Which idling reduction system is most economical for truck owners?

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Commercial Vehicle Engineering Congress and Exposition
Rosemont, Il

October 7-9, 2008

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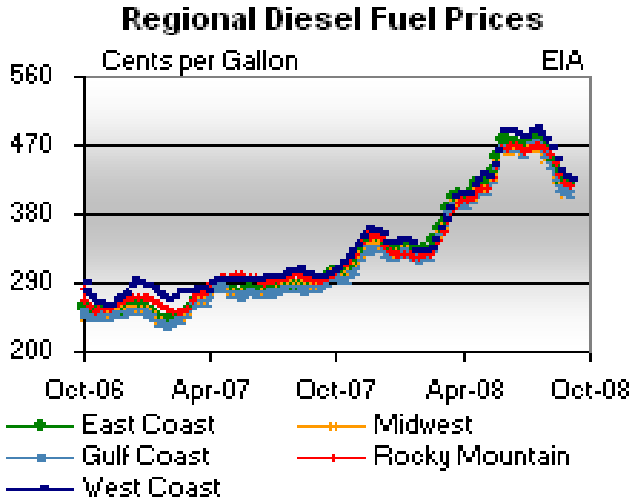
The price of diesel is high

- Idling a Class 8 truck uses 0.6-1.2 gallons per hour
- That can total over $50 a night!
- So even without regulations, there's an incentive to reduce idling
- Even if the price goes down more, idling reduction makes sense



Why do sleepers idle overnight?

For services to resting driver and friend

- Heating, ventilation, and air conditioning (HVAC)
- Power for appliances
  - TV, microwave, refrigerator, computer, hair drier

To keep fuel and engine warm

To mask out noises and smells

Because other drivers do it

For safety

Skip's Volvo has all the conveniences

Workday idling is also important

Long-duration idling occurs

- At ports and terminals
- At busy delivery sites
- At border crossings
- At restaurants

All truck types may idle during the day

- We focus on long-duration idling (>30 minutes)
  - Power take-off excluded
- Idling reduction devices do not enable slow movement in queue ("creep mode")
- Scheduling can reduce workday idling
- Daytime idling represents significant use of fuel

Idling may use over 8% of commercial truck fuel

	Fuel use (million gallons/year)			
	Gasoline	Diesel	Other	Total
Overnight idling	0	666	0	666
Workday idling	1,416	1,002	73	2,491
Total long-duration idling fuel use	1,416	1,668	73	3,157
Total fuel use for commercial trucks	13,922	22,681	378	36,982
Idling % of total use by fuel type	10.2%	7.4%	19%	8.5%

Several technologies can keep cab comfortable

All reduce fuel use, emissions, and noise while they maintain driver comfort

The best choice depends on

- Duty cycle
- Location
- Fuel and equipment cost

Types of on-board equipment

- Automatic engine stop-start controls
- Auxiliary power units (APU) and similar devices
- Cab and block heaters
- Battery or thermal storage air conditioners

Types of electrified parking spaces (EPS)

