



Innovation in Refrigeration

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What is innovation?

Ernest Gundling



New Business



**Changing
the base**



Line extension

the combination of new
ideas with action or
implementation which
results in an
improvement, gain or
profit

***Note: the “improvement”
might not be financial***

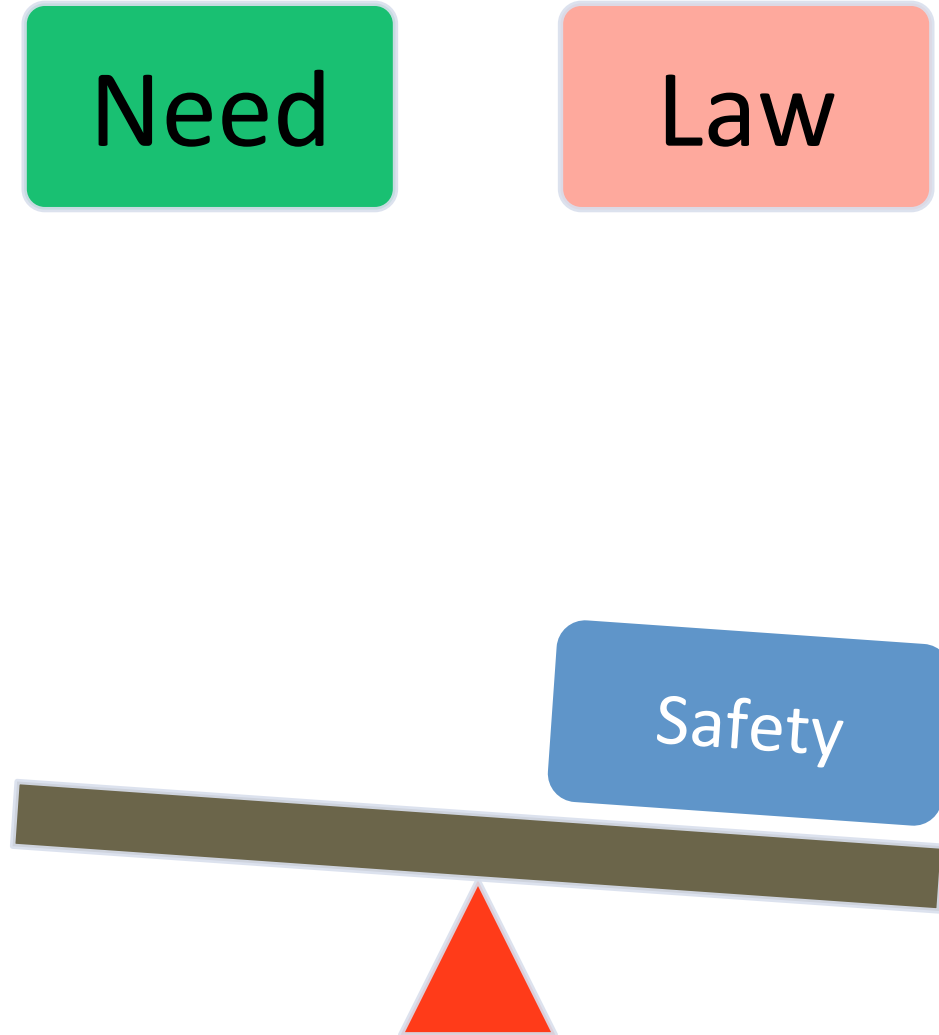
What drives innovation

Necessity is the mother of invention

Need

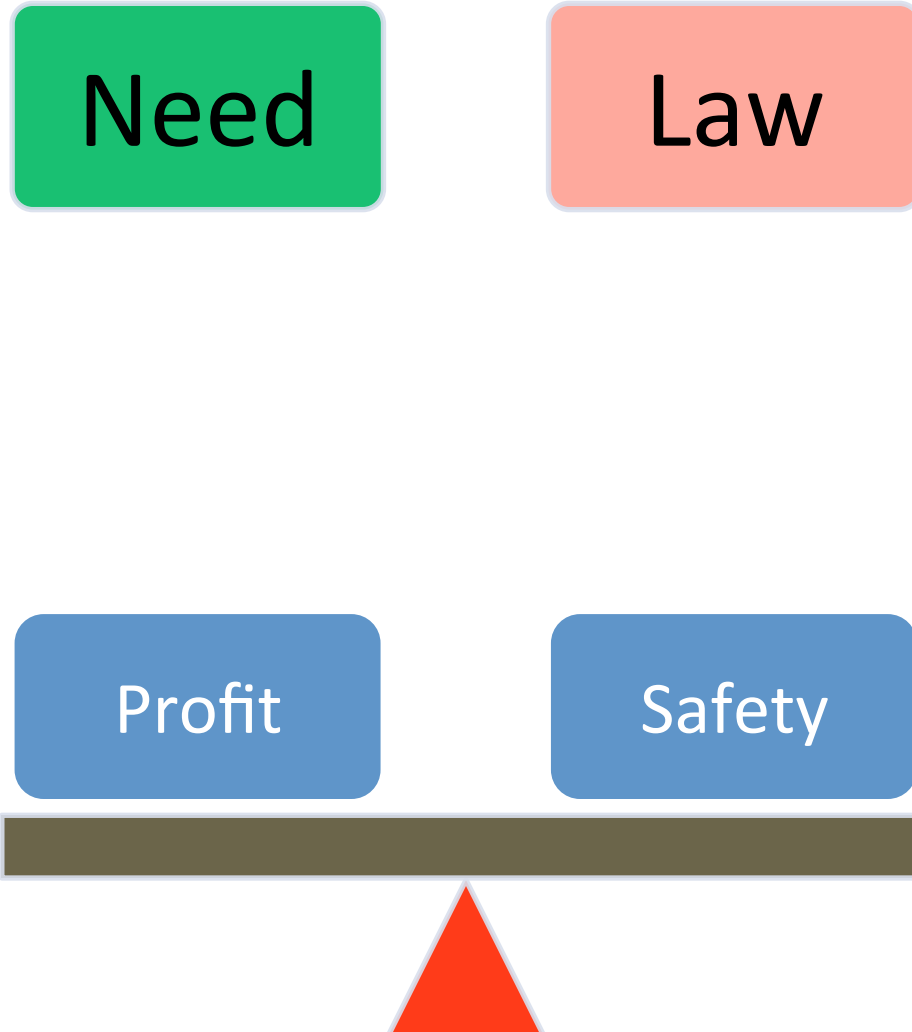
Law

