The need for sensing : two examples from Canada

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AGENDA

- The maximum efficiency
- The need for sensing
- A surplus of energy, a need for power
- A need for bidirectional communication and control
- Conclusion

The maximum efficiency

- A thermodynamics background that goes back to Sadi Carnot (1824) and Antoine Lavoisier (1789);
  - The absolute limit of a heat engine
- Then, starting may be with Watt's machines, came all kind of energy production, conversion, transmission, conservation devices;
- Nowadays, still a few percentage of efficiency could be grabbed to improve individual devices but the real gain will come from sensing.

The need for sensing

- The ability to sense is fundamental to society wellbeing through system operations, scientific exploration, and certainly energy applications.
- Novel sensing technologies needed to solve remote operational challenges in several areas
  - Energy production, transportation and distribution
  - Agriculture
  - Environment
  - All types of infrastructures

(image: KobizMedia/ Korea Bizwire)

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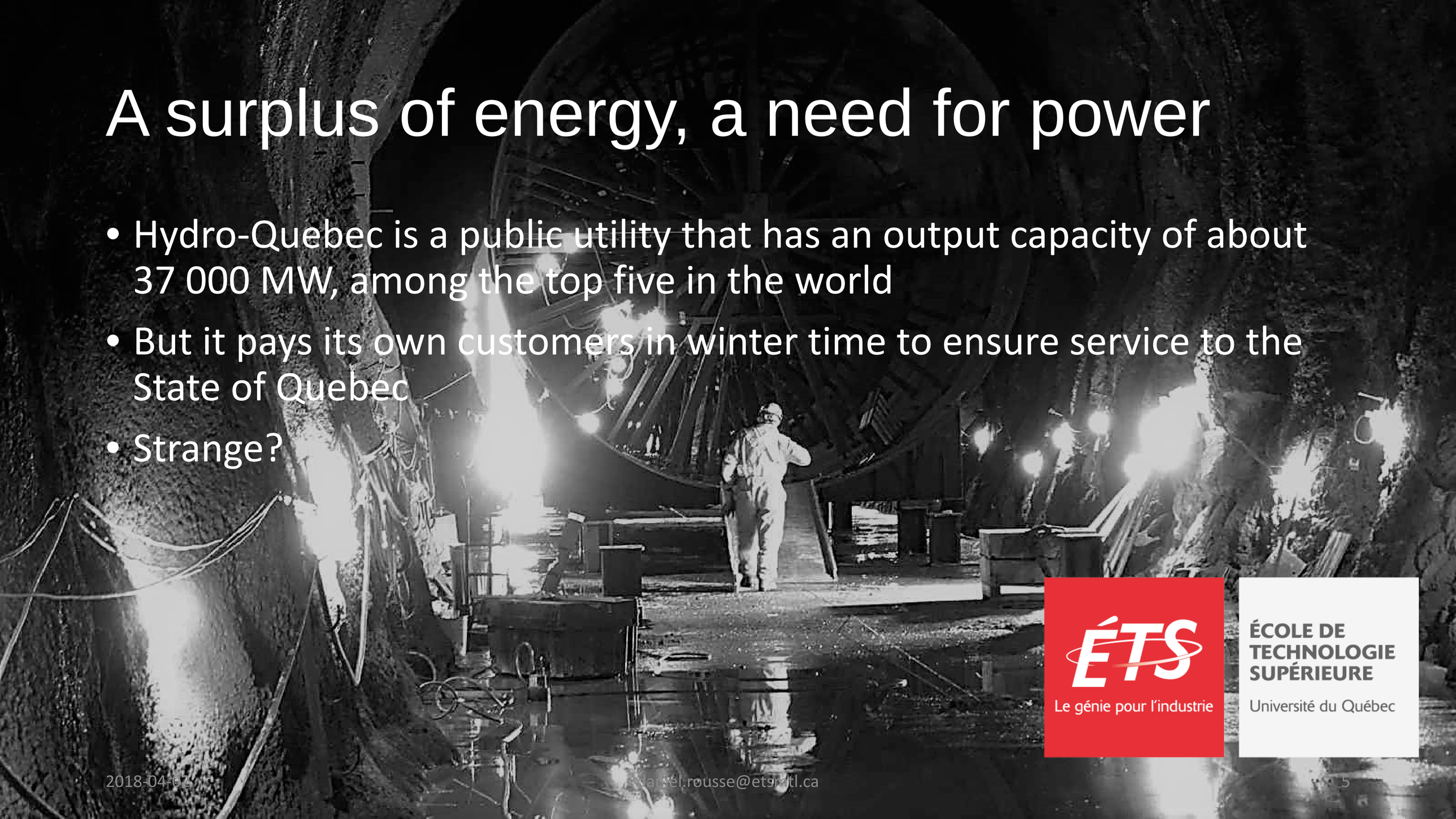
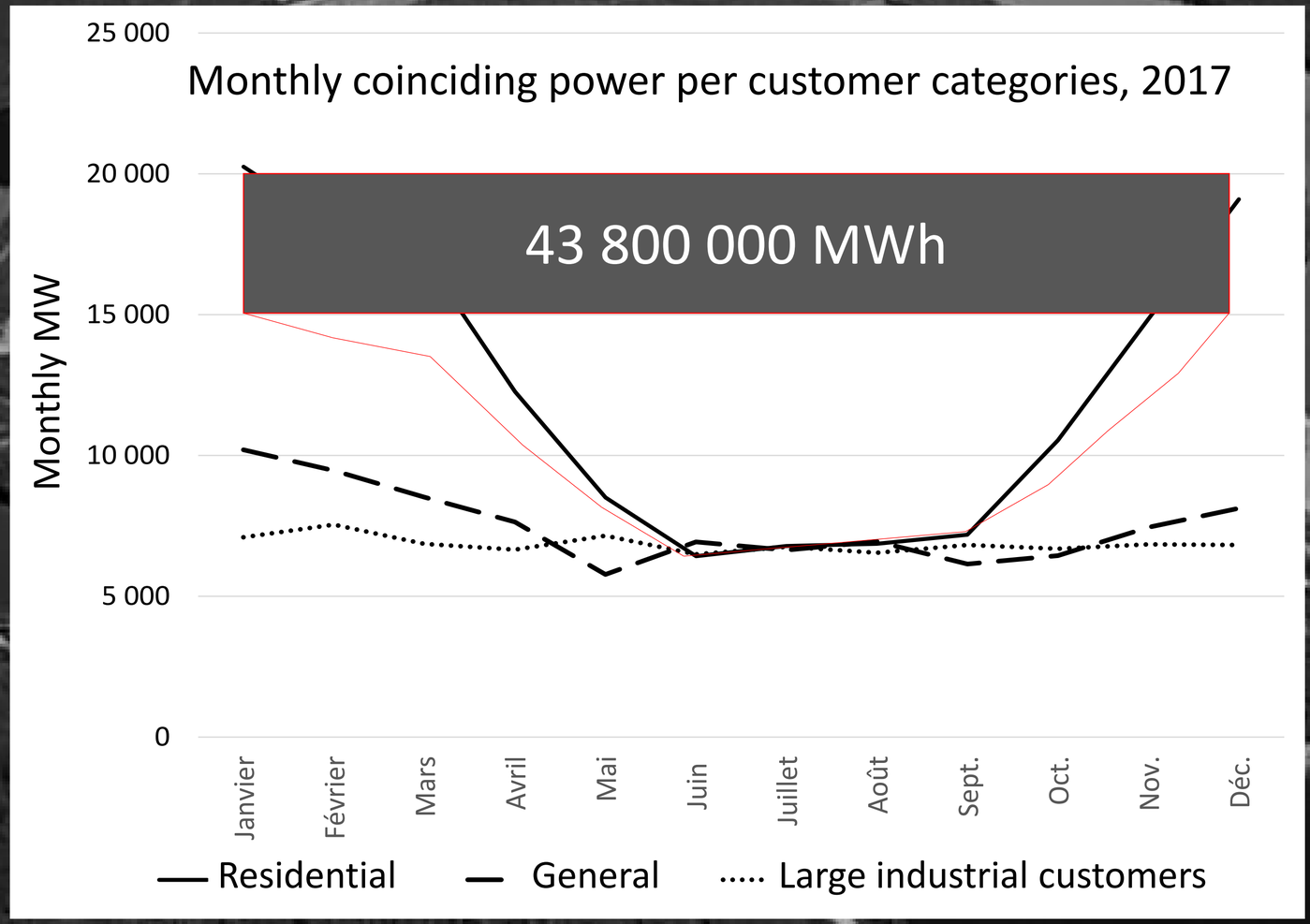
A surplus of energy, a need for power

- Hydro-Quebec is a public utility that has an output capacity of about 37 000 MW, among the top five in the world
- But it pays its own customers in winter time to ensure service to the State of Quebec
- Strange?