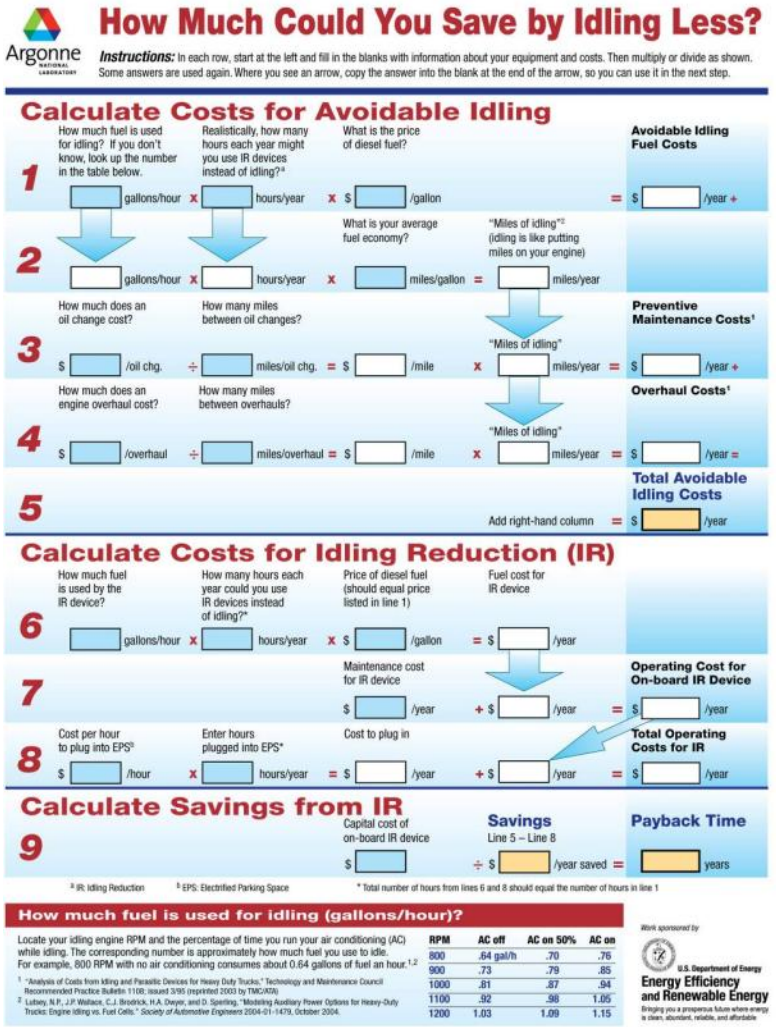
- Single system electrification requires no on-board equipment
- Shore power allows driver to plug in on-board equipment (dual system)

Estimated costs for alternatives vary widely

System	Services	Fuel Use/hr	On-board Cost ($)	Maintenance ($/hr)*	Infrastructure cost ($/space)	Usage Charge ($/hr)
Idling 2001 truck	All	0.77 gal heating 0.98 gal cooling	0	0.12	0	0
Idling 2007 truck	All	0.53 gal heating 0.72 gal cooling	0	0.12	0	0
Cab/bunk heater	Heating	0.06 gal	1,250	0.07	0	0
Storage air conditioner	Cooling	0.20 gal	4,000	0.13	0	0
APU or generator set	All	0.23 gal	8,000**	0.33	0	0
Electrified parking space (single on gantry)	All	2.4 kWh heating 1.7 kWh cooling	10	0	16,700	2.45
Electrified parking space (single on pedestal)	All		10	0	9,000-11,000	1-2
Electrified parking space (dual system)	All		2,500	0.07	Up to 6,000	1

Payback time depends on operating practices

- Fuel savings are the main financial benefit
  - Payback is faster if more idling hours are displaced
- Savings also accrue from reduced maintenance costs
  - Routine maintenance can be performed less often without idling
  - Mileage to overhaul can be increased without idling
  - Worksheet for trucks is based on TMC RP 1108
- Low-idling history should increase vehicle resale value
- Device has residual value



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How Much Could You Save by Idling Less?

Instructions: In each row, start at the left and fill in the blanks with information about your equipment and costs. Then multiply or divide as shown. Some answers are used again. Where you see an arrow, copy the answer into the blank at the end of the arrow, so you can use it in the next step.

