

TOPHAT[®] and SwirlFlash[®]

Technologies for advanced gas turbines
and
retrofit of gas turbines, gas engines and diesels

Alpha Power Systems

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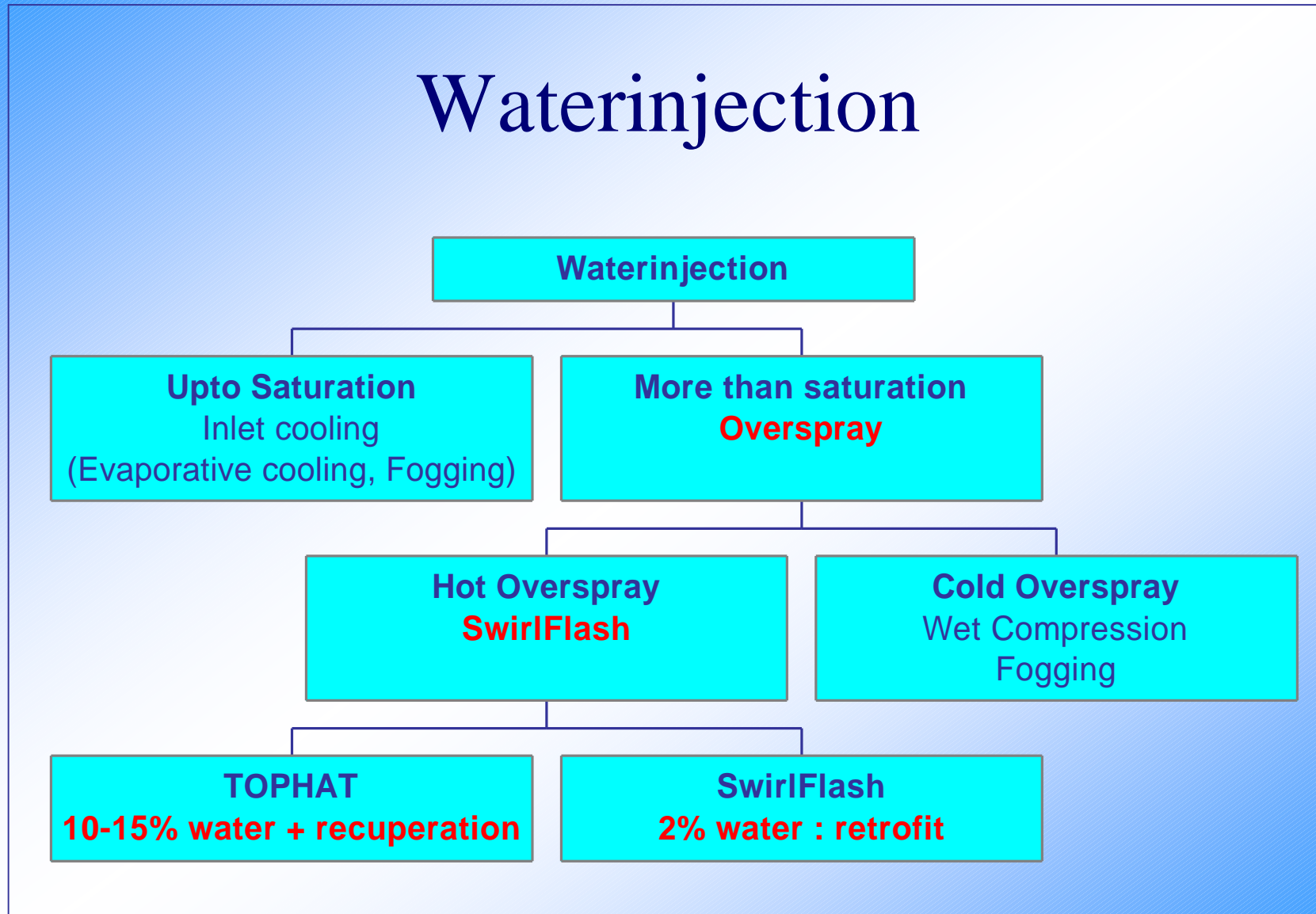
WEB: <http://www.alphapowersystems.nl>