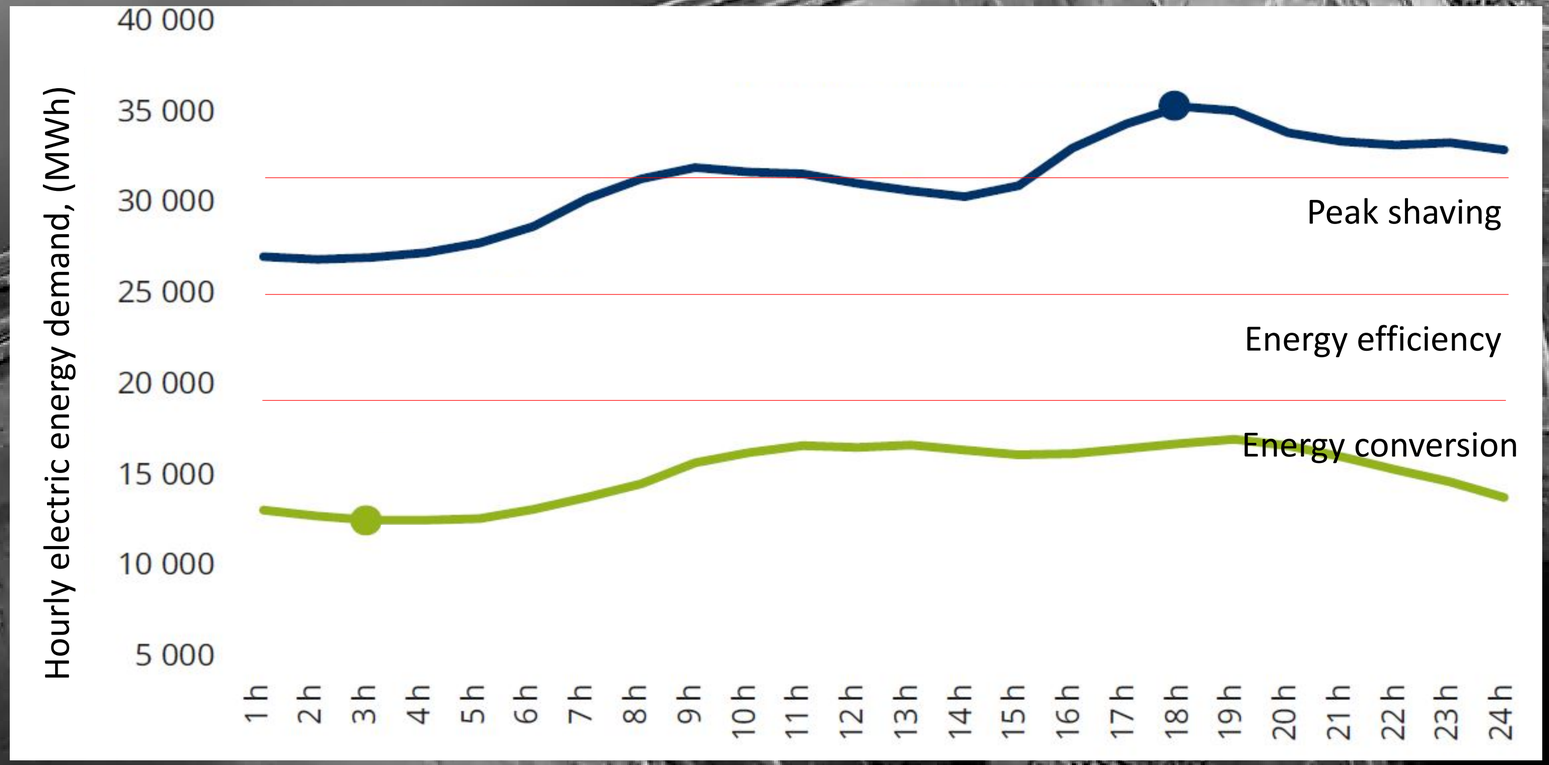
A surplus of energy, a need for power

HDQ (2016a) Répartition du coût de service de l'année témoin 2017, HQD-12 Document 3, Demande R3980-2016, Montréal: Hydro-Québec Distribution



A surplus of energy, a need for power

- In blue, the peak energy demand on Feb 2nd 2016, 6pm: 35 504 MWh
- In green, the lowest energy demand on Oct 8th 2016, 3 am : 12 734 MWh