Calculate Costs for Avoidable Idling

1 How much fuel is used for idling? If you don't know, look up the number in the table below. ____ gallons/hour x Realistically, how many hours each year might you use IR devices instead of idling?[4] ____ hours/year x What is the price of diesel fuel? $ ____ /gallon = **Avoidable Idling Fuel Costs** $ ____ /year +

2 ____ gallons/hour x ____ hours/year x What is your average fuel economy? ____ miles/gallon = "Miles of idling"[2] (idling is like putting miles on your engine) ____ miles/year

3 How much does an oil change cost? $ ____ /oil chg. ÷ How many miles between oil changes? ____ miles/oil chg. = $ ____ /mile x "Miles of idling" ____ miles/year = **Preventive Maintenance Costs**[1] $ ____ /year +

4 How much does an engine overhaul cost? $ ____ /overhaul ÷ How many miles between overhauls? ____ miles/overhaul = $ ____ /mile x "Miles of idling" ____ miles/year = **Overhaul Costs**[1] $ ____ /year =

5 Add right-hand column = **Total Avoidable Idling Costs** $ ____ /year

Calculate Costs for Idling Reduction (IR)

6 How much fuel is used by the IR device? ____ gallons/hour x How many hours each year could you use IR devices instead of idling?* ____ hours/year x Price of diesel fuel (should equal price listed in line 1) $ ____ /gallon = Fuel cost for IR device $ ____ /year

7 Maintenance cost for IR device $ ____ /year + $ ____ /year = **Operating Cost for On-board IR Device** $ ____ /year

8 Cost per hour to plug into EPS[5] $ ____ /hour x Enter hours plugged into EPS* ____ hours/year = Cost to plug in $ ____ /year + $ ____ /year = **Total Operating Costs for IR** $ ____ /year

Calculate Savings from IR

9 Capital cost of on-board IR device $ ____ ÷ **Savings** Line 5 – Line 8 $ ____ /year saved = **Payback Time** ____ years

[4] IR: Idling Reduction [5] EPS: Electrified Parking Space * Total number of hours from lines 6 and 8 should equal the number of hours in line 1

How much fuel is used for idling (gallons/hour)?

Locate your idling engine RPM and the percentage of time you run your air conditioning (AC) while idling. The corresponding number is approximately how much fuel you use to idle. For example, 800 RPM with no air conditioning consumes about 0.64 gallons of fuel an hour.[1,2]

RPM	AC off	AC on 50%	AC on
800	.64 gal/h	.70	.76
900	.73	.79	.85
1000	.81	.87	.94
1100	.92	.98	1.05
1200	1.03	1.09	1.15

[1] "Analysis of Costs from Idling and Parasitic Devices for Heavy Duty Trucks," Technology and Maintenance Council Recommended Practice Bulletin 1108, issued 3/95 (reprinted 2003 by TMC/ATA)

[2] Lutsey, N.P., J.P. Wallace, C.J. Brodrick, H.A. Dwyer, and D. Sperling, "Modeling Auxiliary Power Options for Heavy-Duty Trucks: Engine Idling vs. Fuel Cells," *Society of Automotive Engineers* 2004-01-1479, October 2004.