Safety



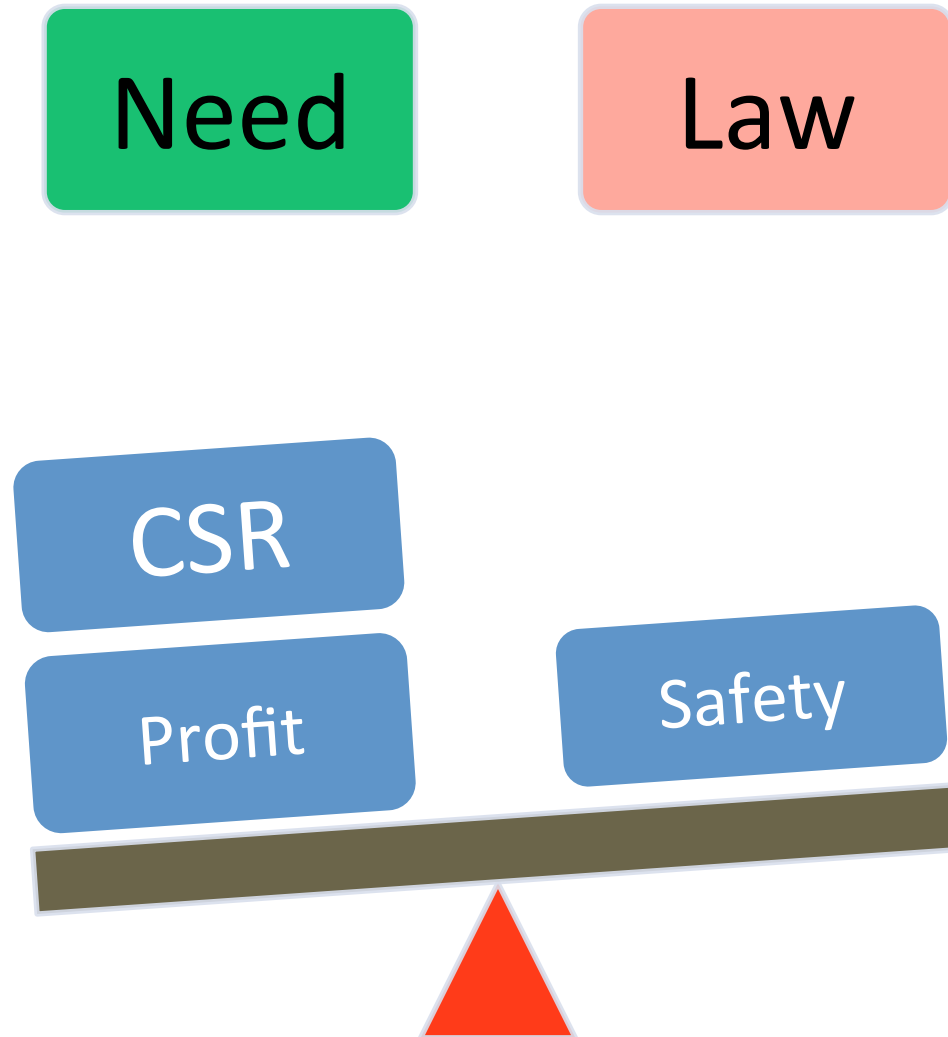
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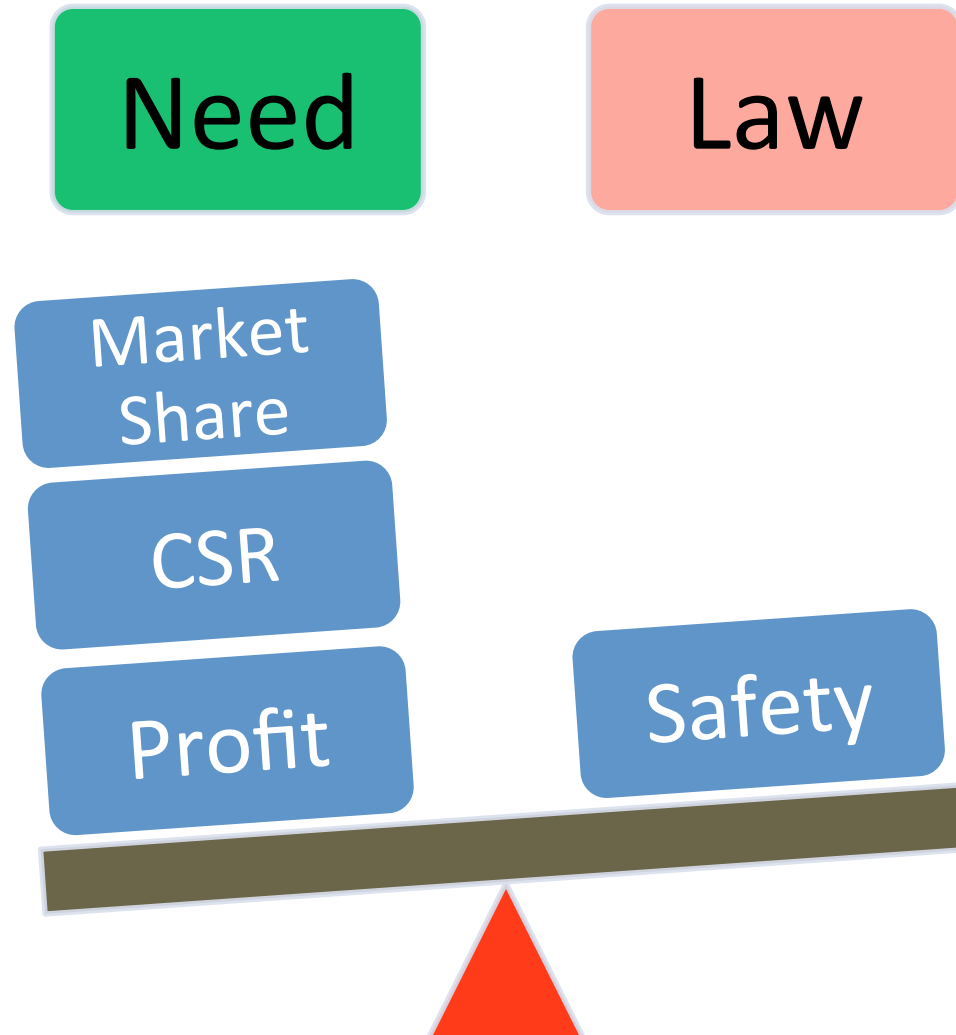
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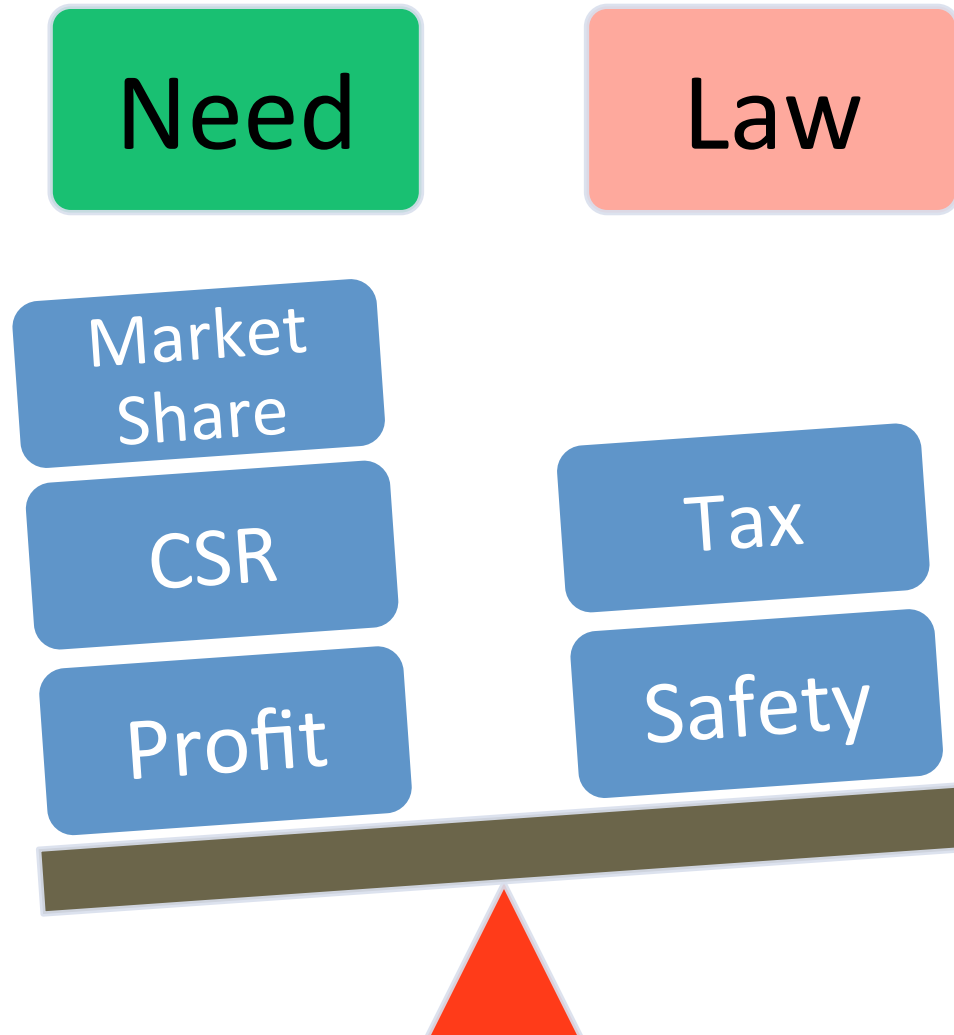