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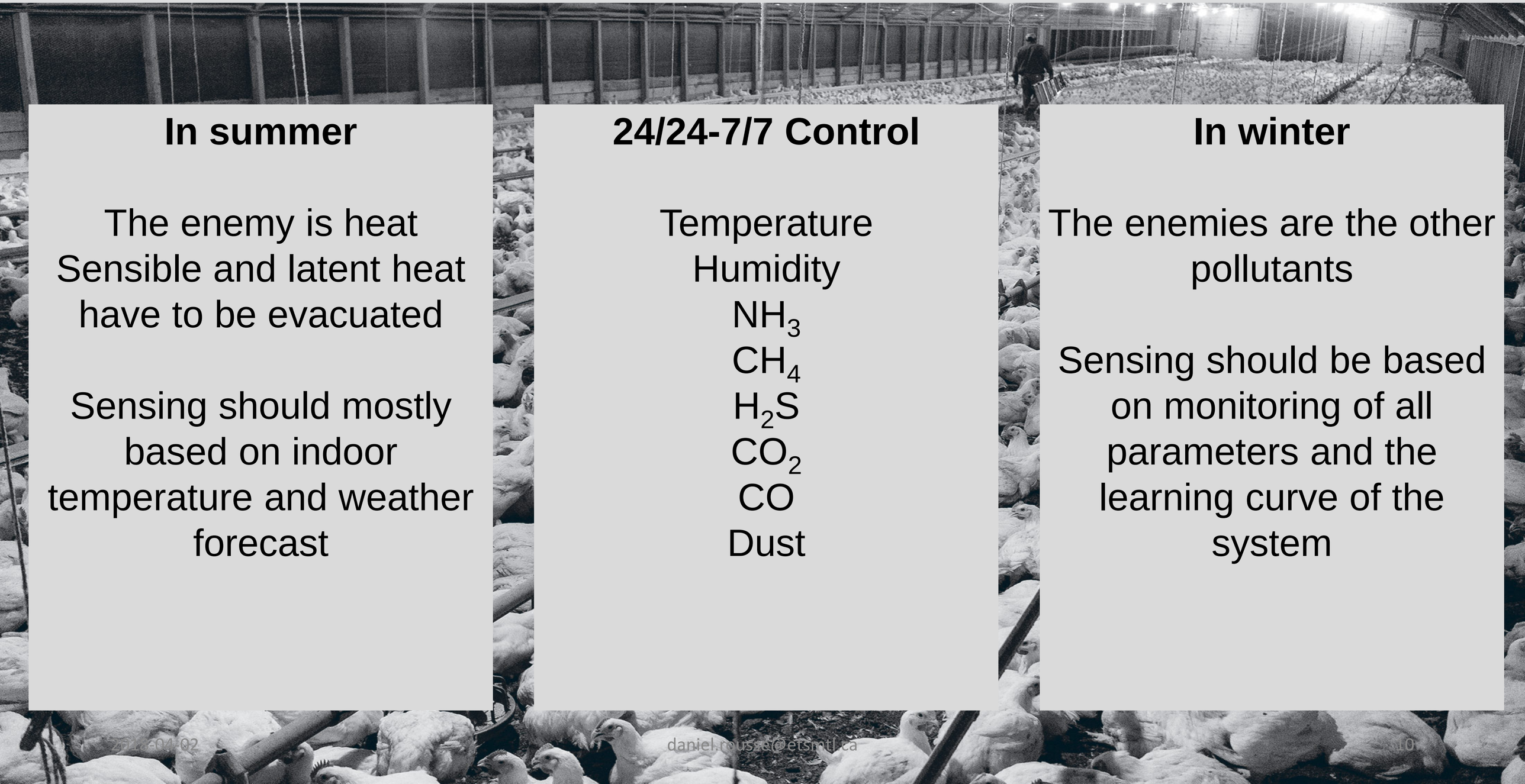