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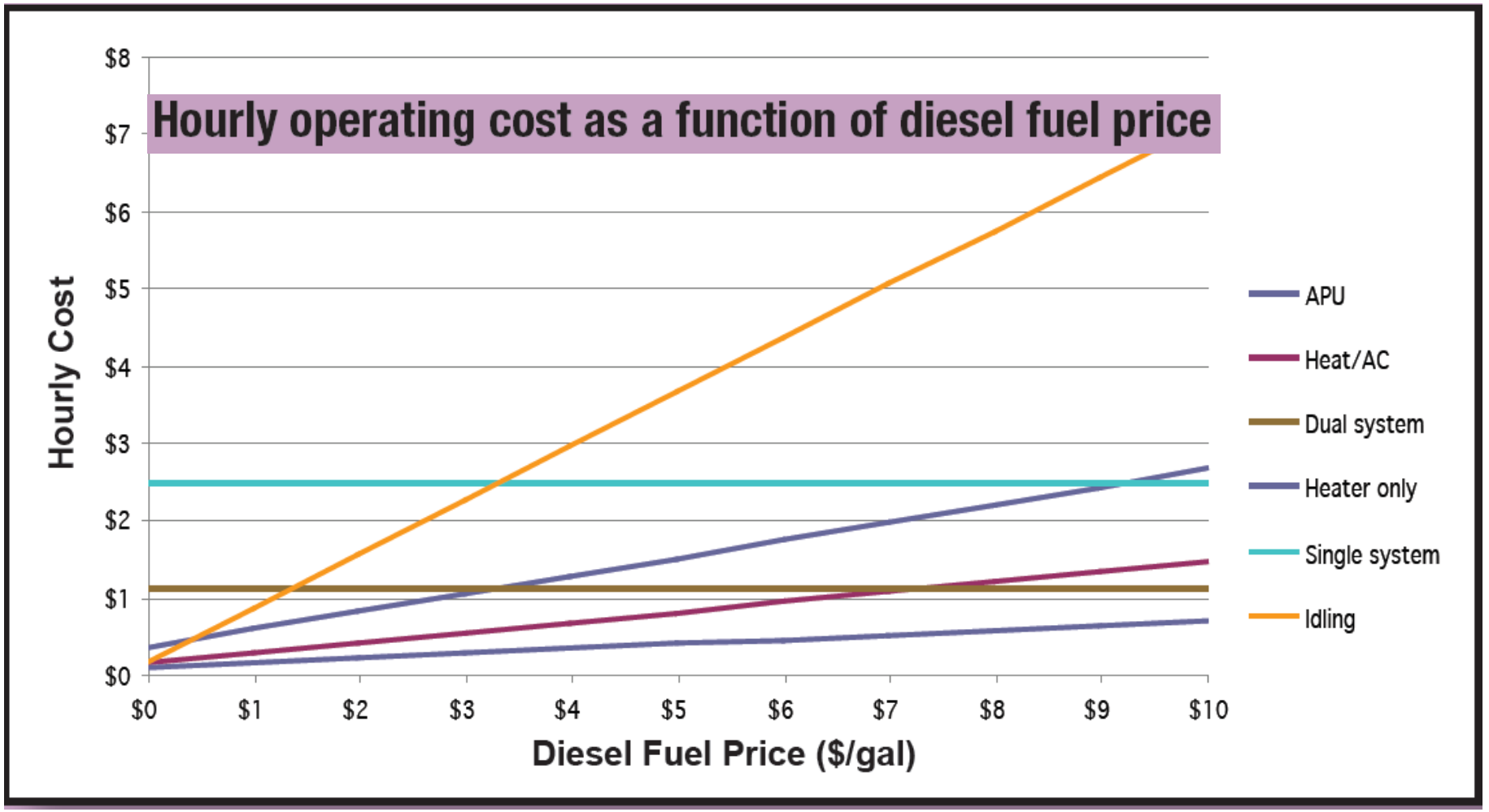