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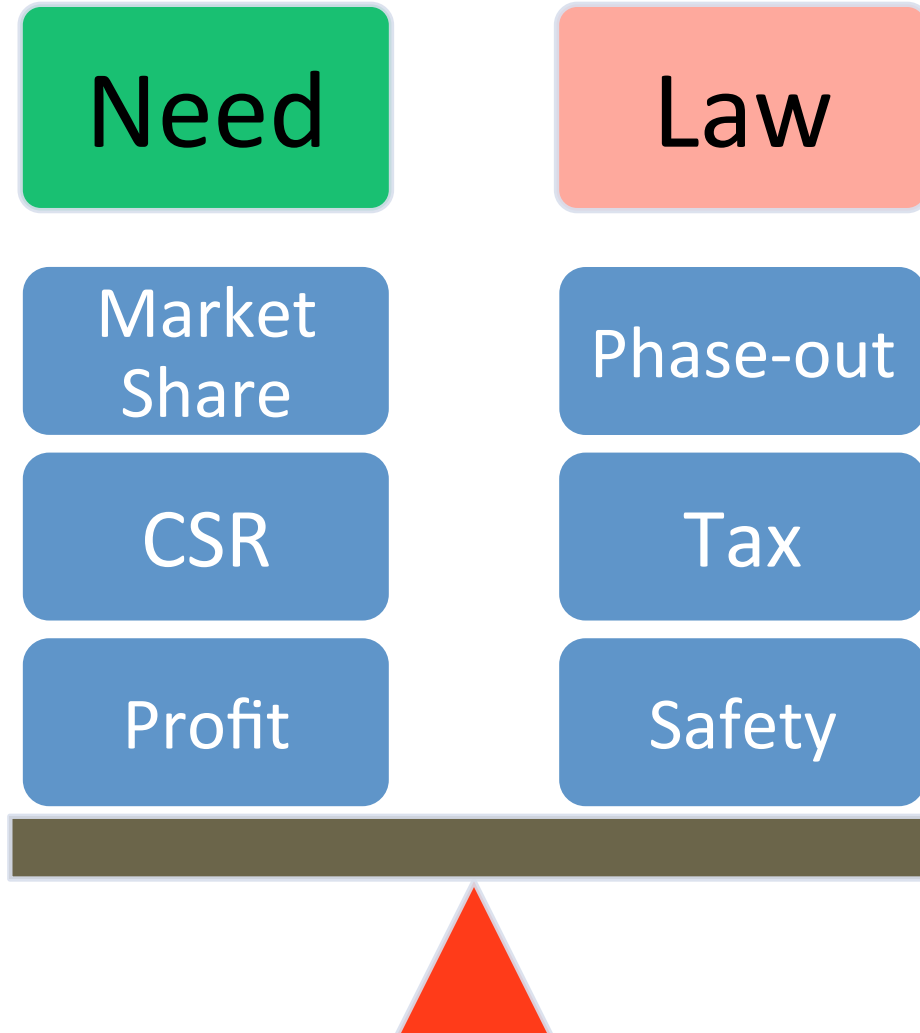
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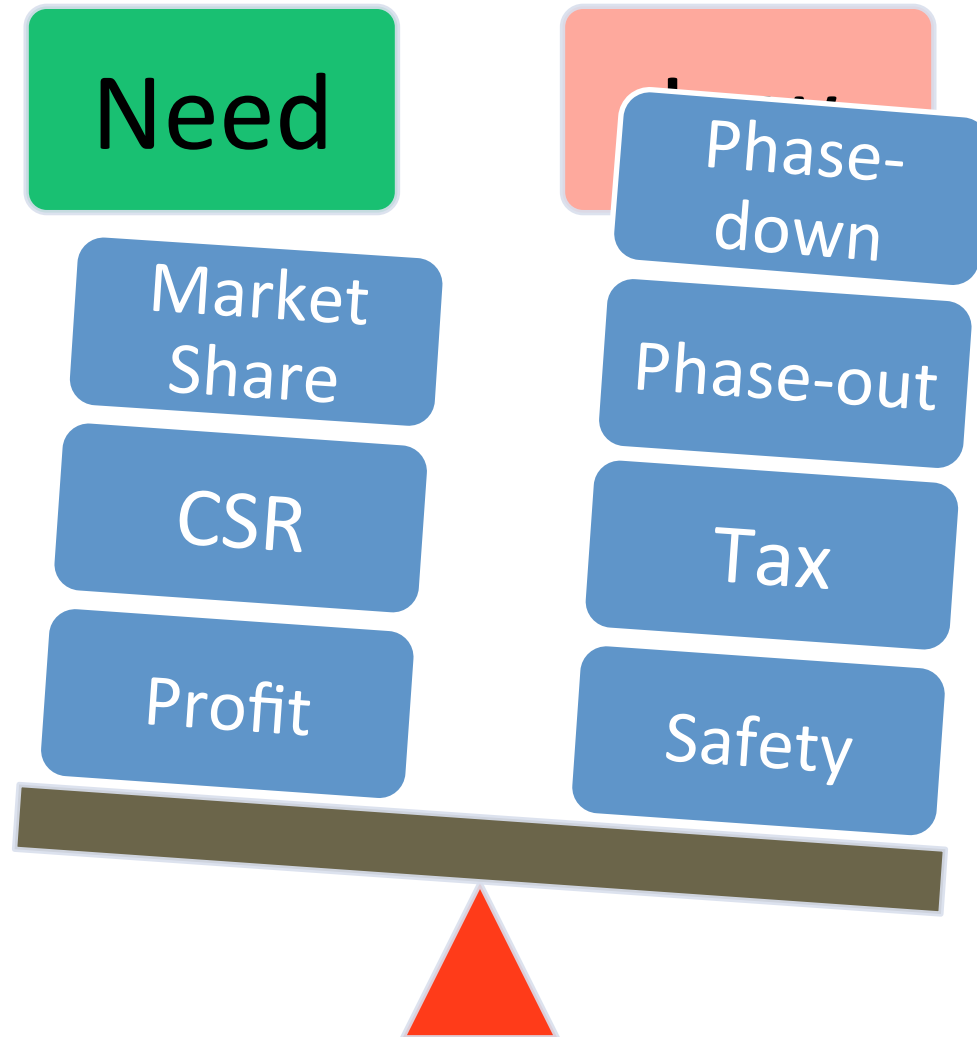
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How does it happen?