Alpha Power Systems

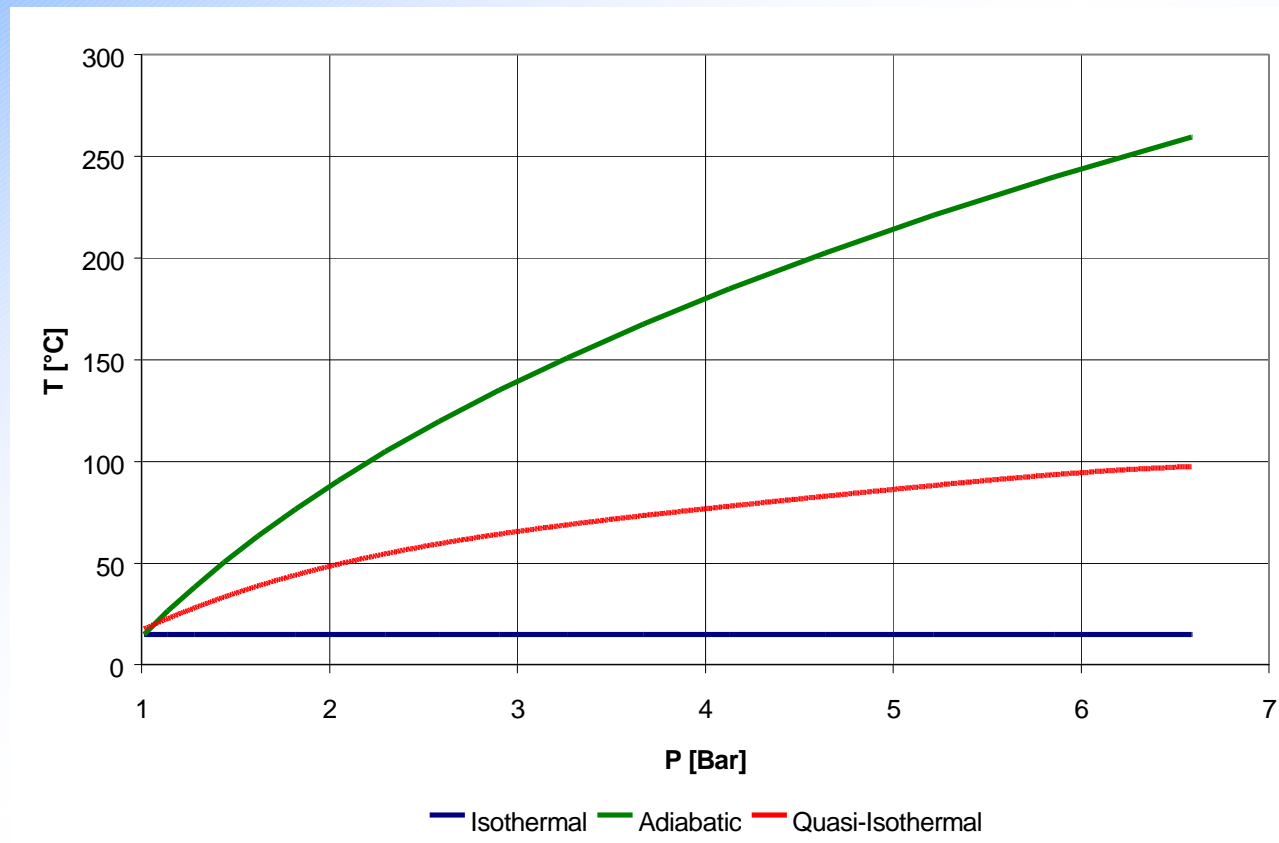
- **Founded in 2000 to commercialize TOPHAT® and SwirlFlash® development of KEMA**
- **Independent entity**
- **Shareholders:**

KEMA	1/3
TNO	1/3
Management	1/3
- **Worldwide exclusive rights to KEMA patents**
- **R&D, design, modelling contracts with KEMA**
- **Main focus: marketing / sales, business development, projectmanagement**

