

HOW TO GAIN MAXIMUM EFFICIENCY IN PLUG-IN CABINETS BY USING NATURAL REFRIGERANTS

Drew Martin
Sales Representative of Secop Inc. USA



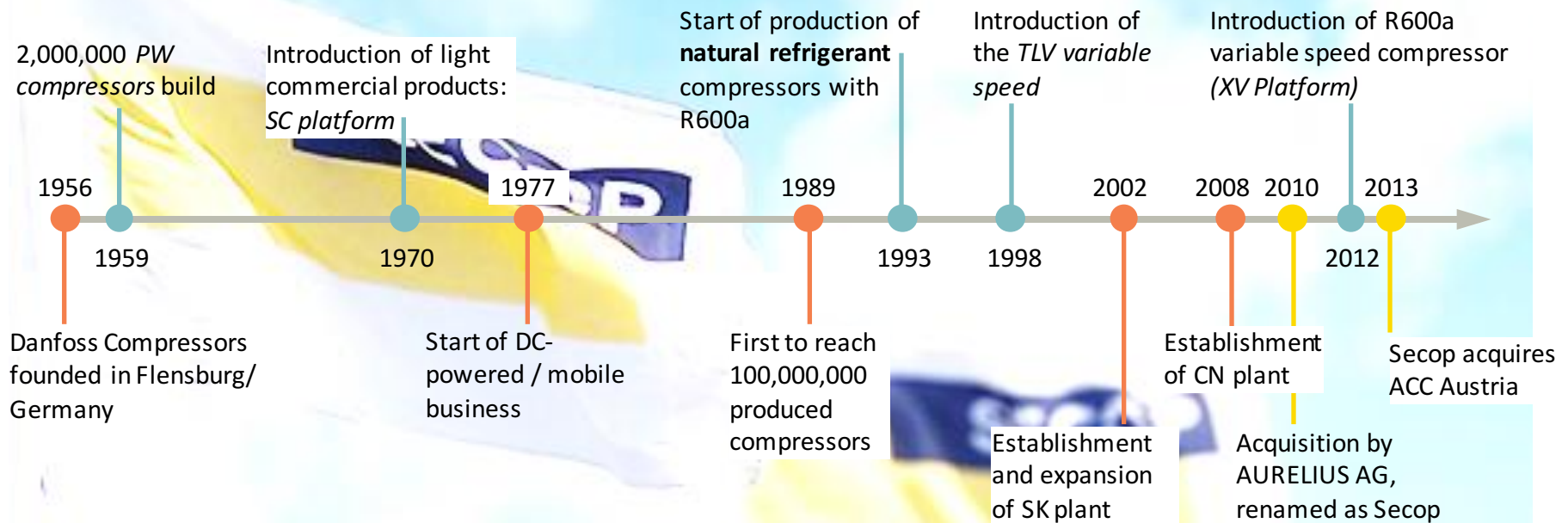
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25 & 26 June 2015 – Atlanta, Georgia

SETTING THE STANDARD

Companie's History

Product/market landmarks



Corporate milestones

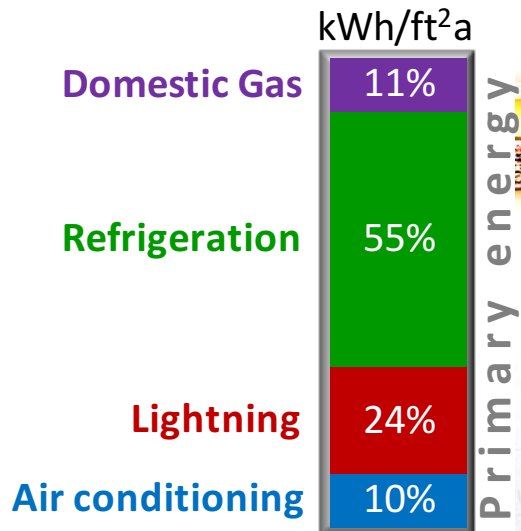
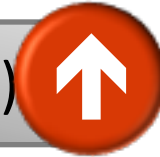
Project overview



