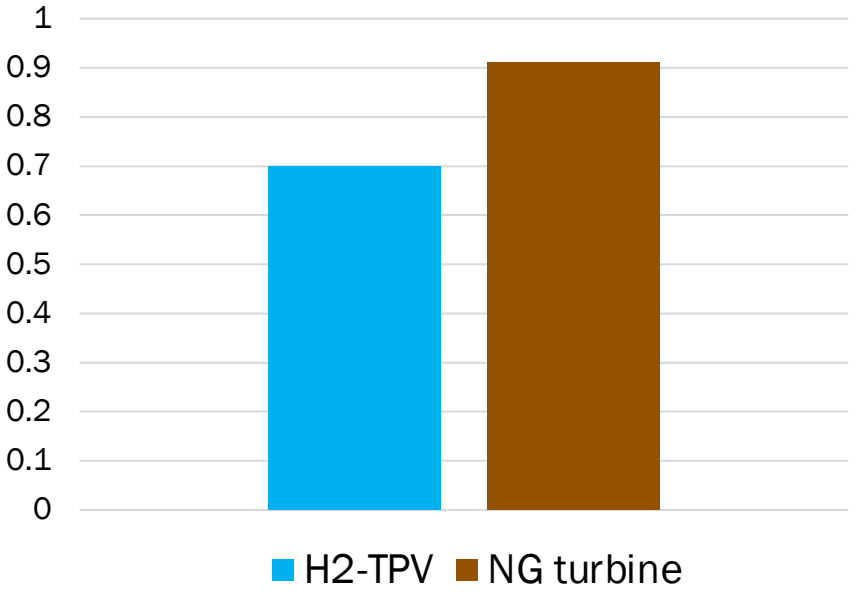
Fuel-to-electricity efficiency: ~47%

Modular design enables stacking to reach large length scales

Challenge #2: Can we design an efficient heat source? ✓

H_2-TPV is cost-competitive in several markets

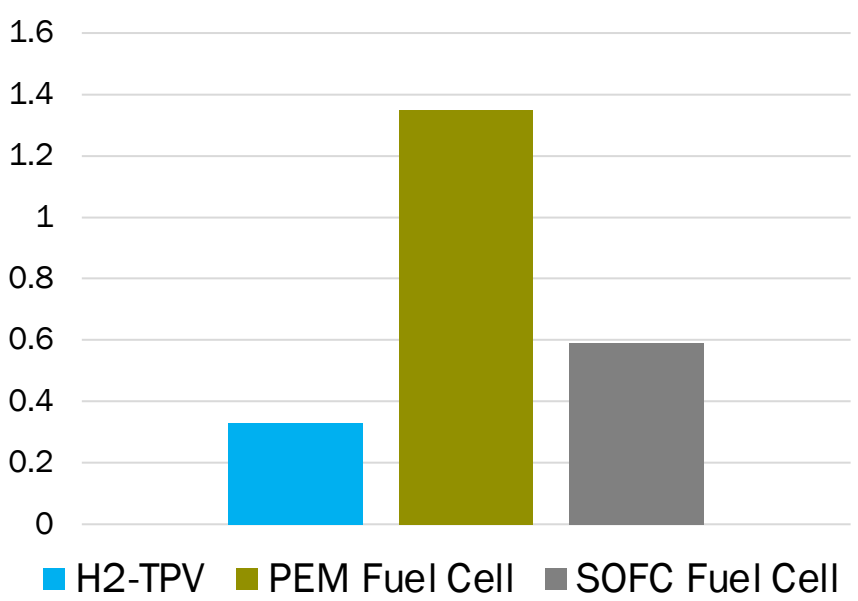
As a replacement for conventional power plants



~20% cheaper, with no CO_2 emissions

For long-duration energy storage

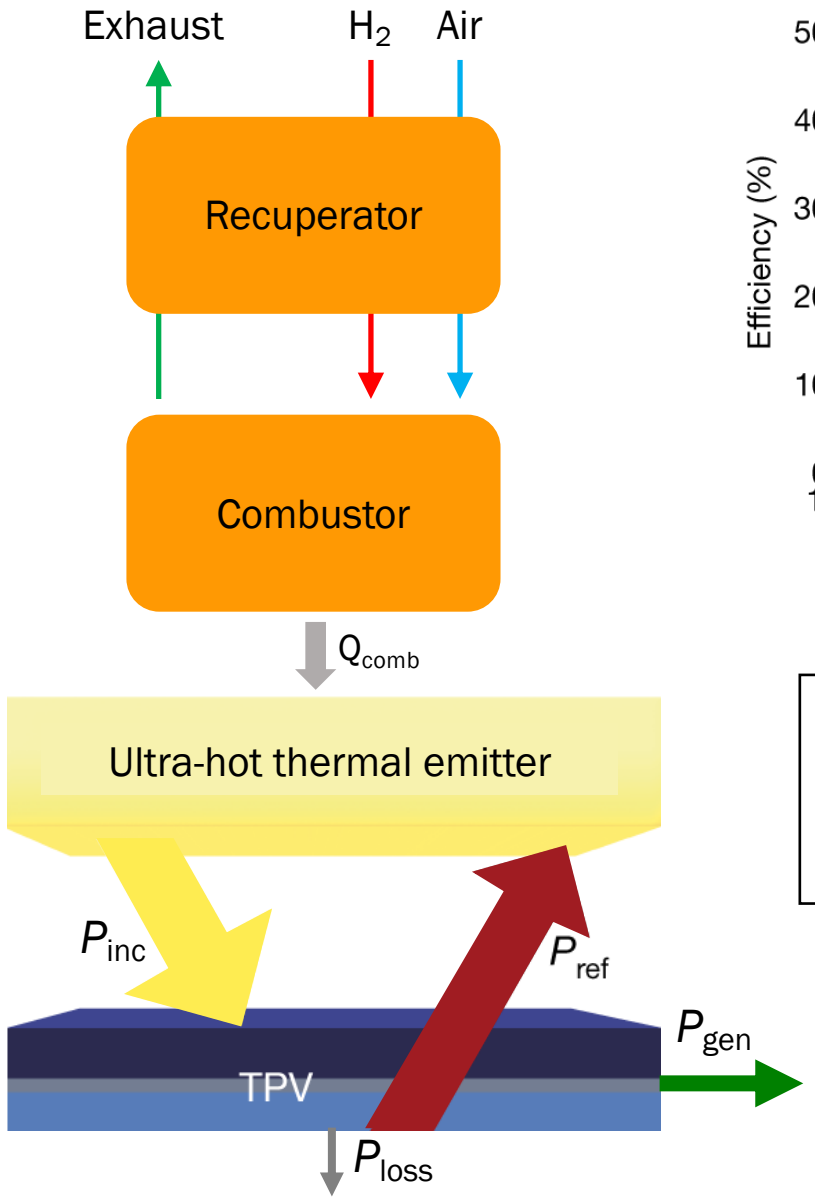
Excess electricity → Hydrogen → Electricity on demand