Waterinjection

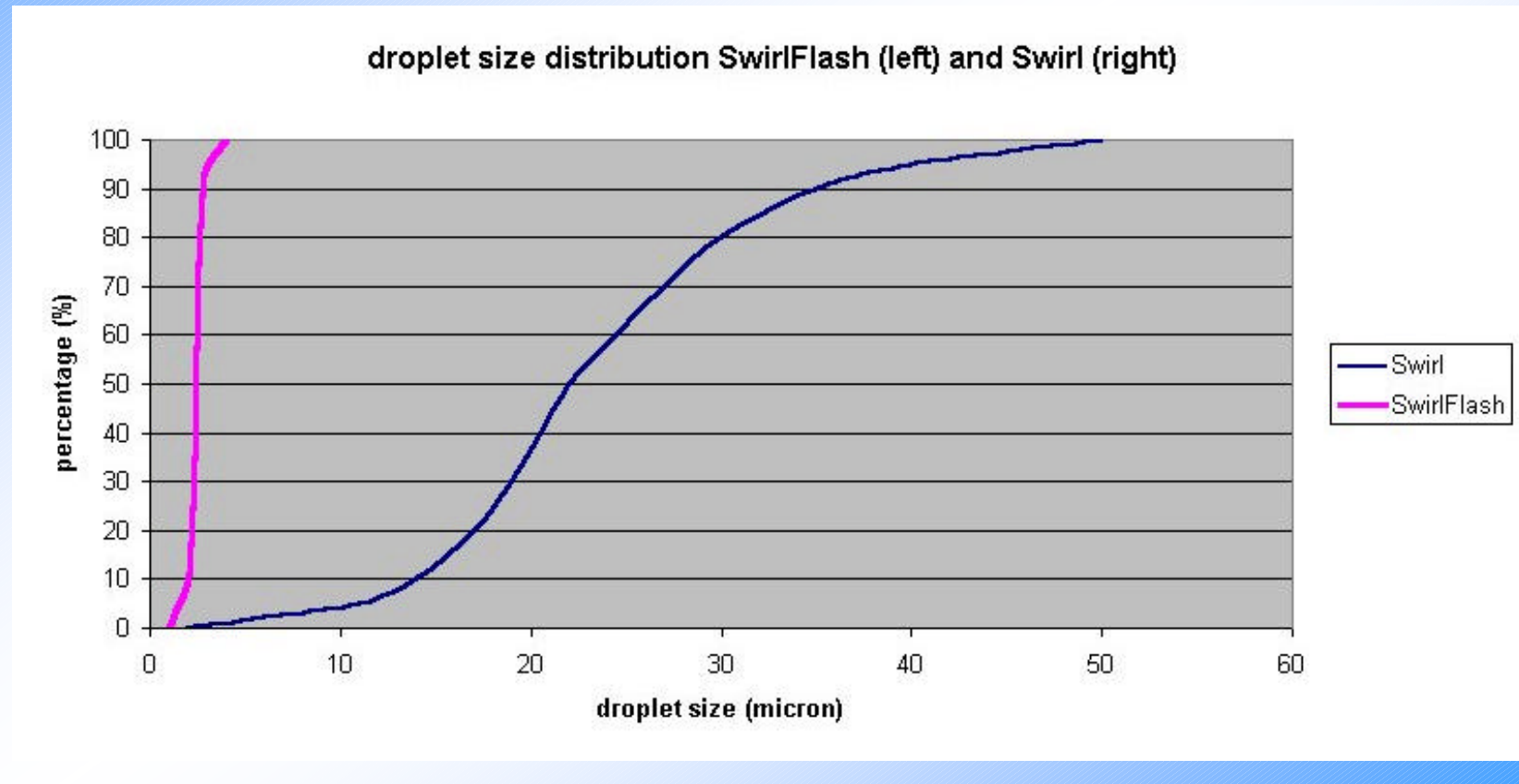


Compression Processes

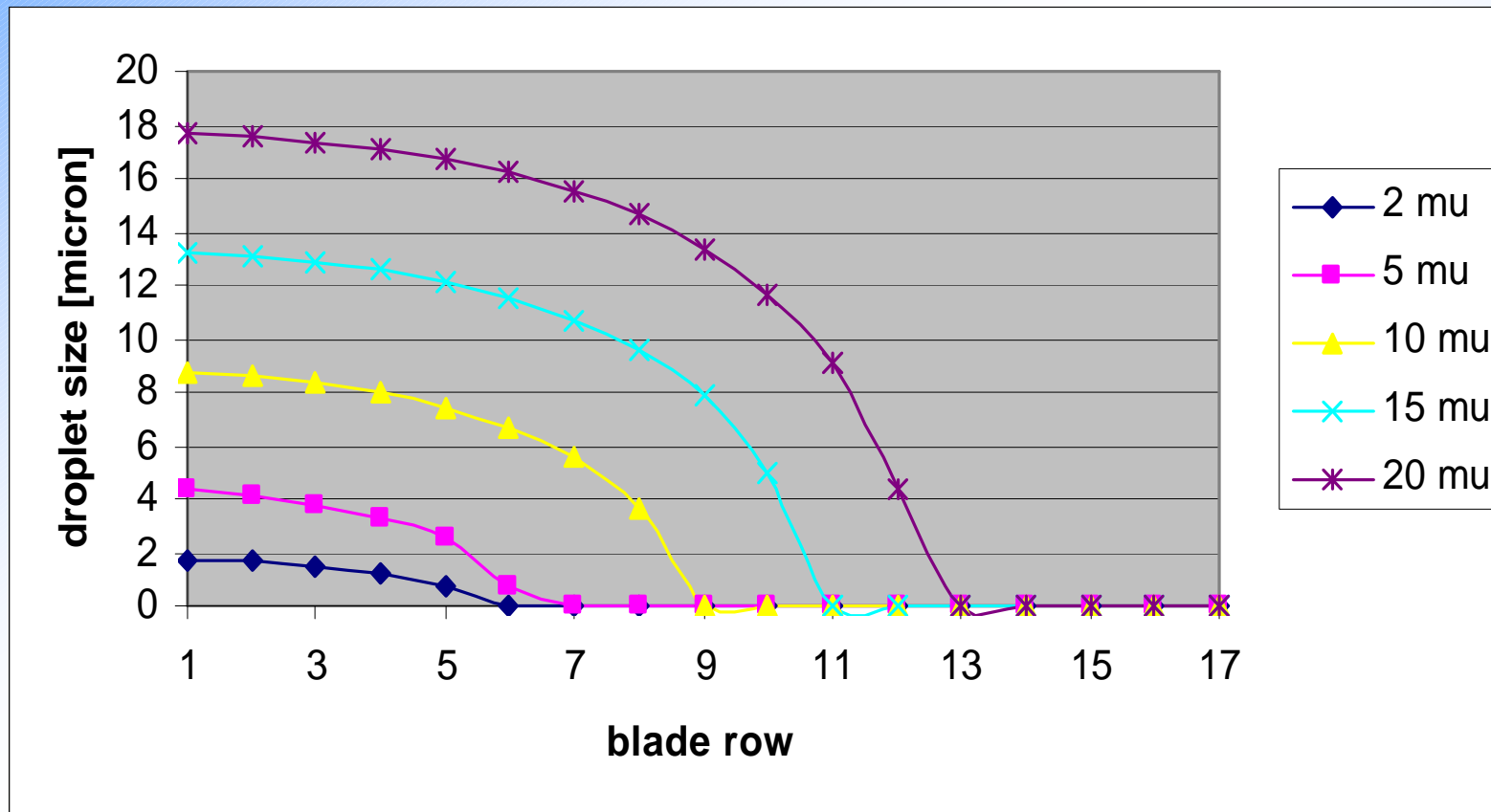


Droplet size distribution

SwirlFlash (left) Swirl (right)