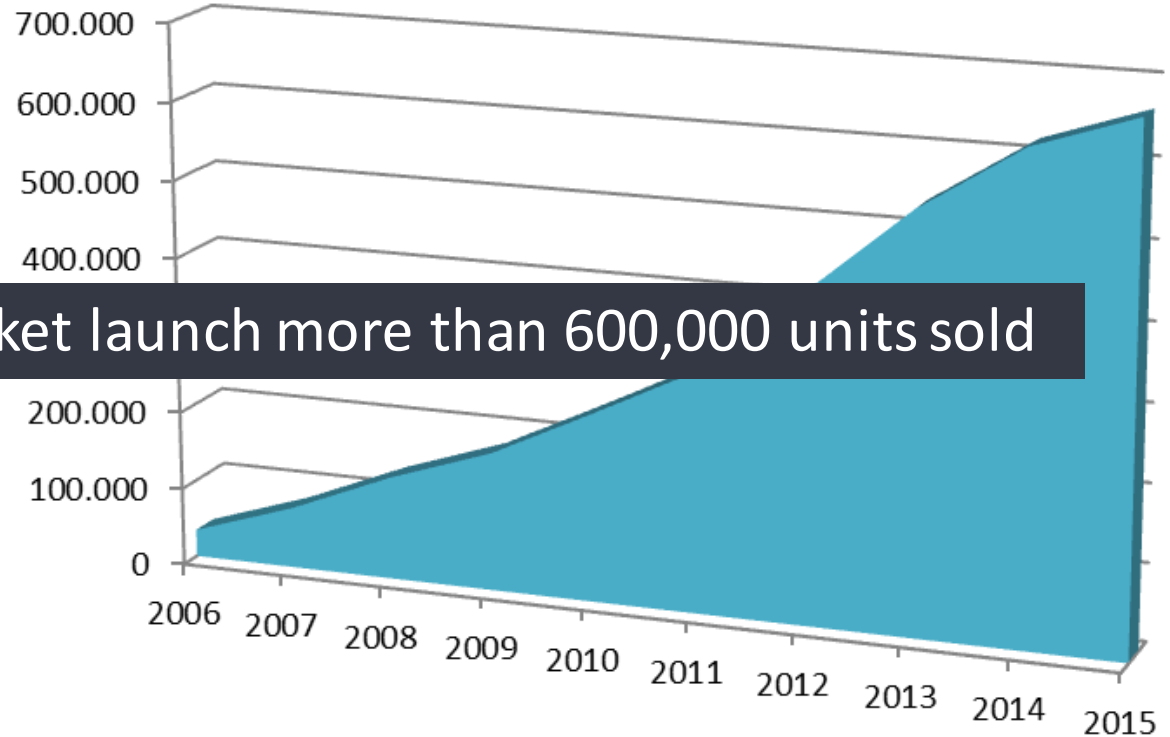
Gross Profit



OpEx (e.g. Energy)