In summer

The enemy is heat
Sensible and latent heat have to be evacuated

Sensing should mostly based on indoor temperature and weather forecast

24/24-7/7 Control

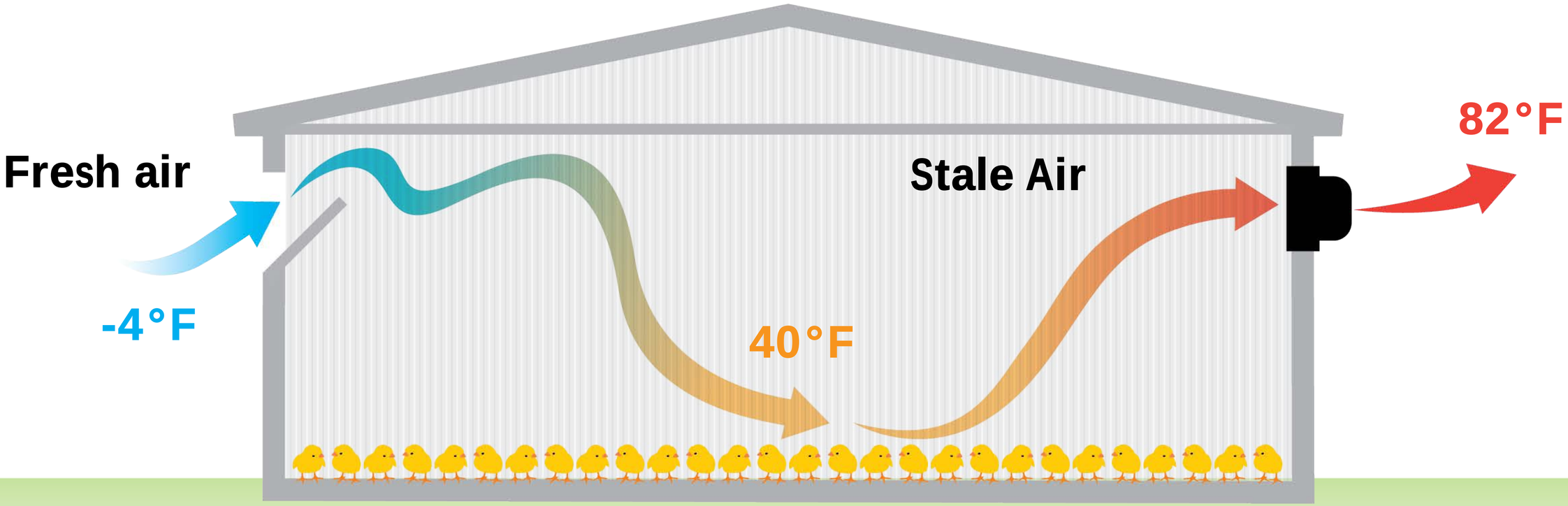
Temperature
Humidity
NH_3
CH_4
H_2S
CO_2
CO
Dust