Evaporation kinetics



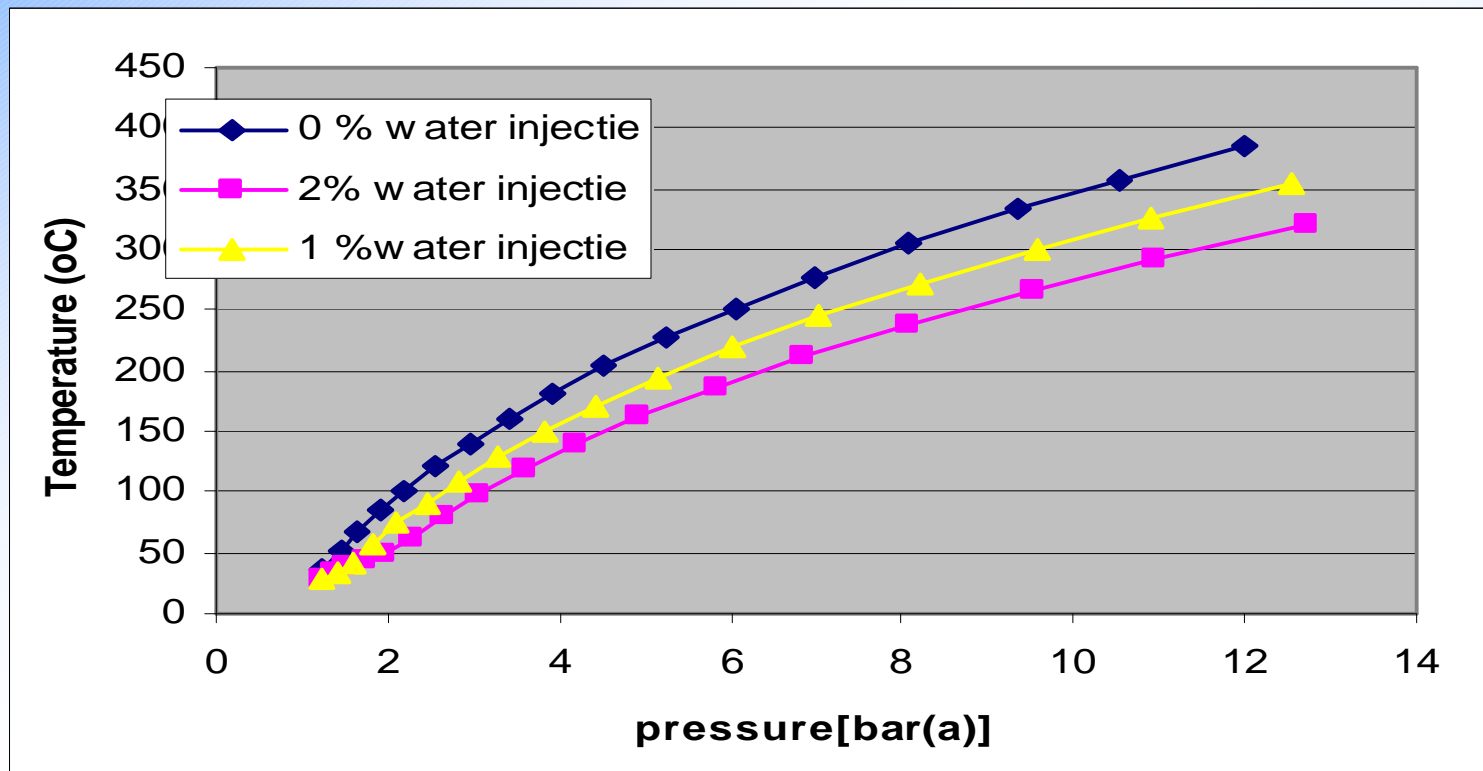
Droplet size

Small droplets $< 5\mu$ are the key item for overspray systems for reasons of:

