

# Sleep Cheap:

## How to Minimize Overnight Costs with Idling-Reduction Equipment

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# Idling-reduction devices can insure against high fuel prices

- All idling-reduction options provide
  - Cost savings
  - Emission reductions
- Savings depend on
  - Fuel price
  - Idling hours
  - Climate
- Combining devices can maximize savings



# Several technologies can reduce idling

- Most could be used for all heavy vehicle modes
- All reduce fuel use, emissions, and noise

## — On-board equipment

- Automatic engine stop-start controls
- Auxiliary power units (APU) and similar devices
- Diesel-fired cab and block heaters
- Air-conditioners
  - *Battery or thermal storage*

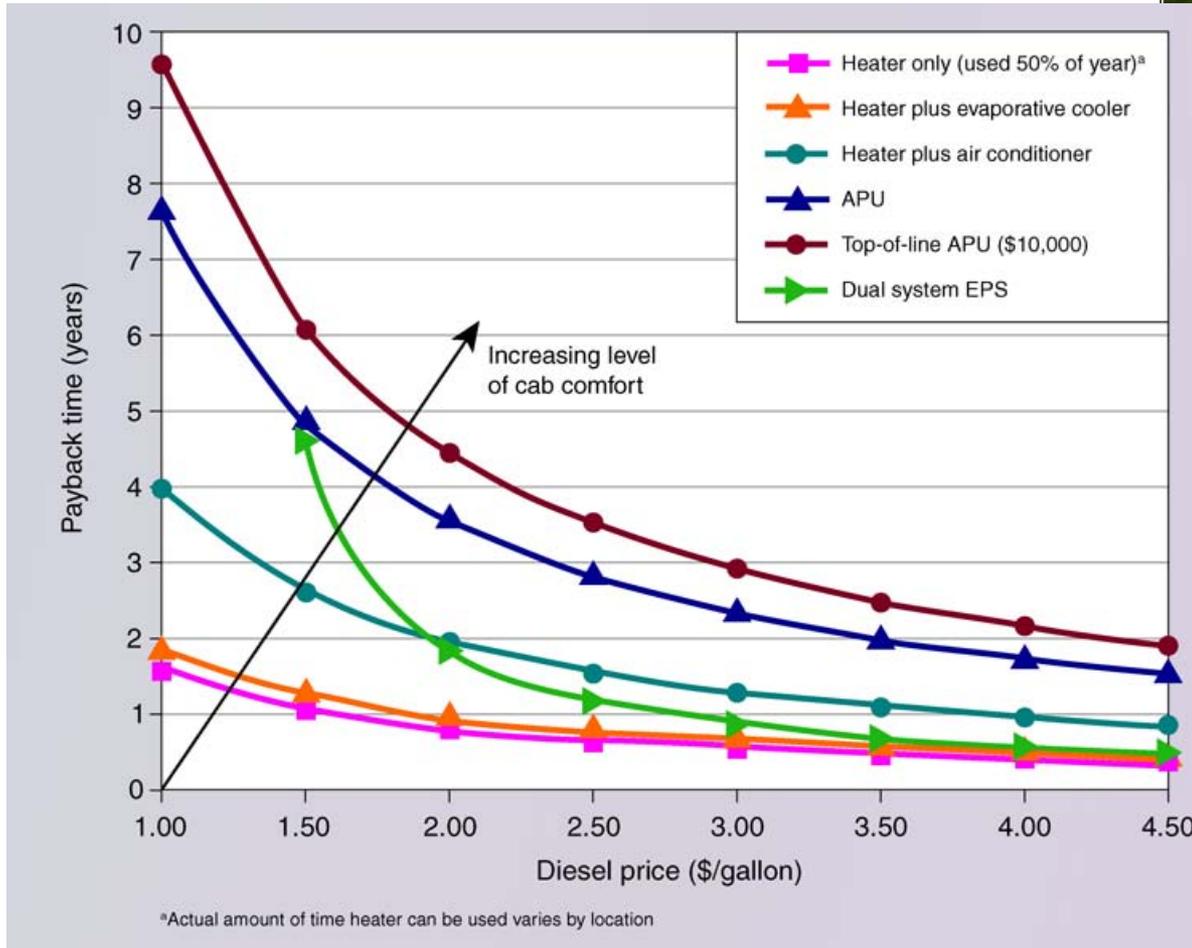
## — Wayside units (electrified parking spaces, EPS)