Lessons from the past

“Everything should be made as simple as possible, but not simpler.”

Albert Einstein

“A true innovator is therefore something of a dichotomy; a split personality which couples deep dissatisfaction with irrepressible hope.”

Me



- Be dissatisfied
- Be broad-minded
- Be interactive
- Be flexible

Refrigeration development

The last twenty years and beyond



Refrigeration development

The reality of our current predicament

“The “winning” refrigerants cannot be identified until a few more critical uncertainties are resolved.”

Clark Bullard, October 2012

“The need for consistent, science-based regulations governing flammability, toxicity and burst pressure”



HFCs



?



???



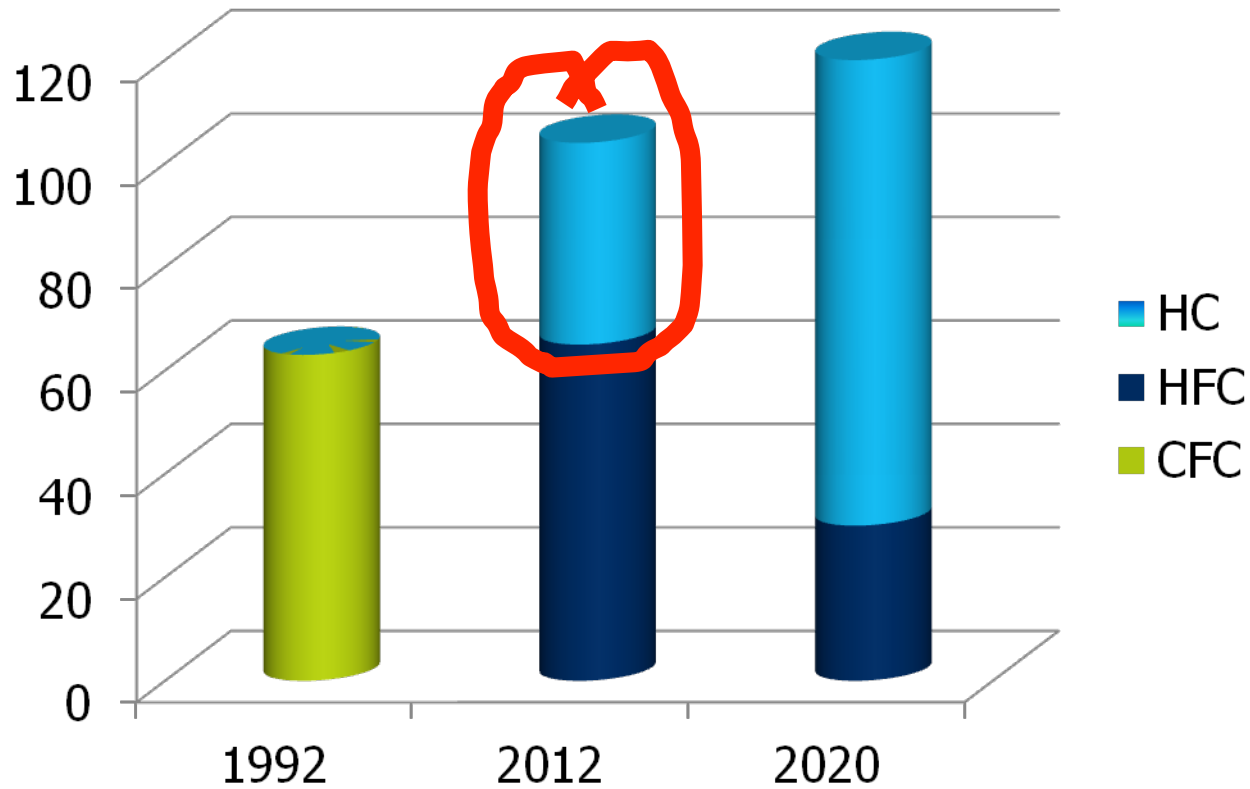
HCFCs



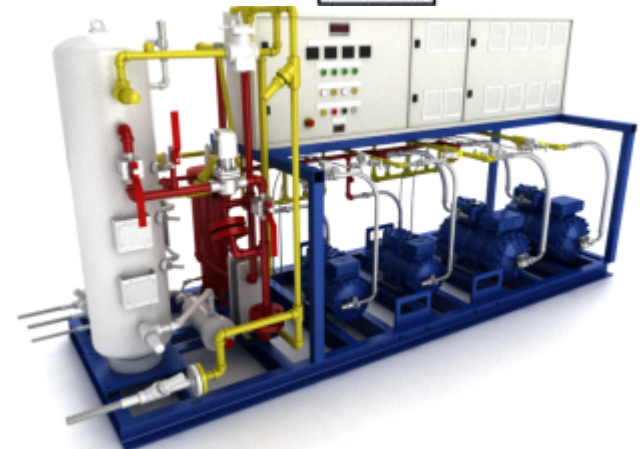
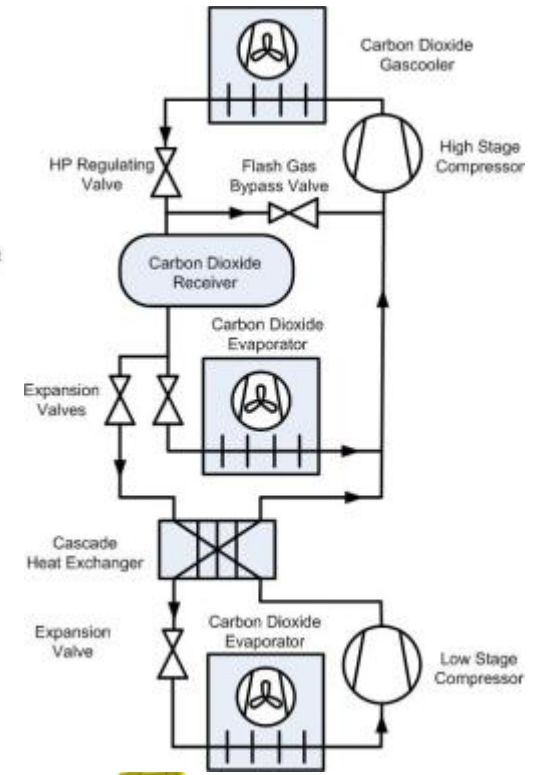
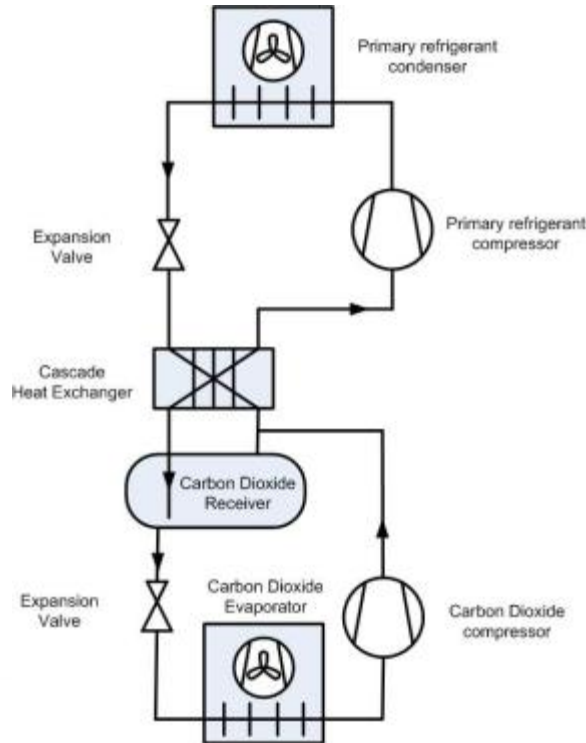
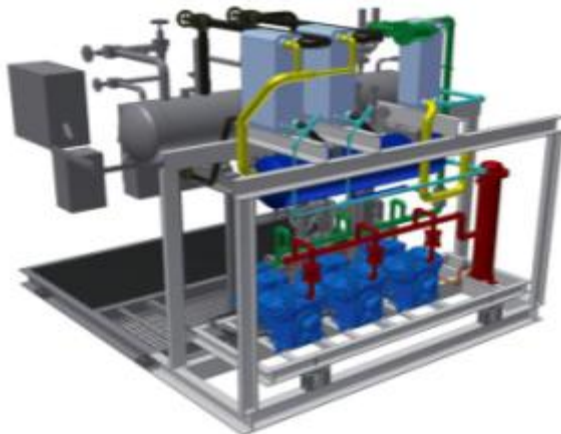
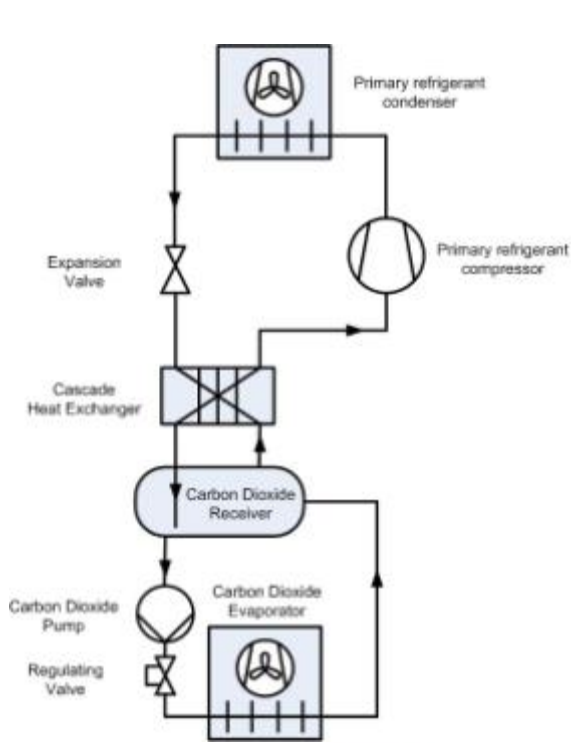
CFCs

“The uncertainties associated with ongoing international negotiations about a possible HFC phasedown schedule and its relationship to the phaseout of other greenhouse gases.”