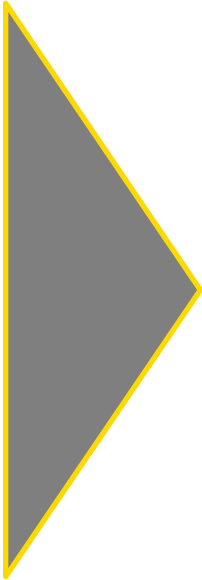
Cumulative market



10 years after market launch more than 600,000 units sold

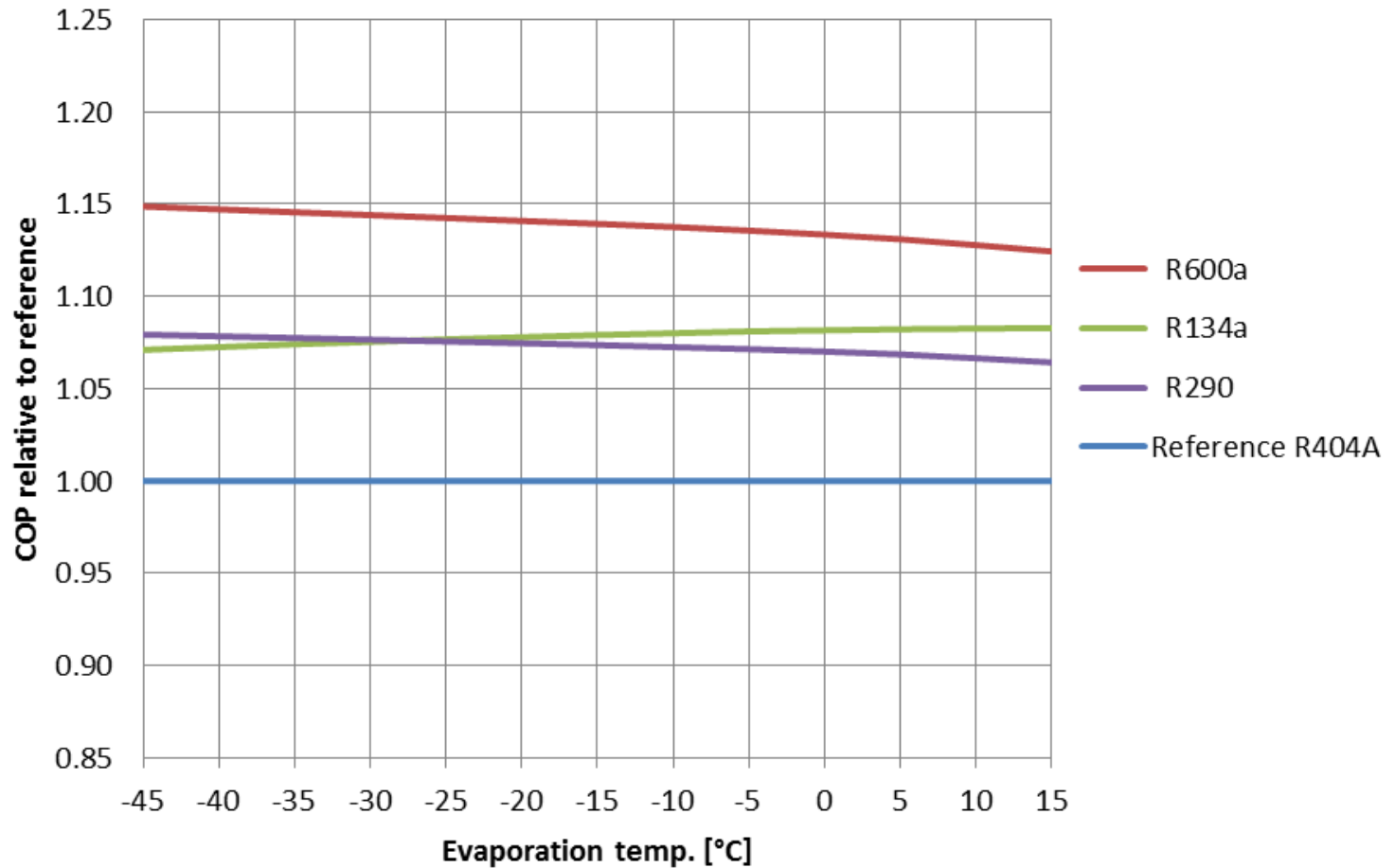
Discounter	Outlets Germany	Outlets World
Total	15,067	29,362