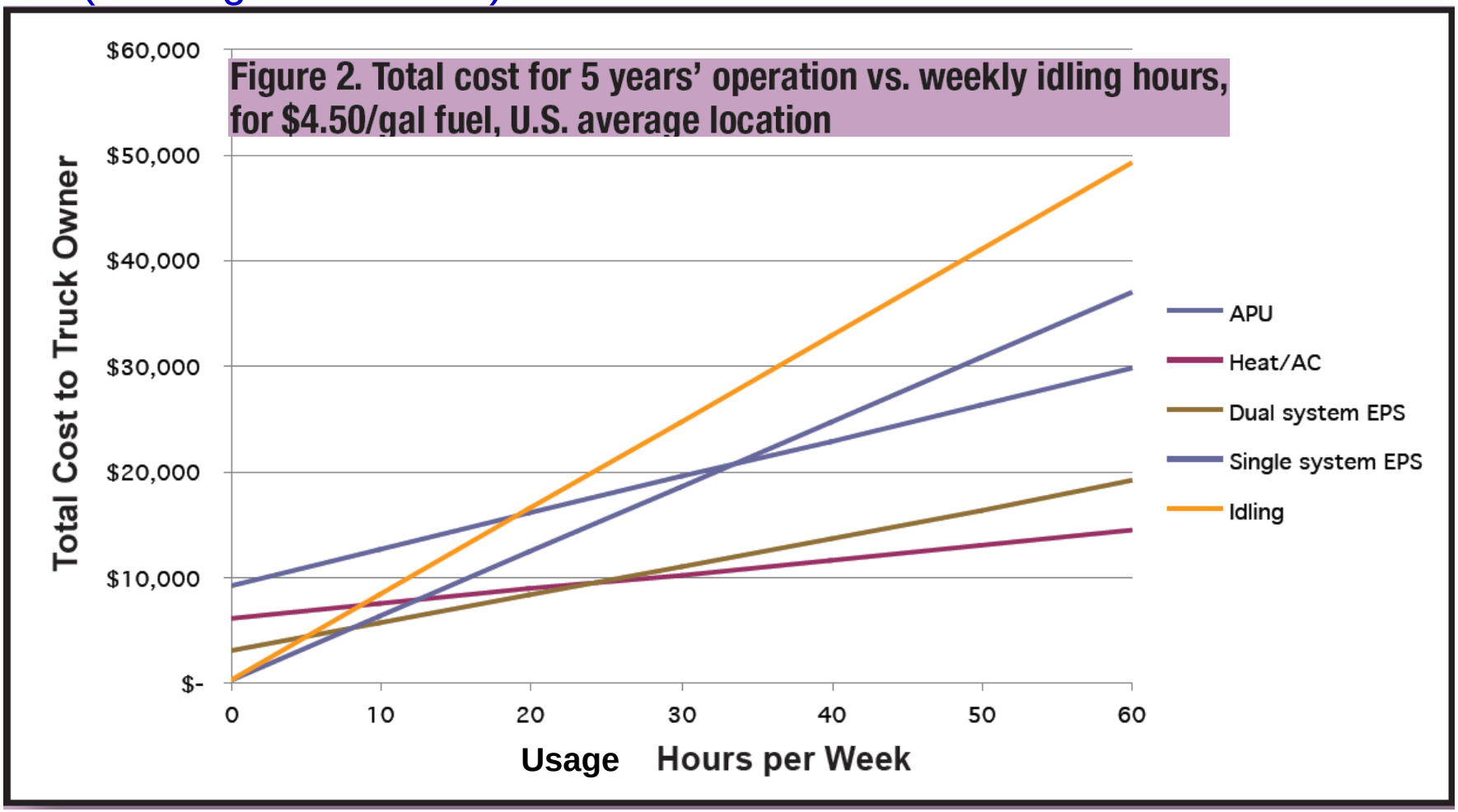
Hourly cost saving depends on fuel price