- Single-system electrification
  - *Requires no on-board equipment*
- Dual-system (shore power)
  - *Allows driver to plug in on-board equipment*
  - *Can plug in dual-capable APU*



# Idling reduction is low-hanging fruit

*It pays for itself in 5 years or less!*



# Technologies have pros and cons

System	Services	Advantages	Disadvantages
Idling	All	No investment	High emissions, noise, fuel use
Automatic start-stop	All, intermittently	Low cost	Noisy, minimal benefit in winter
APU	All	<b>Anywhere, anytime</b>	High cost and weight
Electrified parking space	All	No <b>local</b> emissions, pay-per-view, quiet	<b>Requires equipped location, cost</b>
Heater	Heating	Low cost and weight	Not full service
Air-conditioner	Cooling	Low cost	Not full service, may be heavy

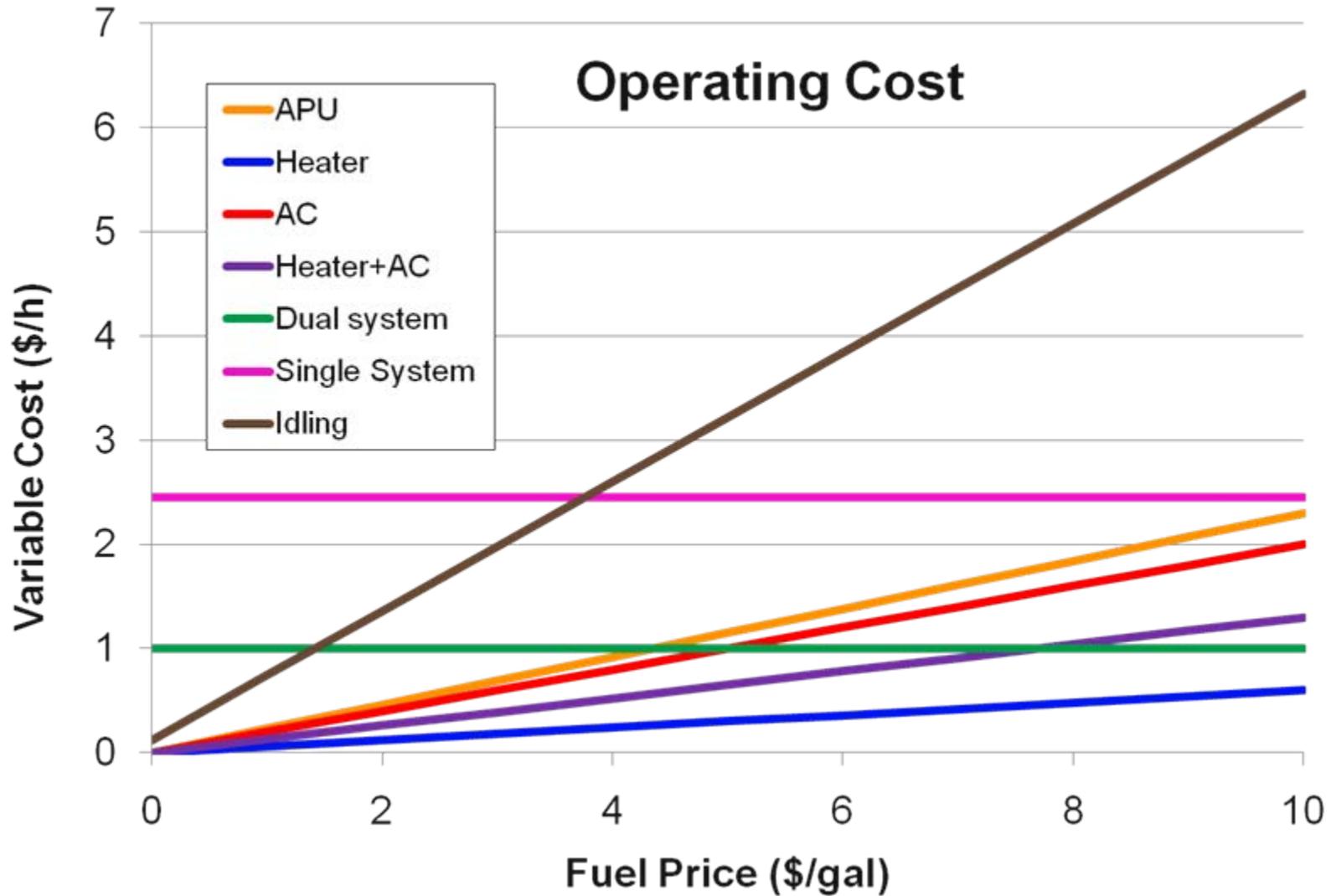


## We used typical cost factors

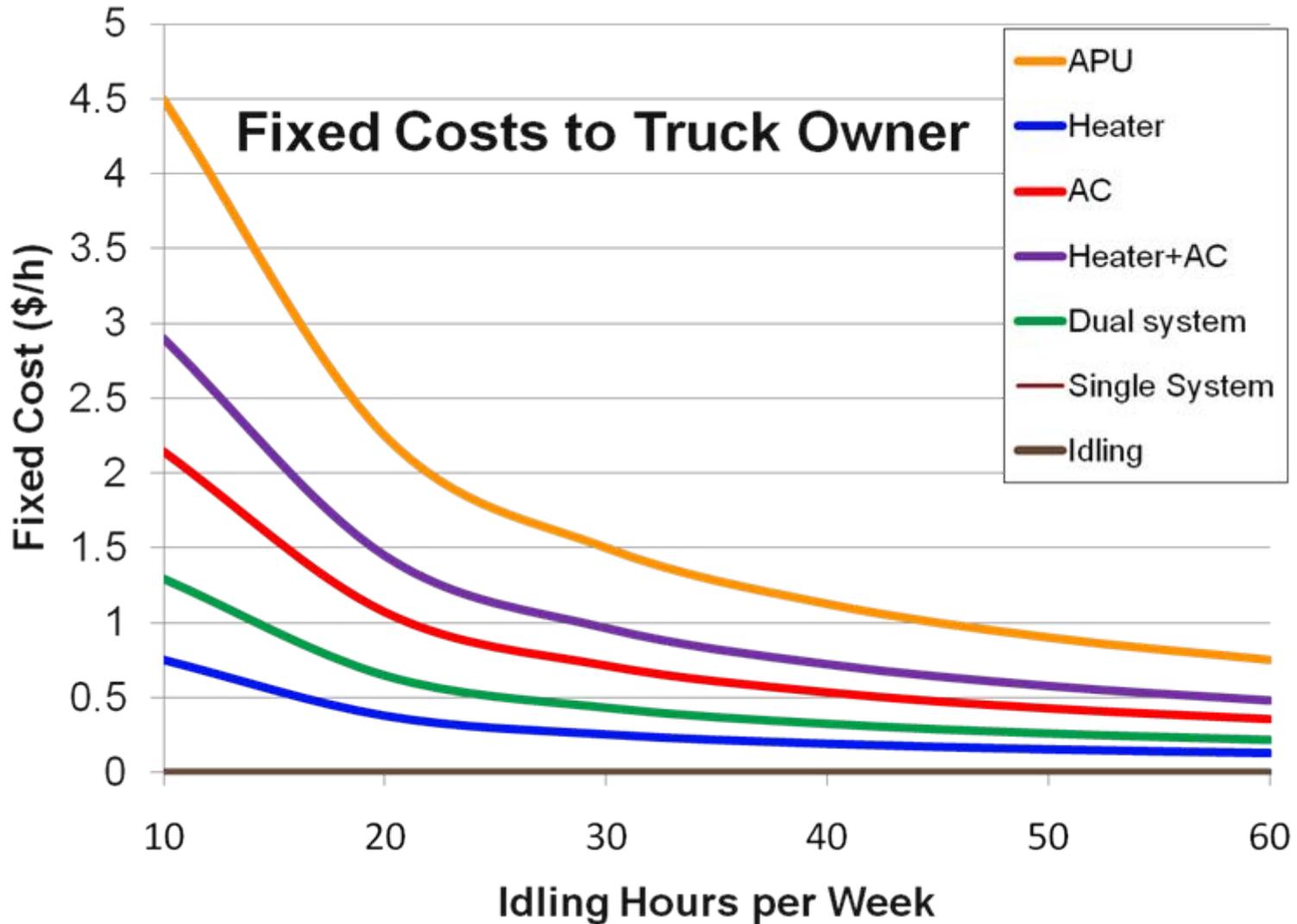
System	Services	Fuel Use/hr	On-board Cost (\$)	Maintenance (\$/hr)	Infrastructure cost (\$/space)	Usage Charge (\$/hr)
Idling 2001 truck	All	0.77 gal cooling	0	0.12	0	0
		0.98 gal cooling				
Idling 2007 truck	All	0.53 gal heating	0	0.12	0	0
		0.72 gal cooling				
Cab/bunk heater	Heating	0.06 gal	1,250	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