Domestic Refrigerator Global Production by Refrigerant Type



Carbon dioxide



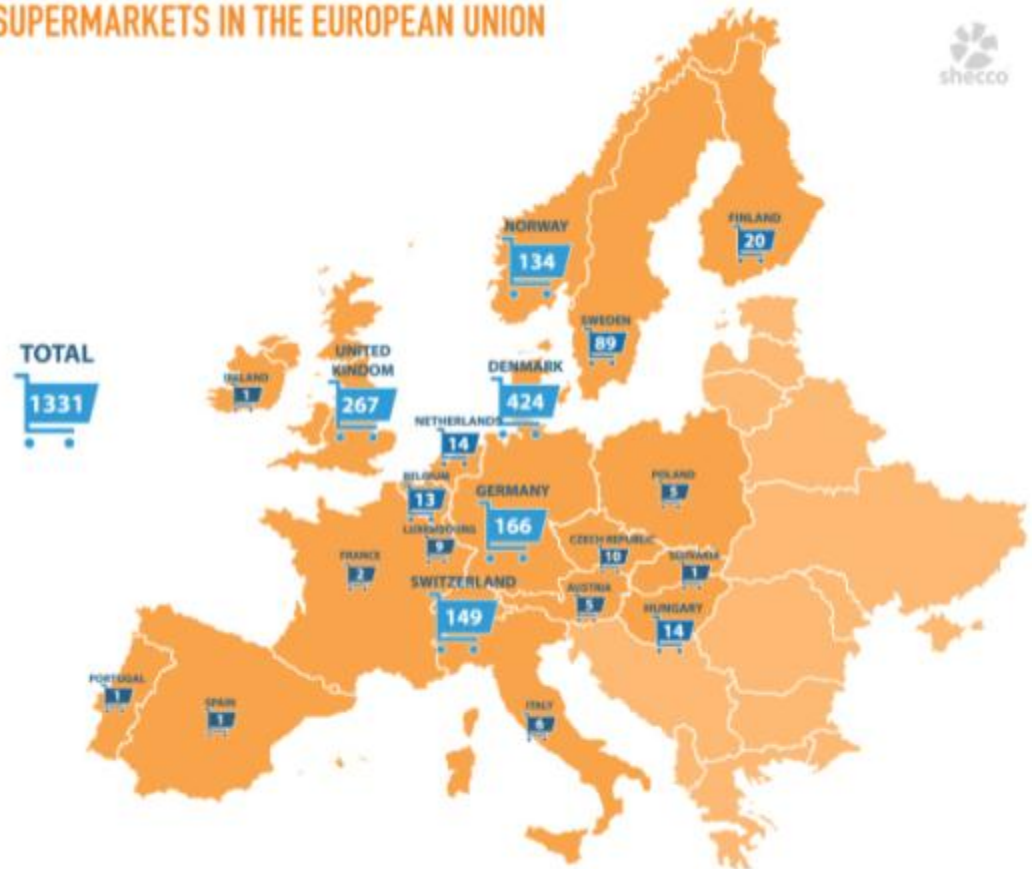
CO₂ TRANSCRITICAL SUPERMARKETS IN THE EUROPEAN UNION

DATA BY COUNTRY



Per million of population

- Denmark 75.7
- Norway..... 26.8
- Switzerland..... 18.6
- Luxembourg..... 18.0
- Sweden..... 9.37
- United Kingdom... 4.31
- Finland..... 3.71
- Germany..... 2.02
- Belgium..... 1.18
- Netherlands..... 0.82



Graphic by Shecco – data from 2010

Opportunities for natural refrigerants

Market matrix

	Ammonia	CO ₂	HC
Domestic	Green	Red	Green
Commercial	Red	Green	Green
Chillers	Green	Red	Green
Heat Pumps	Green	Green	Red
Split & Multi-split A/C	Red	Red	Green
Industrial	Green	Green	Green