- Fast evaporation
- Minimize erosion risk

Compression

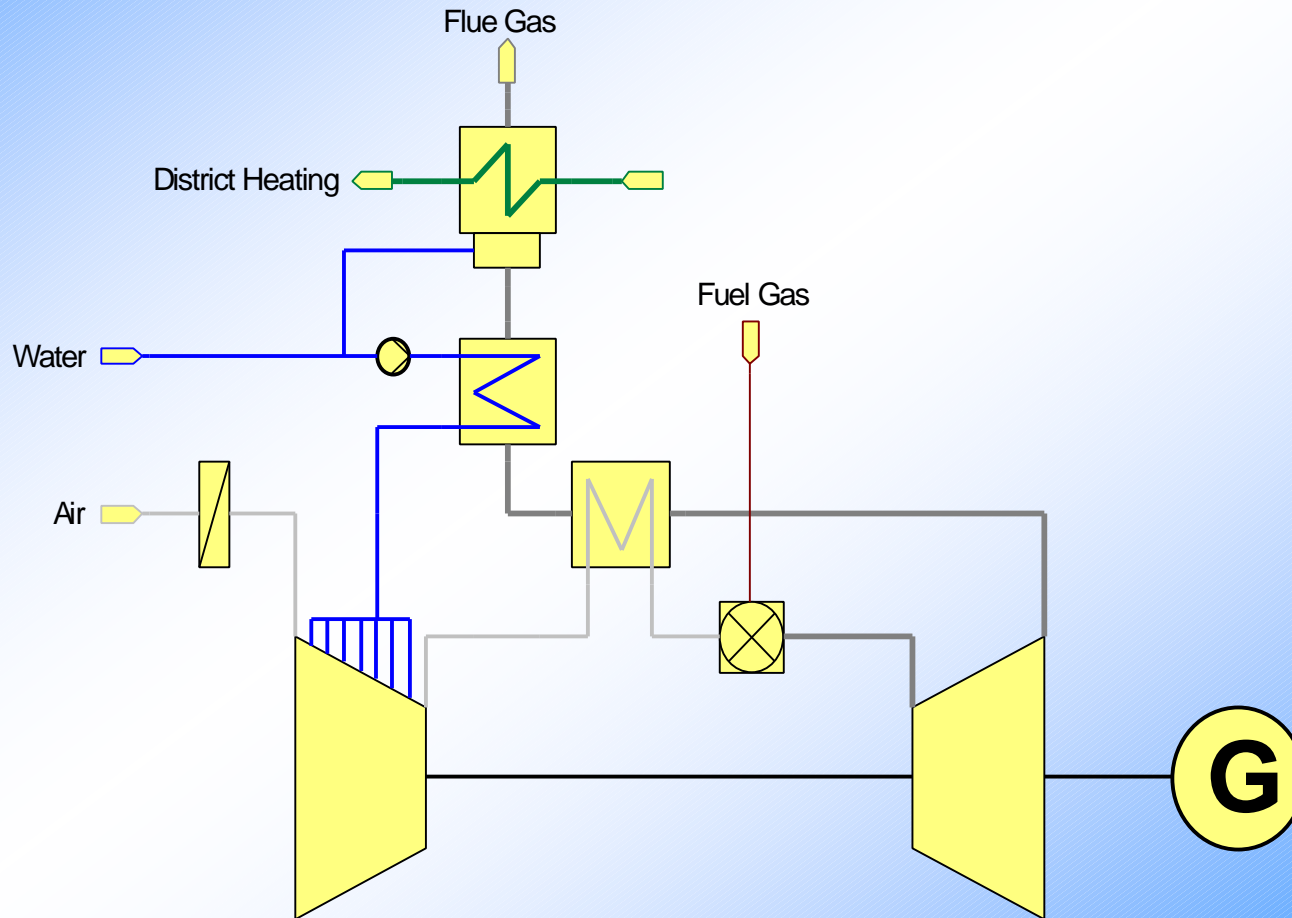
0%, 1% and 2% water



2% SwirlFlash project Amer 8

- 30 MW ABB type GT9
- Installation May 2001
- 43% NO_x reduction