- Hourly costs fixed for wayside systems
- Rise with fuel cost for on-board options, including idling
- Operating cost for all options lower than idling if fuel >$3/gal



Savings to truck owner rise with idling hours

- Options with low investment save most for low idlers
- Options with low hourly cost save most for high idlers
- All alternatives produce savings for >18 hours/week idling ($4.50/gal diesel fuel)



EPS costs borne by infrastructure owner

Capital costs lower for dual system than single

Operating costs dominated by

- Service on debt
- Labor costs (some single systems)
- Electricity cost to lesser extent

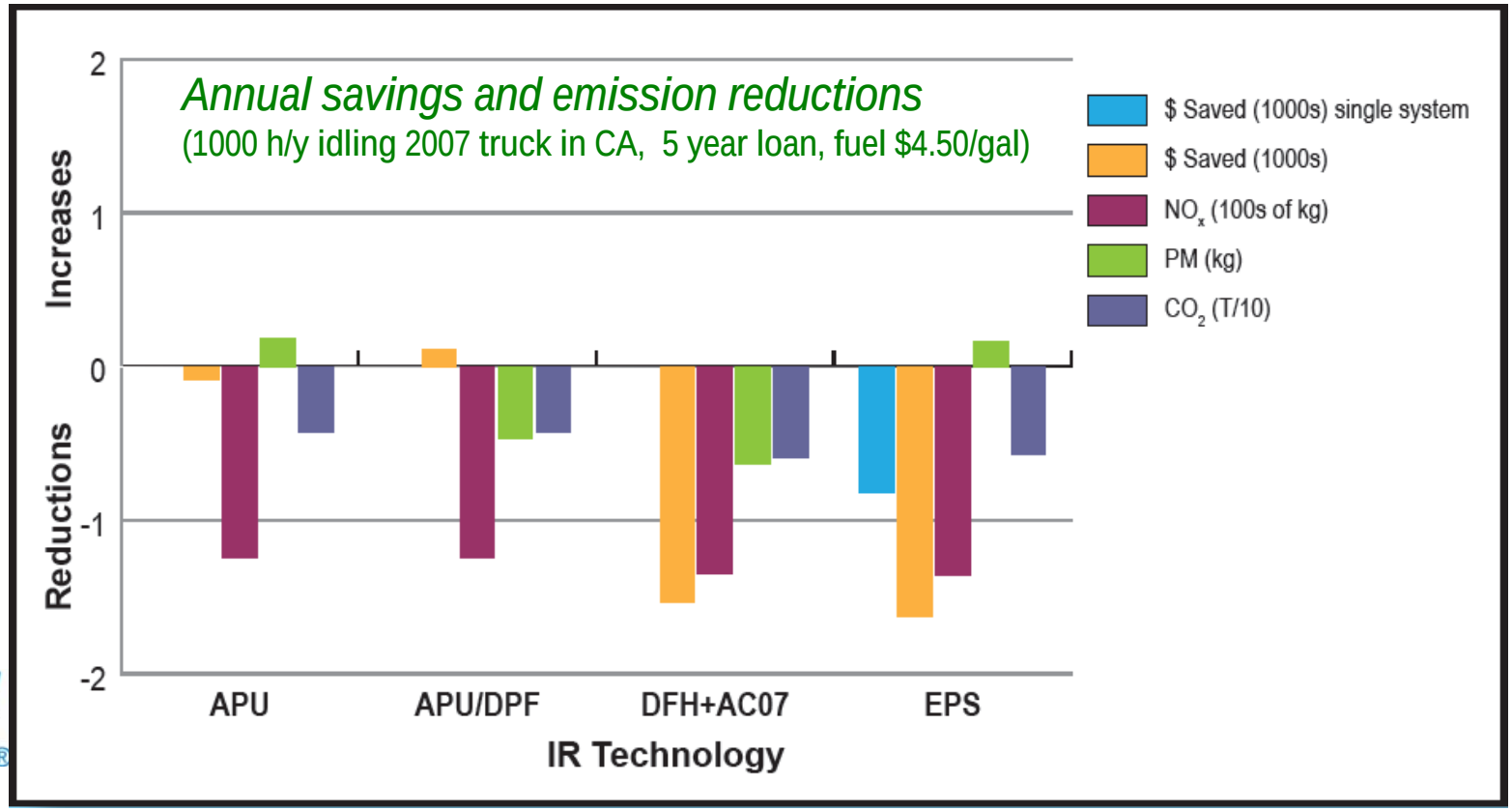
Revenues depend on parking space occupancy

- Major supplier has achieved about 25%
- Recently raised hourly charge

Long-term financial viability remains to be seen.