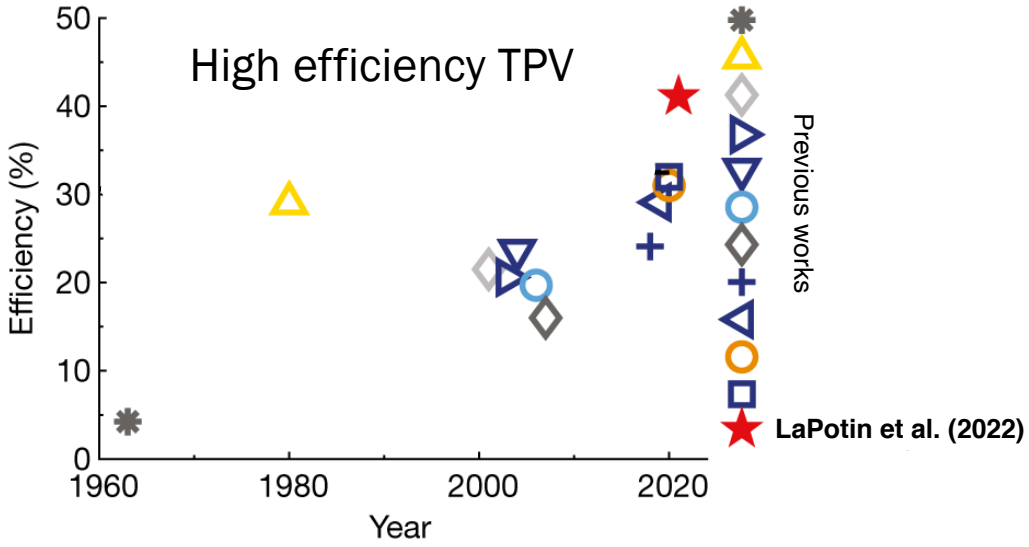


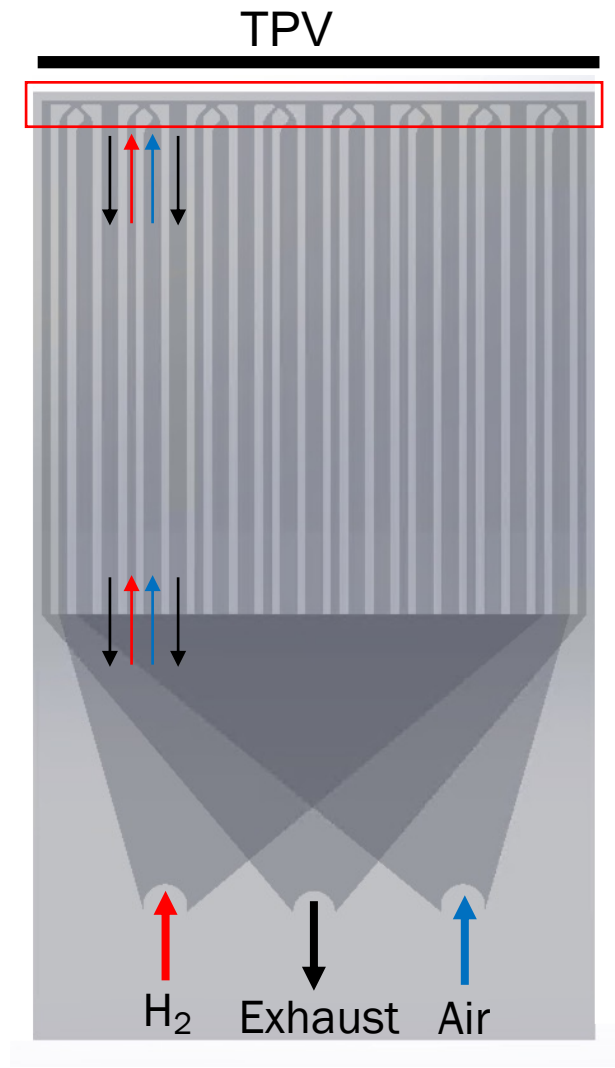
~50% cheaper than SOFC

NG Turbine | PEM Fuel Cell | SOFC Fuel Cell

Clean, dispatchable power with H_2-TPV







Key metrics

- 47% efficiency
- $0.33/W cost
- Dispatchable
- No moving parts

Thanks!

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