10% Power increase
1,3% Efficiency improvement
- Senter supported Netto-project
- 1 year monitoring program

TOPHAT-Cycle



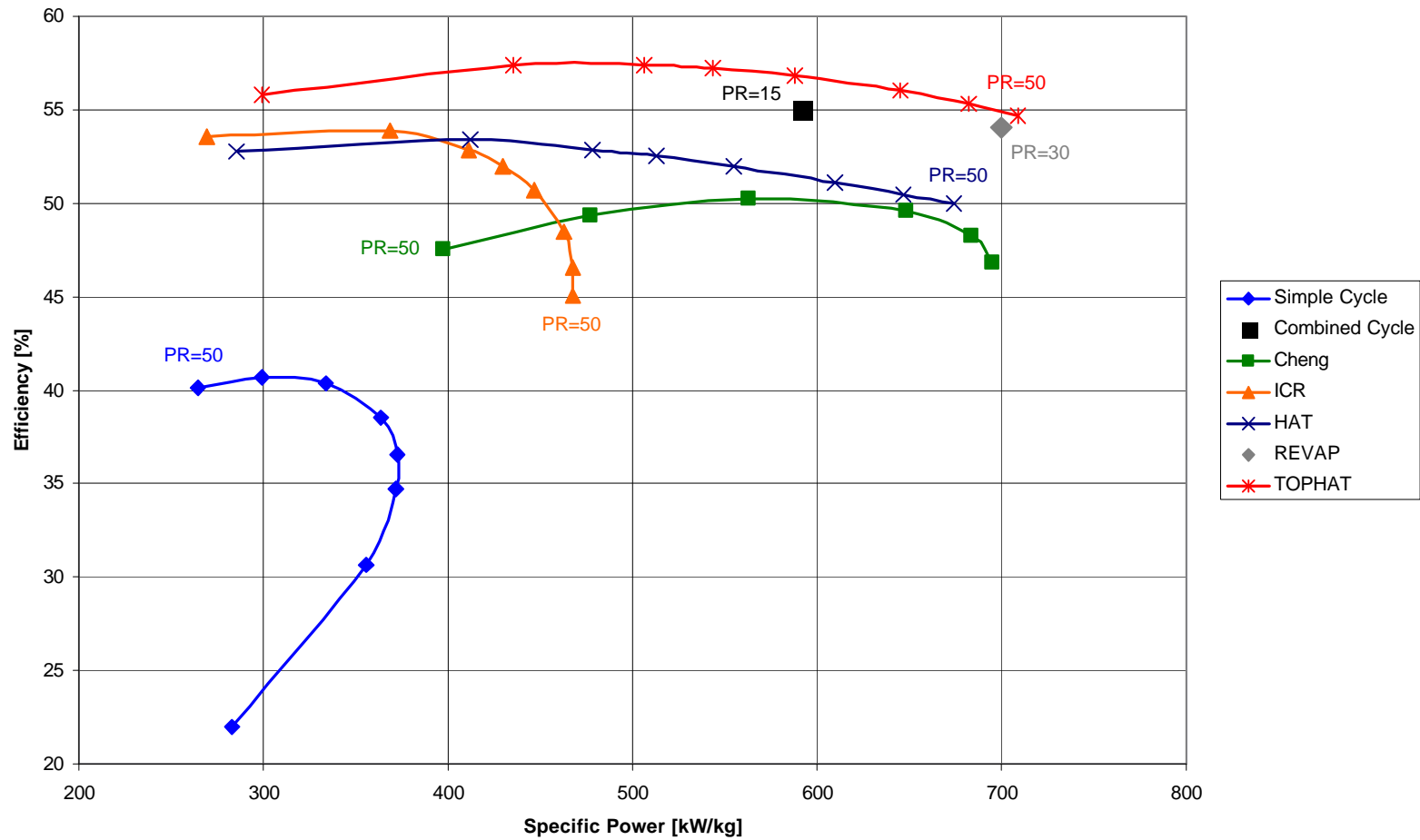
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CAME-GT