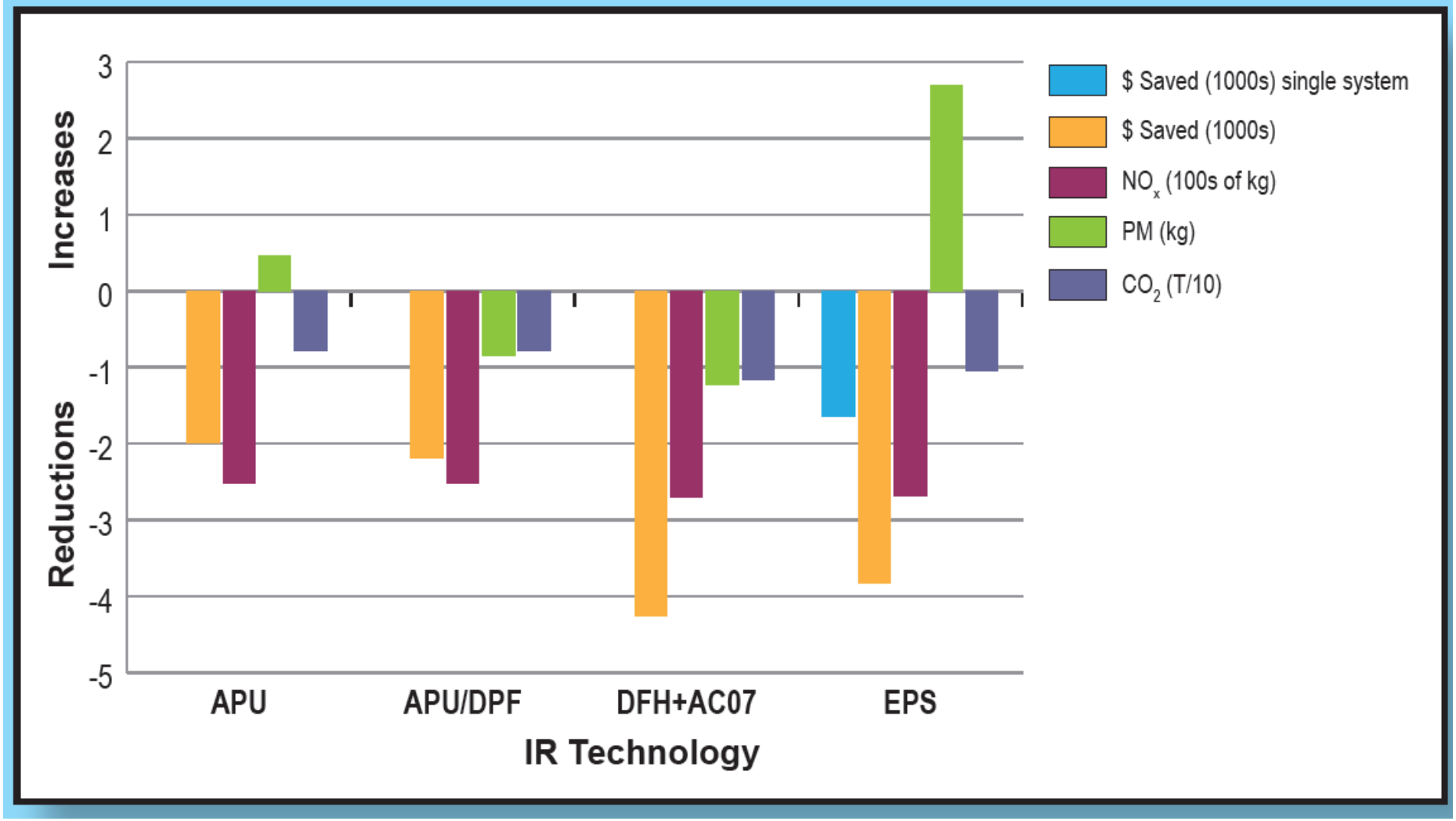
Bang-for-the-buck depends on costs, idling hours, and location

- All idling reduction options save truck owner money and reduce emissions
- Emissions occur at truck and upstream
  - Differ for heating and cooling
  - Differ by state-- heating/cooling mix, power generation mix, urban vs. rural locations
- For low idling times, capital-intensive systems slow to pay back (see graphs)
- For high idling times, operating cost is key factor
- Heater plus energy storage air conditioner beneficial under all conditions



High idling case, with electricity generated by coal

Figure 5. For Illinois, annual financial savings to truck owner and emission benefits compared to a 2007 truck for idling reduction options, 40 hours/week idling, $4.50/gal fuel



Thank you!

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