Project overview

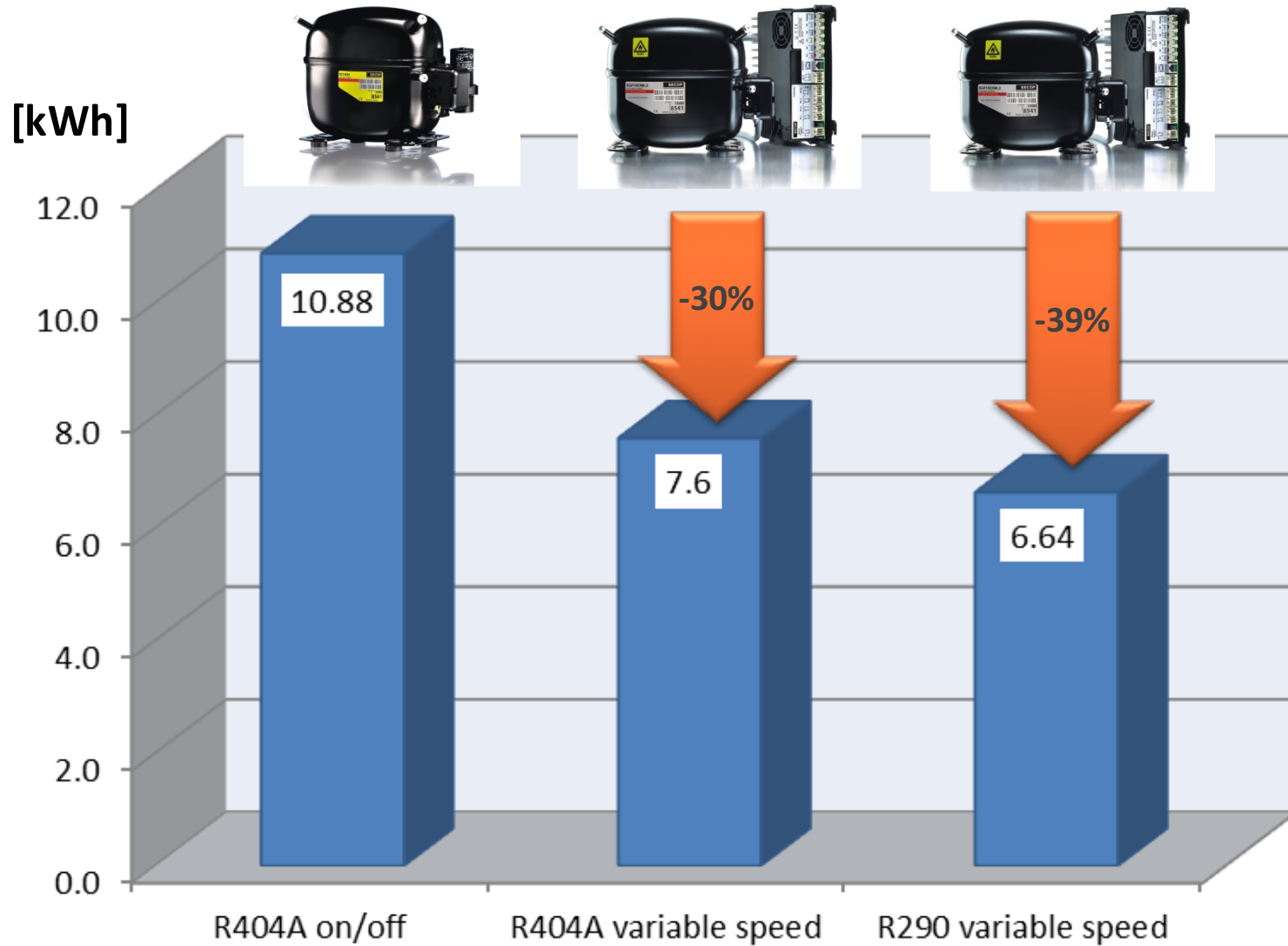
Cabinet spec	old		new
Capacity	33 cu.ft. (1,130 L)		33 cu.ft. (1,130 L)
lightning	Filament lamp		LED
HACCP compliance	w/o		Integrated logging
Remote Monitoring	w/o		Modbus protocol
Fan	Shaded-pole		EC motors
refrigerant	R404A		R290
Compressor	on/off		variable speed

Why R290?