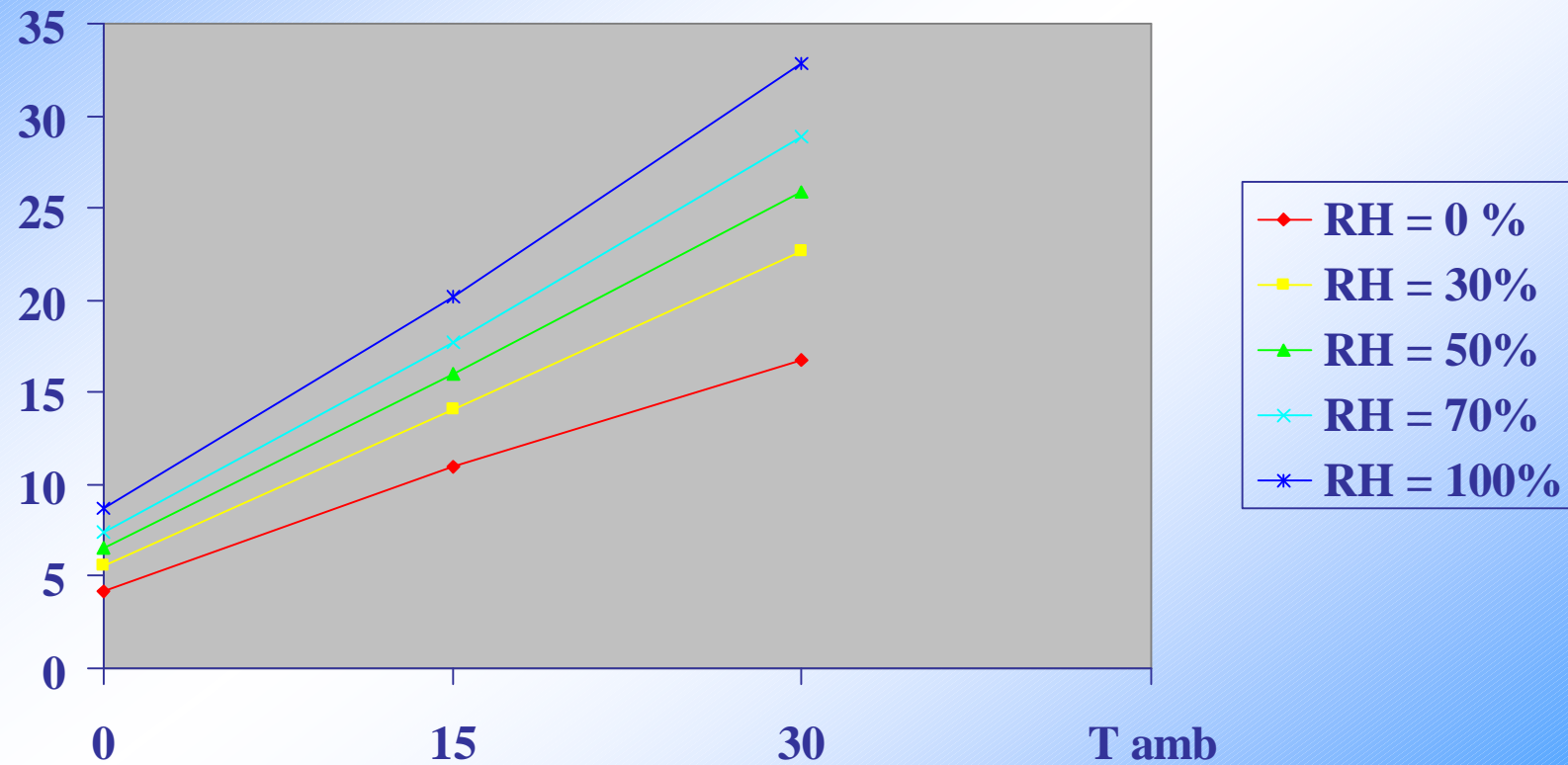
Next steps towards TOPHAT

- Increase water quantity
- Combination with recuperation
- Interstage injection
- Use of low value heat
- Recovery of water