# Operating cost for on-board devices rises with fuel cost

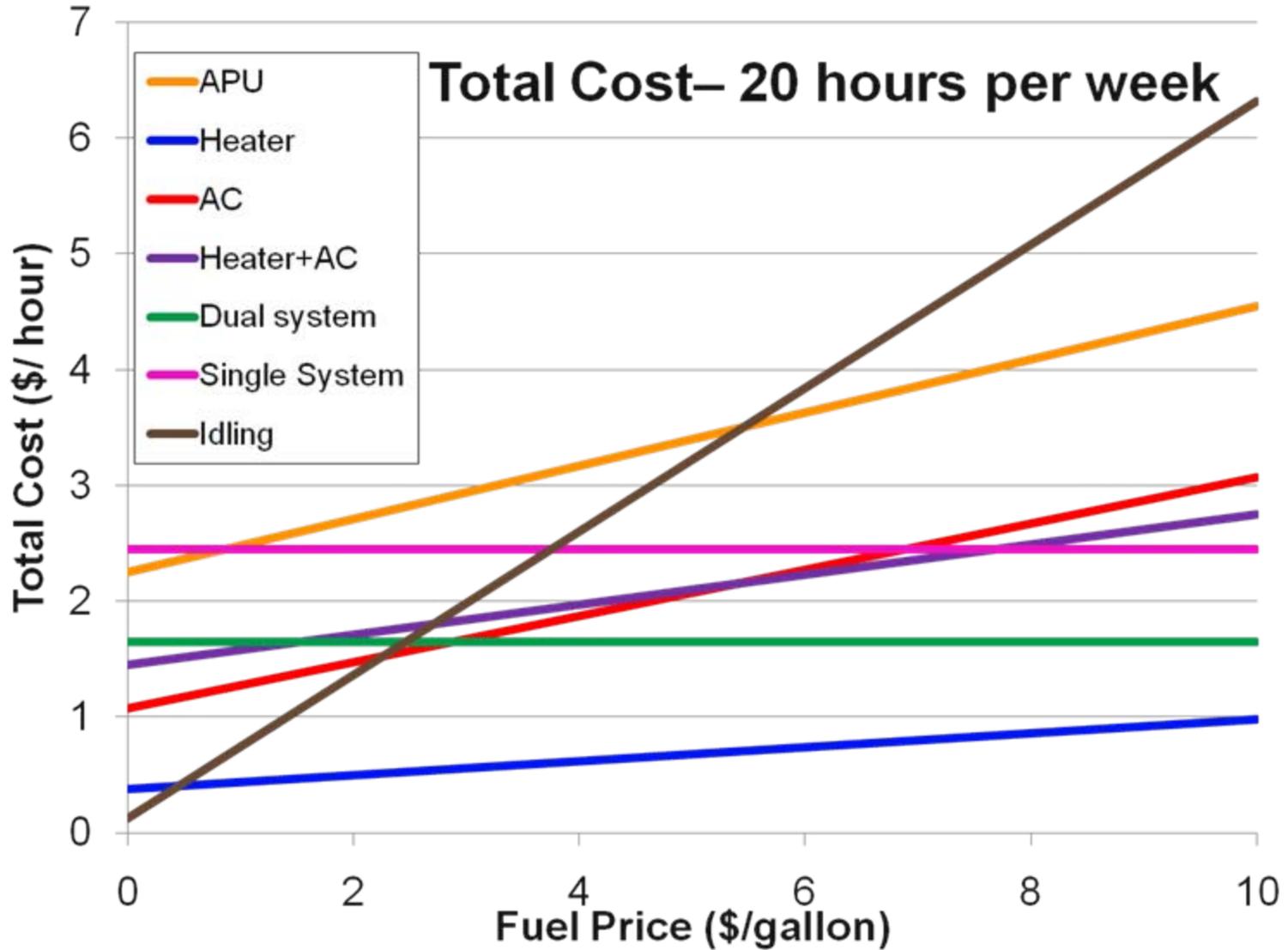


# Fixed cost decreases when amortized over many hours

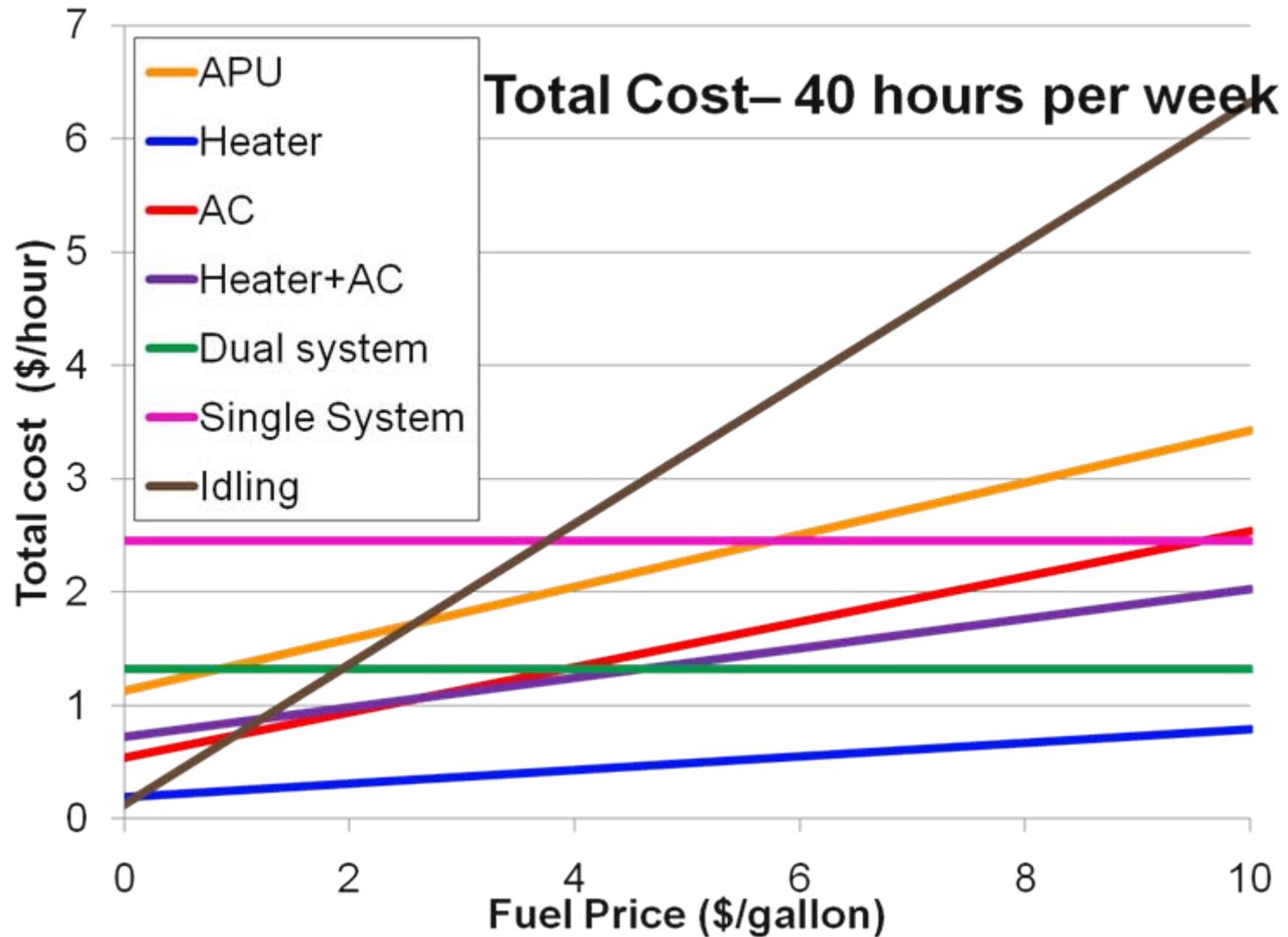


Note: 5 years of use is assumed

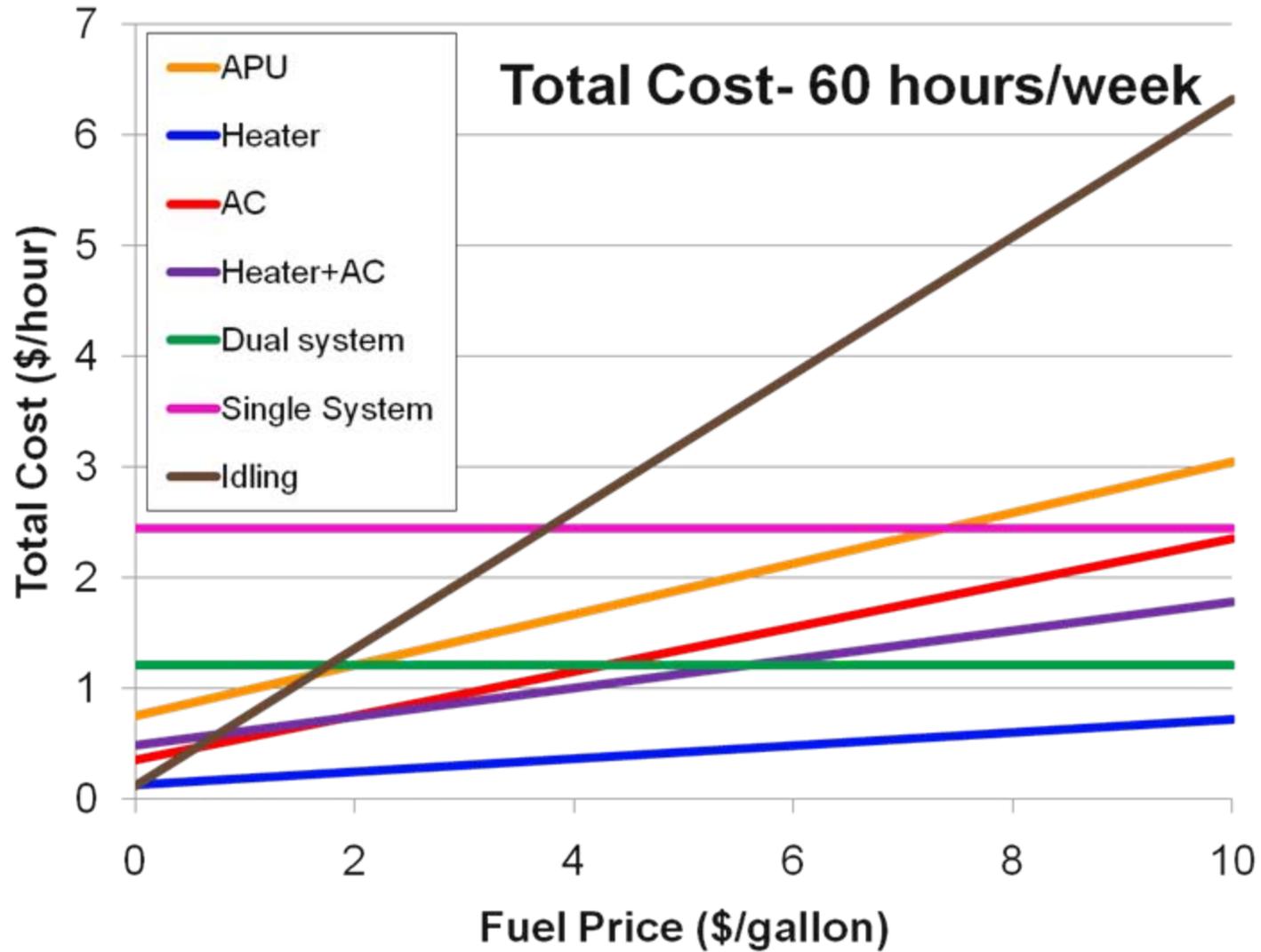
# Total cost per hour for low idlers



# Total cost per hour for average idlers

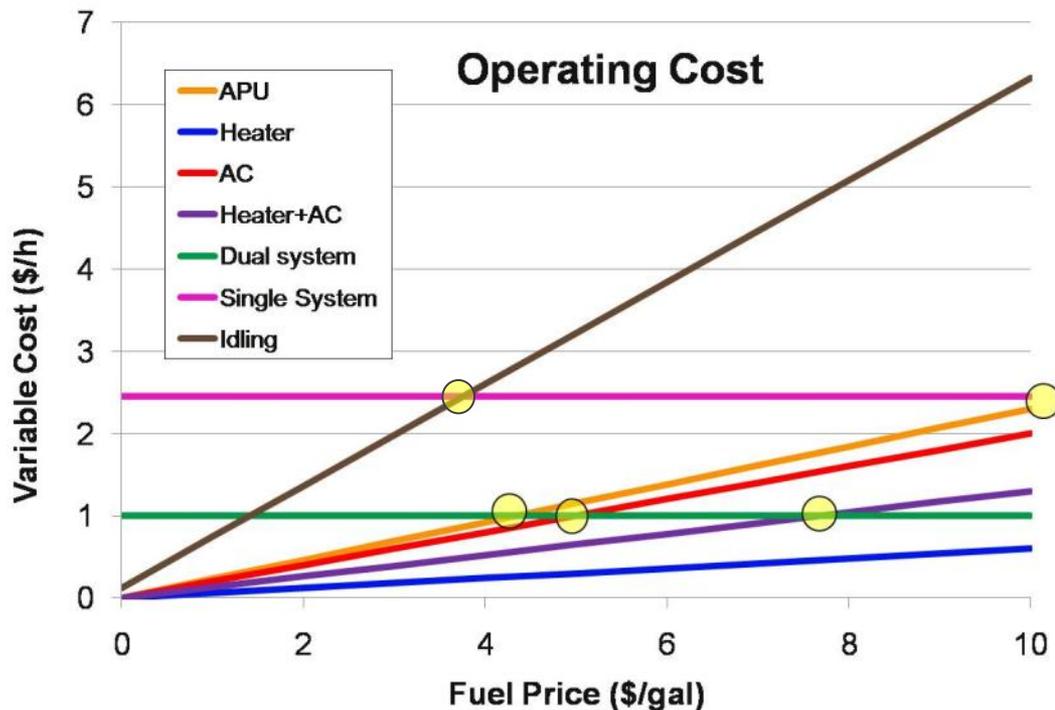


# Total cost per hour for high idlers



# If fuel prices change, users with