In winter

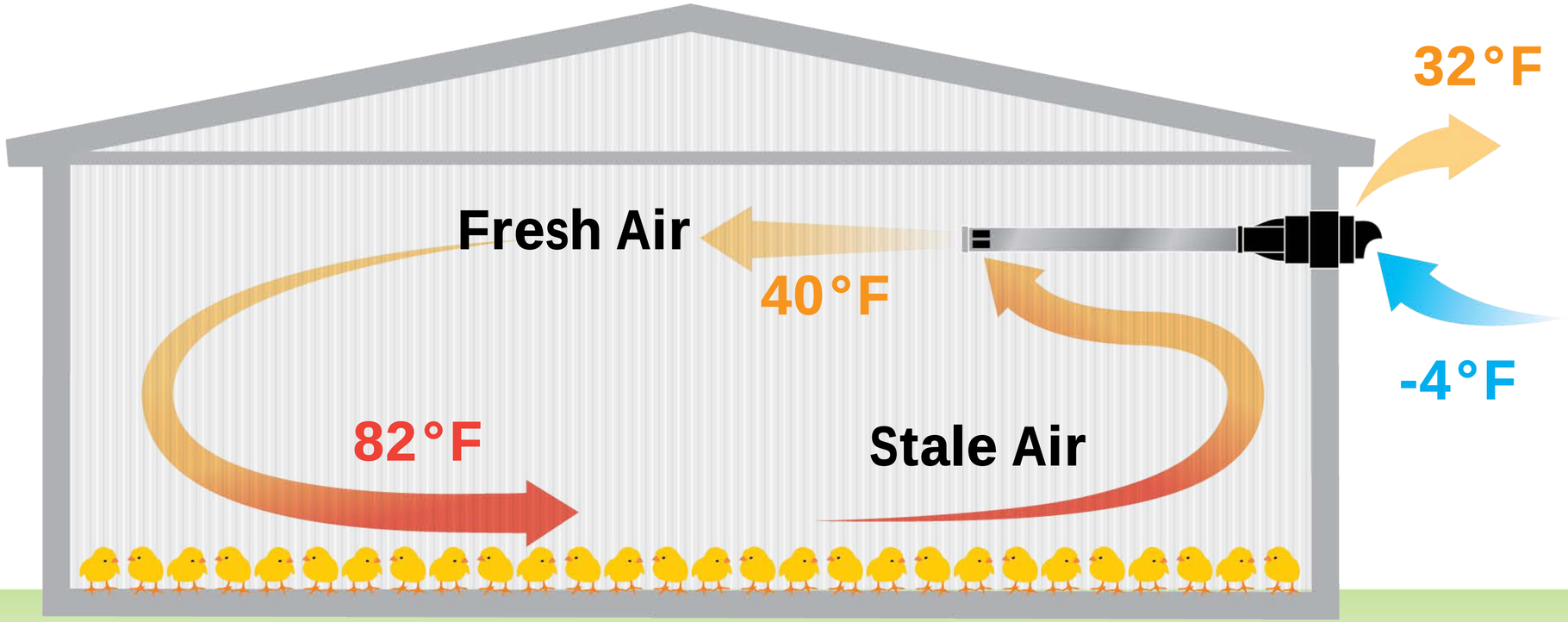
The enemies are the other pollutants

Sensing should be based on monitoring of all parameters and the learning curve of the system

