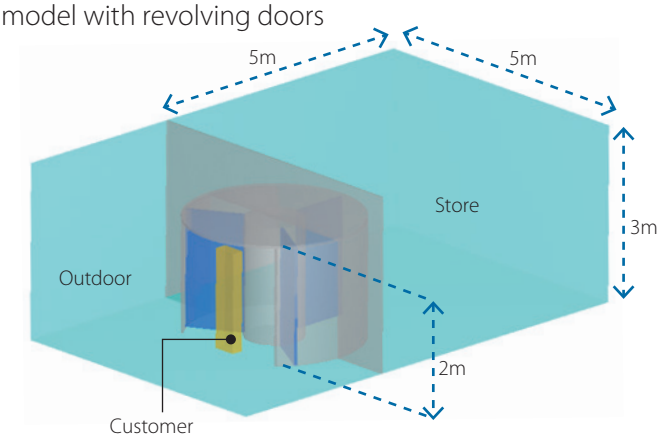
Estimate of Heat Loss Through Revolving Doors

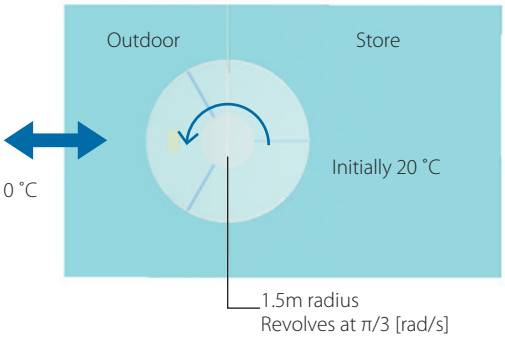
On a cold day, revolving doors can become a factor of heat loss by letting warm air escape and cold air enter. scSTREAM is used to estimate how much heat may be lost through revolving doors when a customer enters and exits a store.

Simulation Model and Conditions

Store model with revolving doors

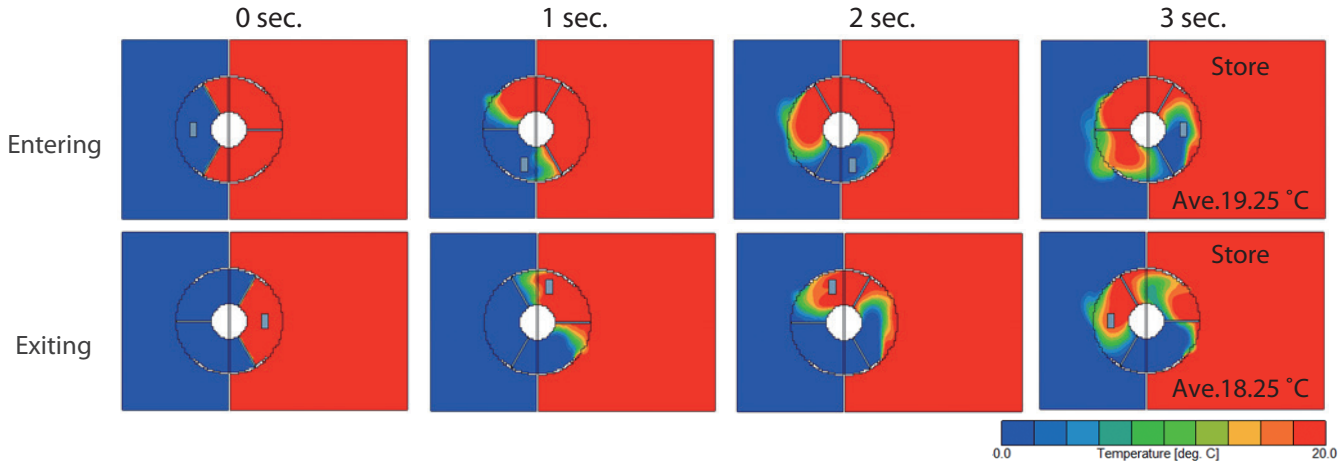


Transient analysis: $\Delta t = 0.01$ sec.
Analysis time: 0 to 3 sec.



Simulation Results

Temperature contour at 1.5m from floor



Estimated heat loss and CO_2 emission

	Heat loss from Store [kWh]			Cost [$]	CO_2 emission [ton]
	1 customer	300 times/day	30 days/month	1 month	1 month
Revolving doors	0.0631	18.9	568	59	3.1 E-4
Sliding doors	0.0397	11.9	357	37	2.0 E-4

Heat loss = ρ V Cp ΔT

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

Electricity: 0.104 [$/kWh]*,
CO_2 emission: 5.5 E-7 [ton/kWh]*

* Based on Annual Energy Review, 2011, U.S. Energy Information Administration

Notes

In this particular simulation setup, more heat is lost when a customer exits the store than when he/she enters the store. The estimate of heat loss for one month is roughly sixty dollars, which is about fifty percent more than a setup with sliding doors.