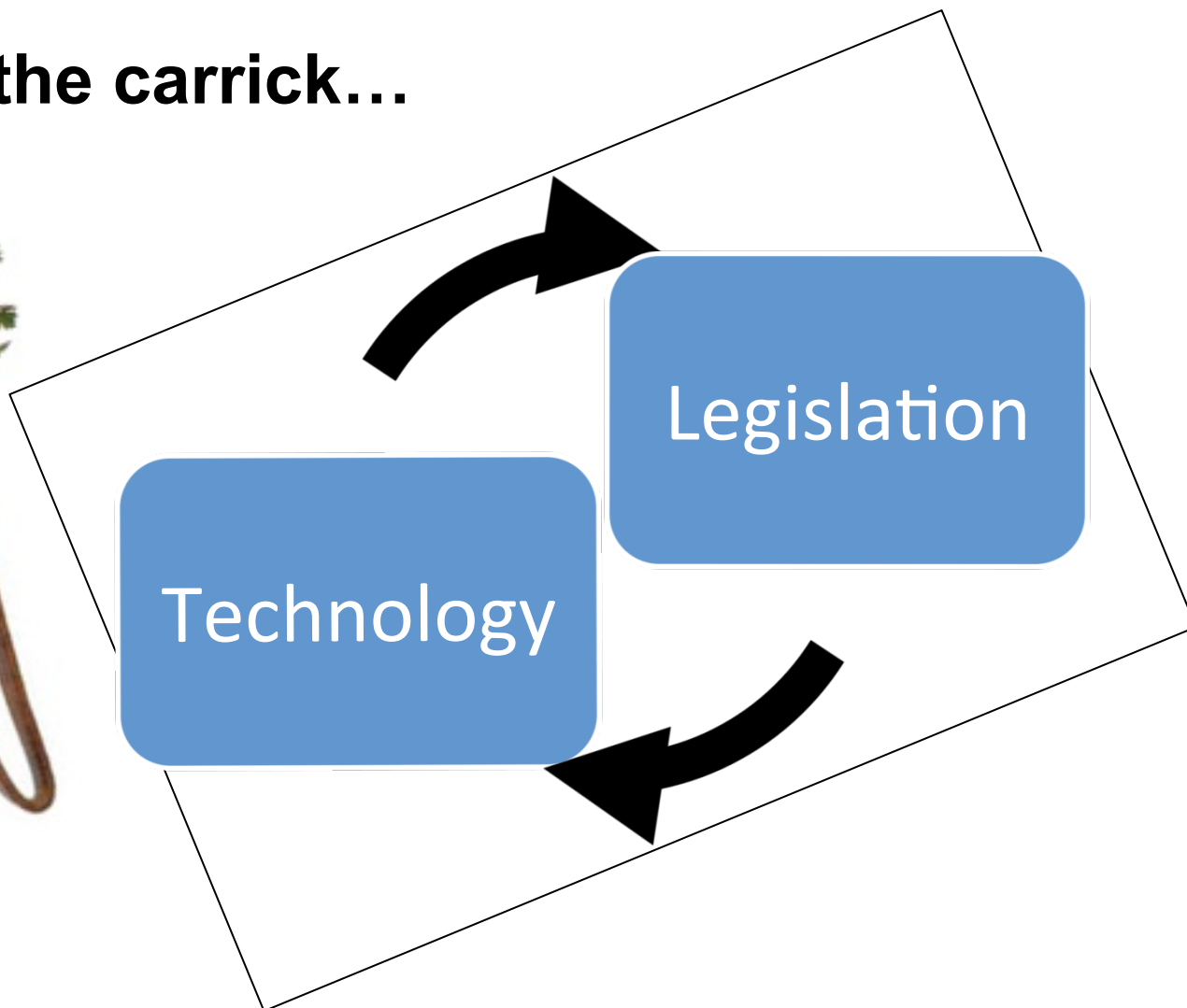
The role of legislation

Some options

- Ban on use?
- Subsidy for installation?
- Subsidy for use?
- Restriction on production?
- Restriction on use?
- Taxation of carbon effect?
- Control of qualifications?



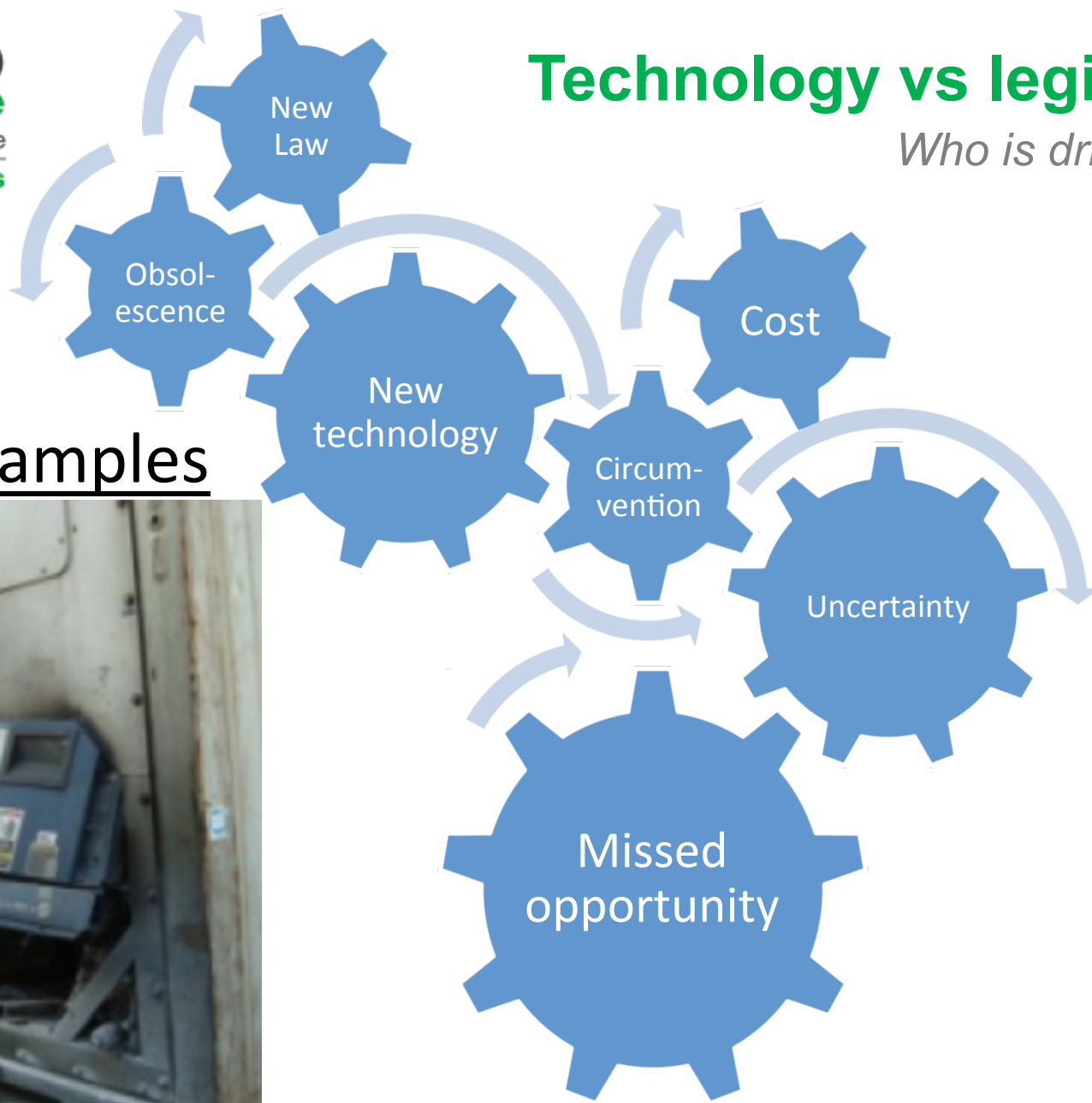
Introducing the carrick...



...and don't forget the Khazzoom postulate

Technology vs legislation

Who is driving who?



Some examples



Technology vs legislation

Who is driving who?





Oil-free Compression
VSD **Built** **IN** **HMI** **Semihermetic** **Compression** **h**
Intelligent Control

To set you up for the rest of the conference

- *We need laws that encourage the right stuff...*
- *...and eliminate the possibility of wrongdoing*
- *Make more use of the 'carrick', eg targeted tax*
- *Carbon-effect should be the guiding principle*
- *Forced innovation is still a profit-opportunity*
- *And finally, we have a lot of catching up to do*





Thank you very much for your consideration
and your support.

The ATMOsphere Europe team is looking
forward to meeting you in Brussels!