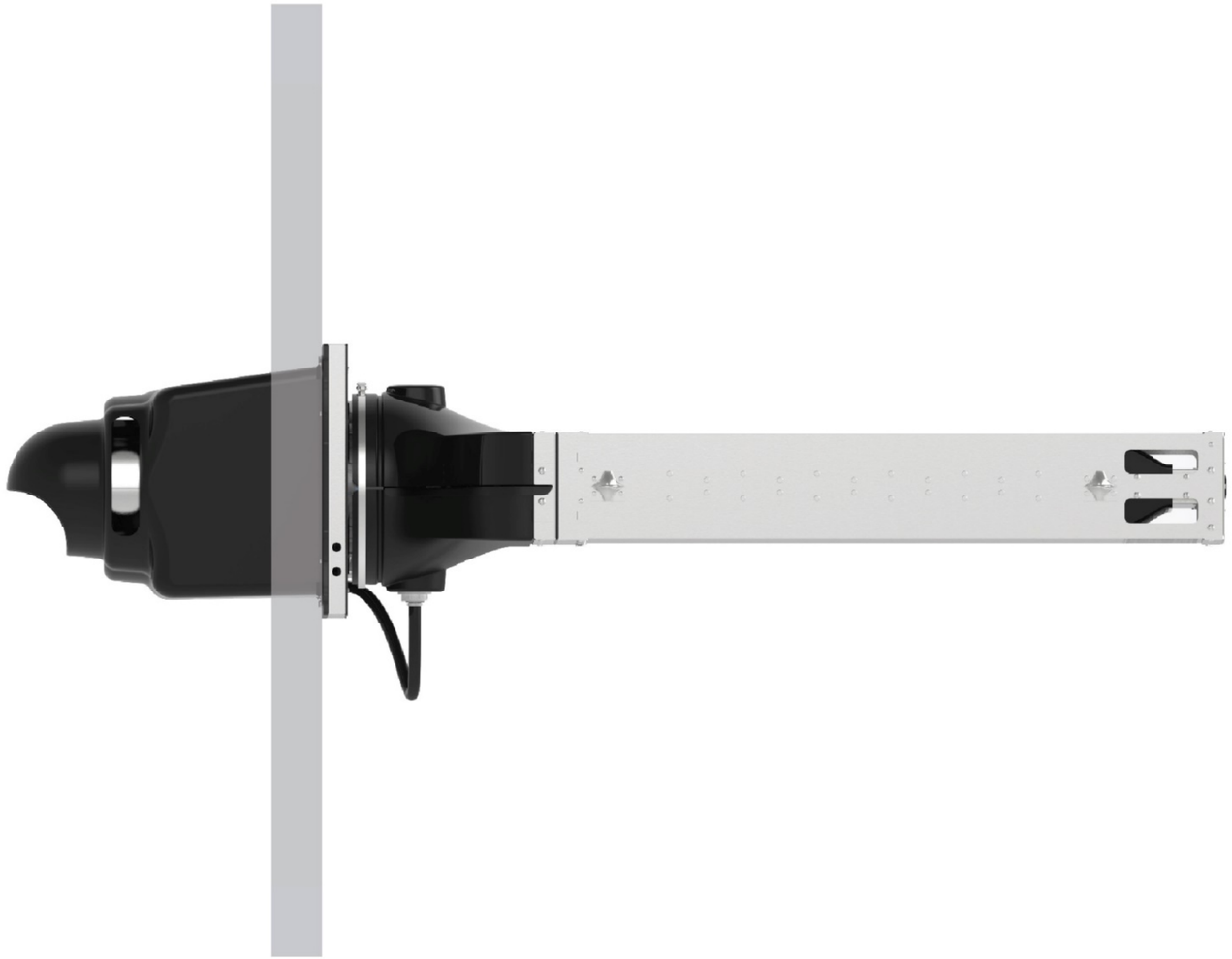
Cold Weather Typical Ventilation



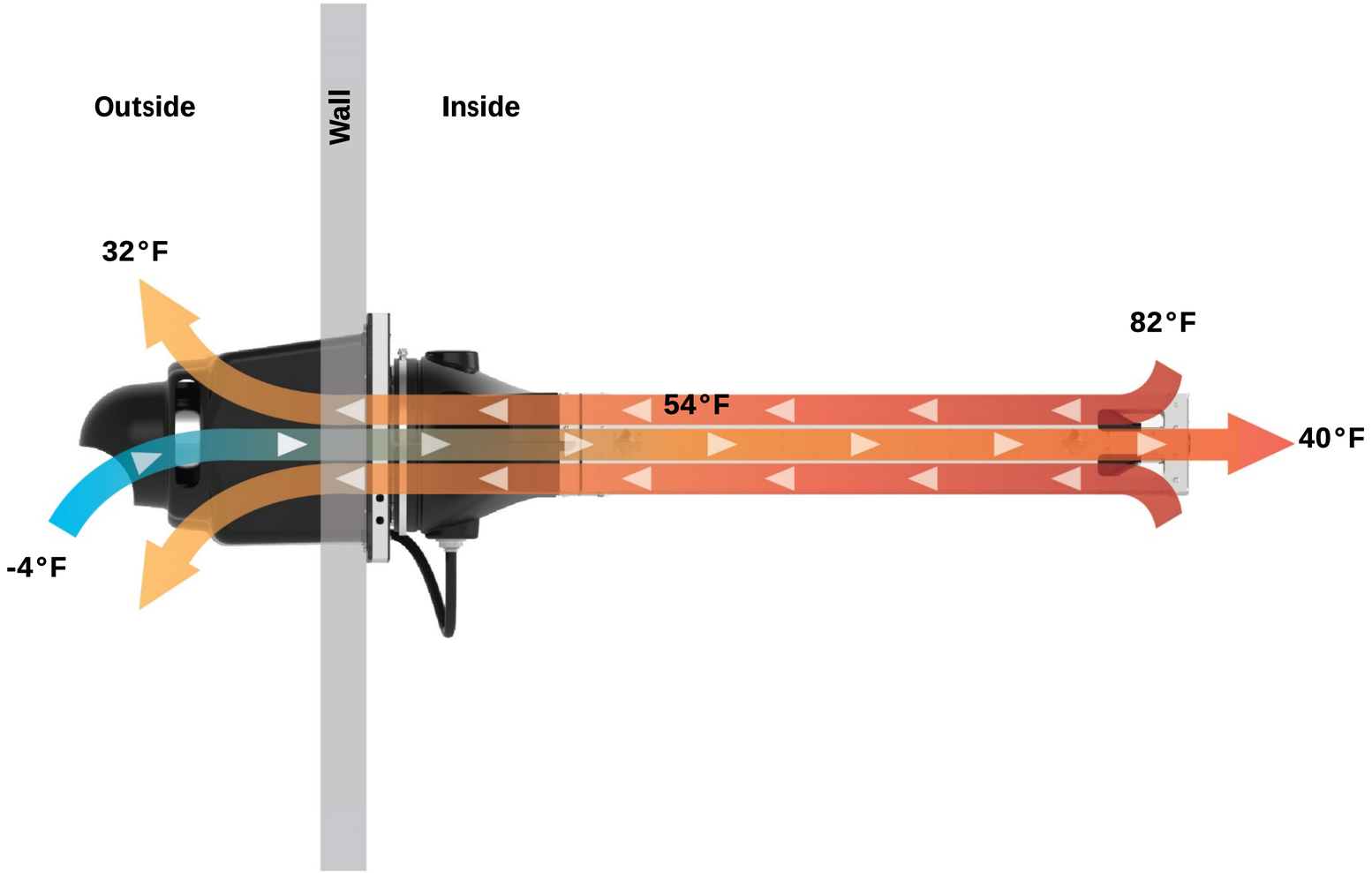
Cold Weather ESA Ventilation

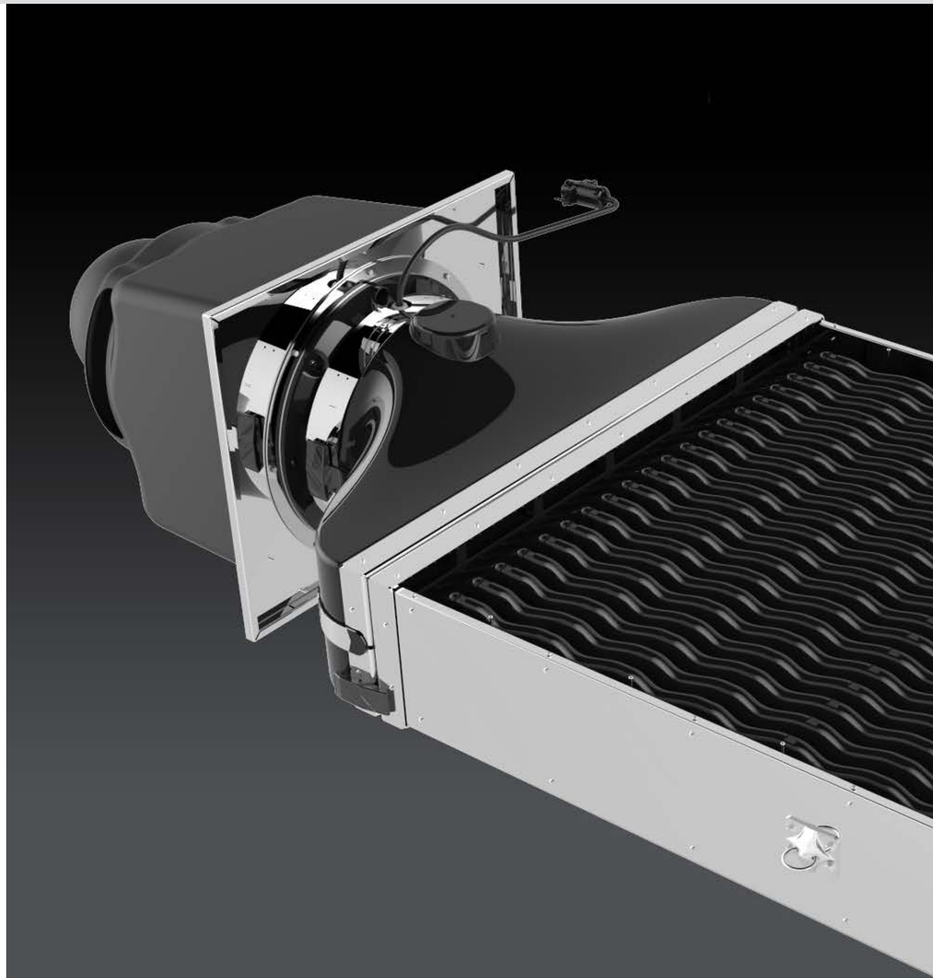


Heat Exchanger



How it works





Prix Innovation

The need for bidirectional communication and control

Table 1 Technical Data Collected by the producer for flocks starting Nov 7th 2014, Oct. 27th 2015 and Oct. 21st 2016

	Weight	FCR	Mortality	Density
	kg		%	lbs/sq.ft
Before	52960	1.71	4.27%	6.74
Year 1	59250	1.68	2.53%	7.54
Year 2	56740	1.64	1.27%	7.22

Table 2 Technical Data Collected by the producer for flocks starting Dec 26th 2014, Dec 31st 2015 and Dec 23rd 2016

	Weight	FCR	Mortality	Density
	kg		%	lbs/sq.ft
Before	52010	1.93	2.81%	6.61
Year 1	54640	1.61	1.24%	6.95
Year 2	61250	1.69	2.89%	7.79

Test carried with 16 units demonstrated that proper communication between units was responsible for a major improvement

Stéphane Forest, La Ferme du Grand Orme, Sainte-Mélanie, Quebec, CA

CONCLUSION

The upcoming improvements in energy efficiency will not mostly depend on improvement of each and every component of a system or process but in the ability to have all elements interact with each other and react to their environment.

And this will require sensing, more sensing, advanced sensing.

Questions/Fragen/Preguntas?

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