

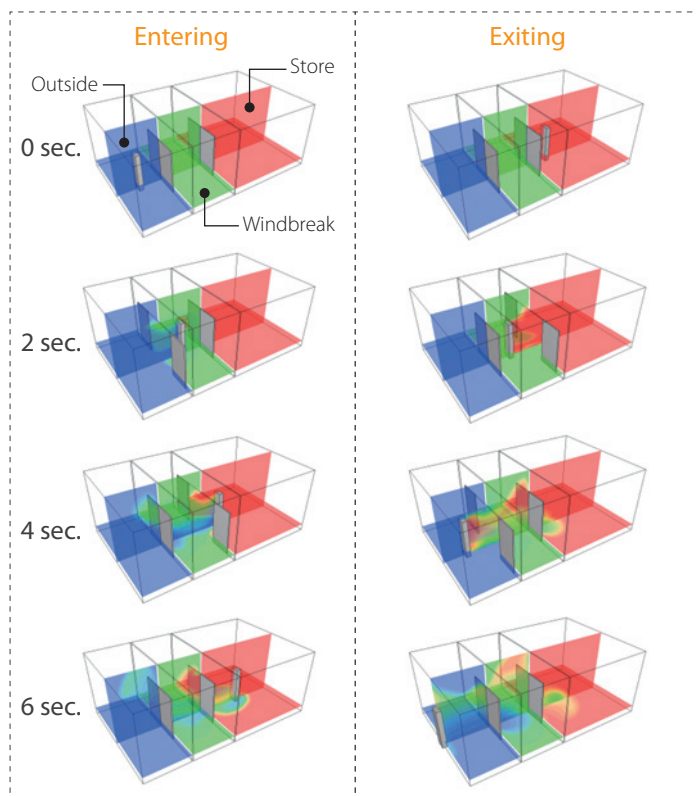
Estimate of Heat Loss with/without Windbreak Space

Windbreak spaces are known to function as thermal barriers when doors are closed. Simulations are performed using scSTREAM to compare heat loss from indoor air with/without windbreak space when doors are opened, as a person enters and exits a small mock store.

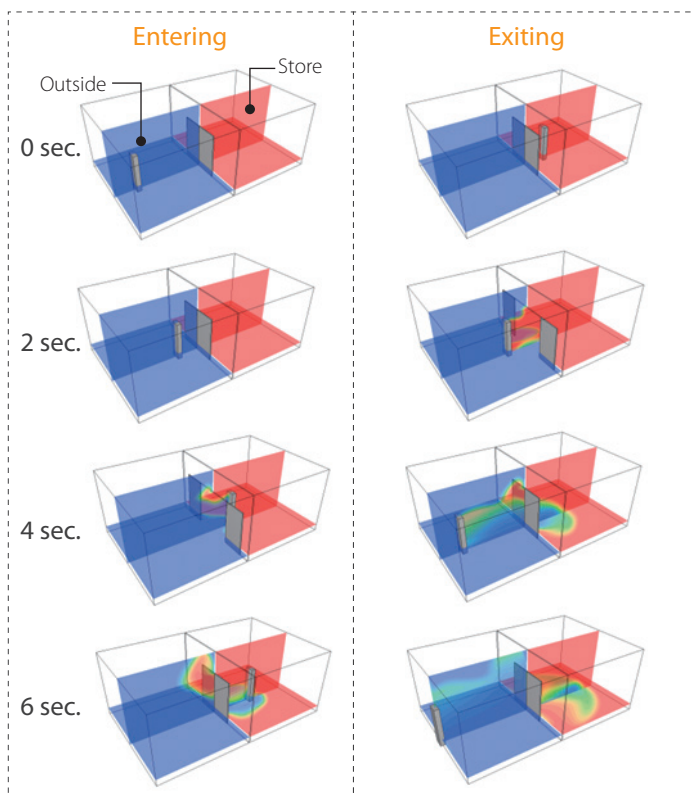
Simulation Model and Results

Dimension	5m x 4m x 3m store with sliding doors (1m x 2m each) 5m x 2m x 3m windbreak space
Initial condition	Indoor 20 °C, Outdoor 0 °C, Windbreak space 10 °C

With windbreak space



Without windbreak space



Comparison

	Heat Loss from Store [kWh]			Cost [\$]	CO ₂ emission [ton]
	1 customer	300 customers/day	30 days/month	1 month	1 month
With windbreak	0.0180	5.41	162	45	0.9 E-4
Without windbreak	0.0397	11.9	357	100	2.0 E-4
Difference	-	-	-	55	1.1 E-4

$$\text{Heat loss} = \rho V C_p \Delta T$$

ρ : density of air
 V : store volume
 C_p : specific heat of air
 ΔT : difference in initial and final average indoor temperature

Electricity: 0.28 [\$/kWh]*

CO₂ emission: 5.5 E-7 [ton/kWh]*

* Based on White Book on Energy, 2011, Agency for Natural Resources and Energy, Japan

Notes

It is shown that a windbreak space minimizes the heat loss from indoor air when the doors are opened by a person entering/exiting a store. A fair amount of money can be saved, and CO₂ emission can be reduced accordingly.