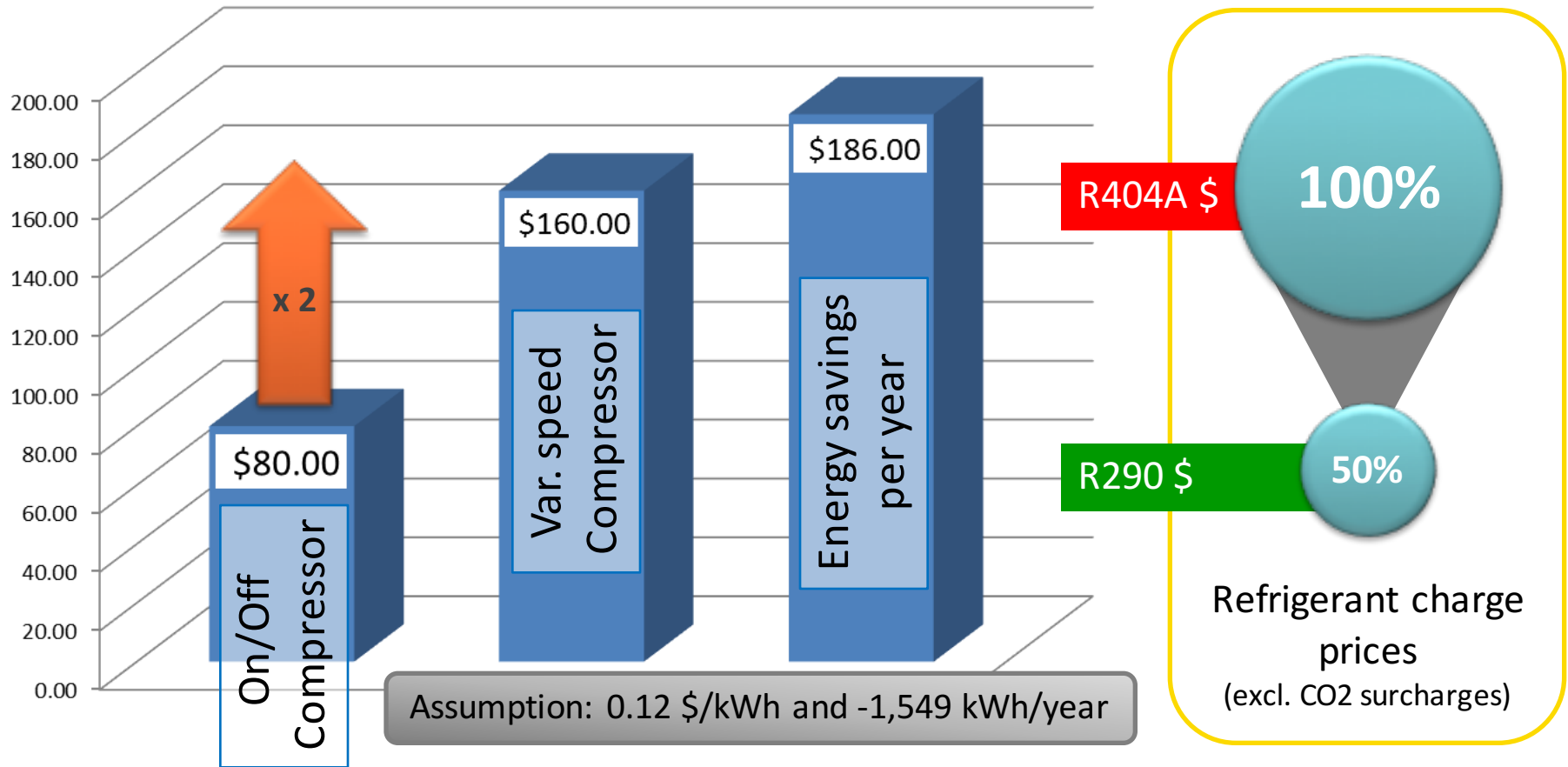
Relative (Rankine) COP of various refrigerants
 at $T_c=45^\circ\text{C}$, no subcooling, $T_{suc}=32^\circ\text{C}$



Efficiency Analysis



Cost Analysis



Barriers and Solutions

Appliance

- Adding electronics/complexity
- Re-design to get max efficiency
- Design for R290/flammable refrigerants
- Cost

Barriers

Facility

- Production lines cannot handle flammable refrigerants
- Safety concerns

Service

- No trained maintenance personnel

Solutions

- Get external support
- Inform about design requirements
- Evaluate what value variable speeds can add
- Savings possible by integration?

- New filling stations
- Safety measures e.g. gas-detection
- Emergency ventilation

- Get staff trained on flammable refrigerants
- Introduced adequate tools

Future plans

Today:

- Solution is well accepted in particular segments e.g. Food retail

Future:

- Market penetration of household will swap to light commercial segment
- Prices for inverter electronic will decrease further
- Inverter technology will be adopted in to two dimensions: capacity demand and integrated functions
 - Capacity demand: from counter tops to three door cabinets – freezing and cooling
 - Functions: from compressor control to system control
- 3rd generation of variable speed compressors with +30% efficiency are under development

SECOP

THANK YOU



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Drew Martin
a.martin@secop.com
678 323 1982

4000 Northfield Way
Suite 600
30076 Roswell, Georgia

www.secop.com