flexibility can switch

- Previous slides assumed driver was stuck using a single device
  - Purchase decision was based on forecast of average price over 5-years' use
- Crossover allows driver to reduce actual operating cost
- Flexibility depends on what's on board
- Driver never has to pay more than it costs to plug in
  - Pays less if fuel cost below cross-over point
- Flexibility bounds hourly cost and insures against high fuel price



## Truck owner can cap cost by plugging in at high fuel price

Switch from	Plug into	Above Fuel Price (\$/gallon)	Maximum Total Hourly Cost (\$)		
			20 h/week	40 h/week	60 h/week
Idling	Single system EPS	\$3.80	\$2.45	\$2.45	\$2.45
APU (electric-capable)	Dual system EPS	\$4.40	\$3.25	\$2.10	\$1.75
APU (not electric-capable)	Single system EPS	\$10.20	\$4.70	\$3.55	\$3.20
Battery AC	Dual system EPS	\$5.00	\$2.10	\$1.55	\$1.35
Thermal storage AC	Single system EPS	\$12.25	\$3.55	\$3.00	\$2.80
Heater	Single system EPS	\$40.80	\$2.80	\$2.65	\$2.55
Dual system EPS		any	\$1.65	\$1.30	\$1.20

- Table is based on per-hour price for largest single-system EPS purveyor
- Lower price would lower cross-over point and make use more attractive to on-board equipment owners.



# Thank you!

- Work sponsored by DOE Office of Vehicle Technologies
- For more information, check out:  
<http://www.transportation.anl.gov/engines/idling.html>
- Contact me: [lgaines@anl.gov](mailto:lgaines@anl.gov)