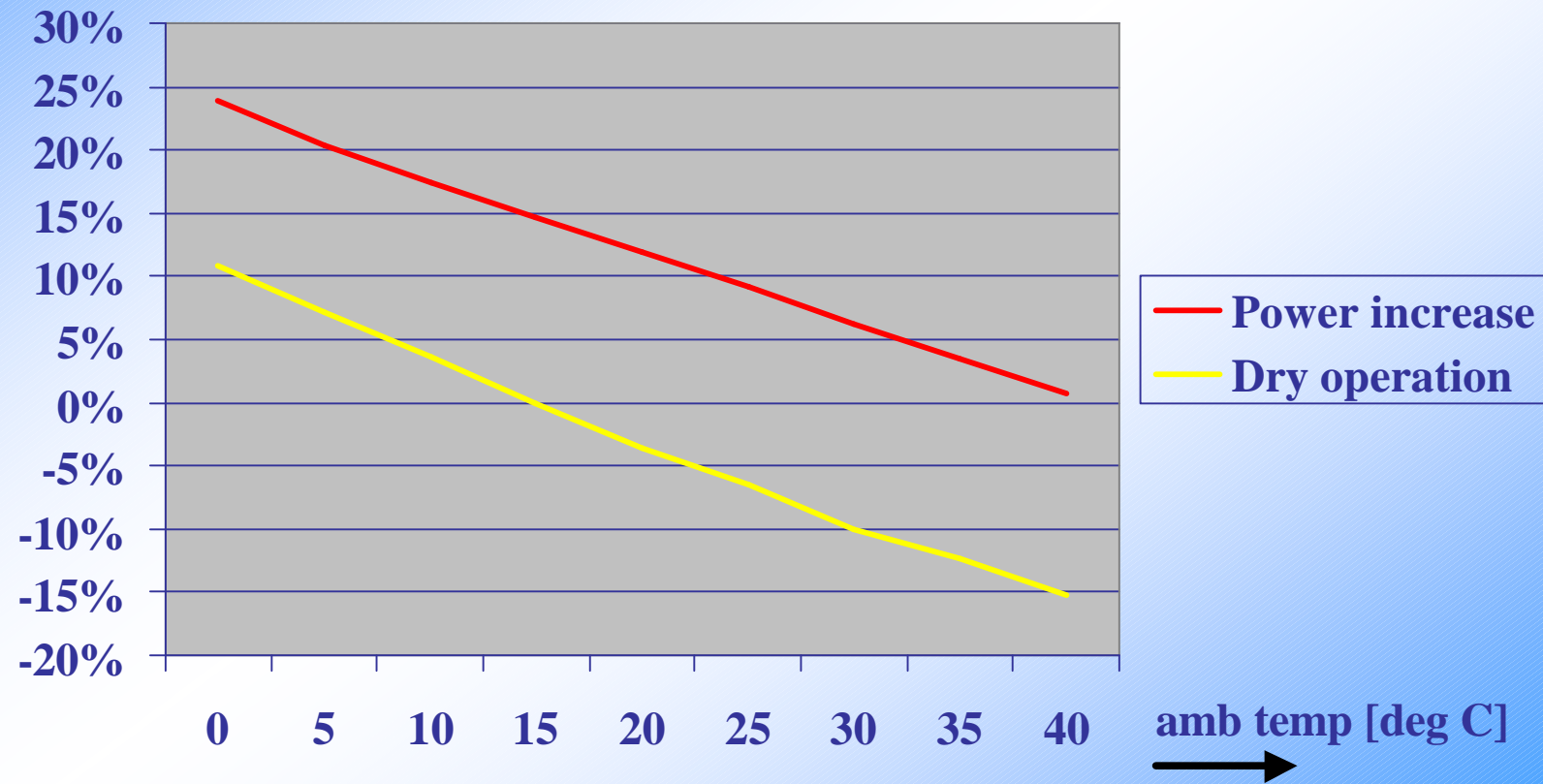
Process Benchmark



$T_{\text{compr. inl.}}$ (water: 2% at 200°C)



Effect SwirlFlash 0°C- 40°C



Conventional spray vs SwirlFlash

	Swirl	SwirlFlash
Pressure	high	high
Temperature	low	high
Mean diam.	20? - 30?	2? - 3?
Weight	1000 x	1 x
Aerosolic	no	yes
Residence time	long	short
Ambient temp	> 12 C	> 0 C