10 YEARS
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Rick Mihelic

Director Future Technologies Studies
North American Council for Freight Efficiency

Electric Trucks – The Future of Freight

NACFE

www.nacfe.org

- Unbiased, non-profit
- Mission to double freight efficiency
- Fleets, manufacturers, shippers, software, governments, associations, etc.
- Scale available technologies
- Guide future change

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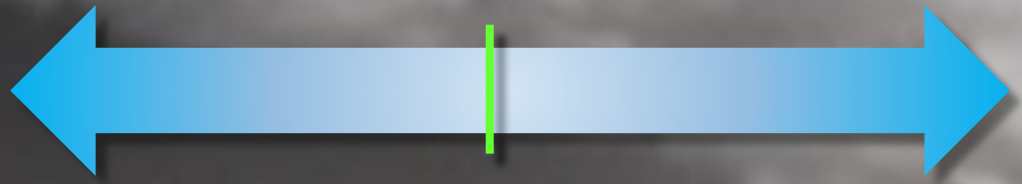
Electric Trucks

Finding A Middle Ground

"I don't believe in electric trucks"



"It's the end of diesel"

"Right product for every customer
No predetermined answer for them"
Tim Proctor – Cummins

"No one solution that fits all fleets
We consider all technologies"
Mike O'Connell – PepsiCo

Argument **FOR** Electric Trucks		VS.	Argument **AGAINST** Electric Trucks	
1	Commercial battery electric vehicle (CBEV) weight is not an isue	**WEIGHT**	1	Vehicle tare weight is too high to support my freight needs
2	CBEV technology is proven and here now	**TECHNOLOGY**	2	Technology is not ready
3	Maintenance will be less costly		3	Maintenance may not be less costly
4	CBEVs will last beyond 10 years		4	Vehicle life is too short
5	CBEVs will be competitively priced	**COST**	5	Vehicle purchase price is too high for a positive ROI
6	CBEVs will be less expensive to operate		6	Vehicle operating costs are too great for positive ROI
7	CBEVs will command a premium at resale		7	Vehicle residual value is questionable
8	Trust the market to provide CBEV charging solutions	**CHARGING**	8	Charging infrastructure is not ready
9	Trust the market to provide CBEV charging solutions		9	Charging Infrastructure is not fast enough
10	The grid and market will evolve with CBEVs		10	The electric grid cannot support growth in electric vehicles

NACFE's findings on these 10 arguments are discussed in detail in its Electric Truck Guidance Report

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Weight

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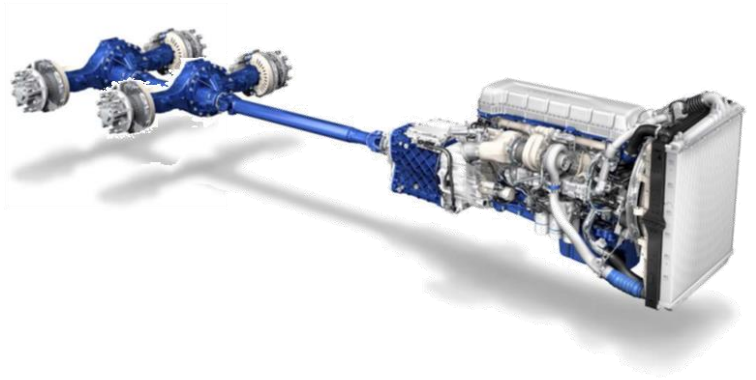
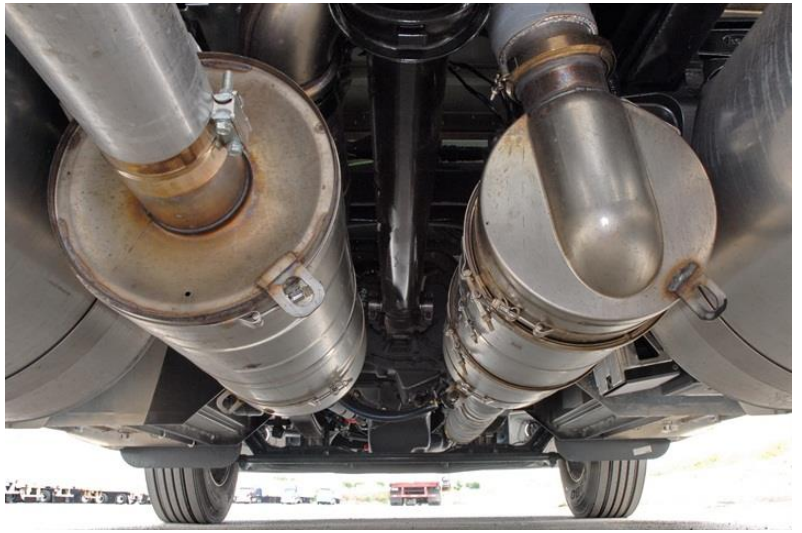
What Comes Out of a Diesel Truck?

- Engine & Transmission
- Drive Lines and Axles
- Emissions Systems
- Fluids, Tanks, Lines
- Filters
- Charge Air & Turbos

Over 7,800 lbs





Diesel Truck Subsystem	Approximate Weight (lb)
Engine & Related	2,300
Transmission & Related	810
Driveshaft Parts	230
Fuel Tank & Related	200
Rear Tandem Axle	1,200
Exhaust/Emission Systems	480
Diesel Fuel (full)	1,728
DEF	209
12V Batteries (3)	180
Cooling System	310
Other Brackets, Mounts, Cables, Components	200
Total Diesel Related	7,847

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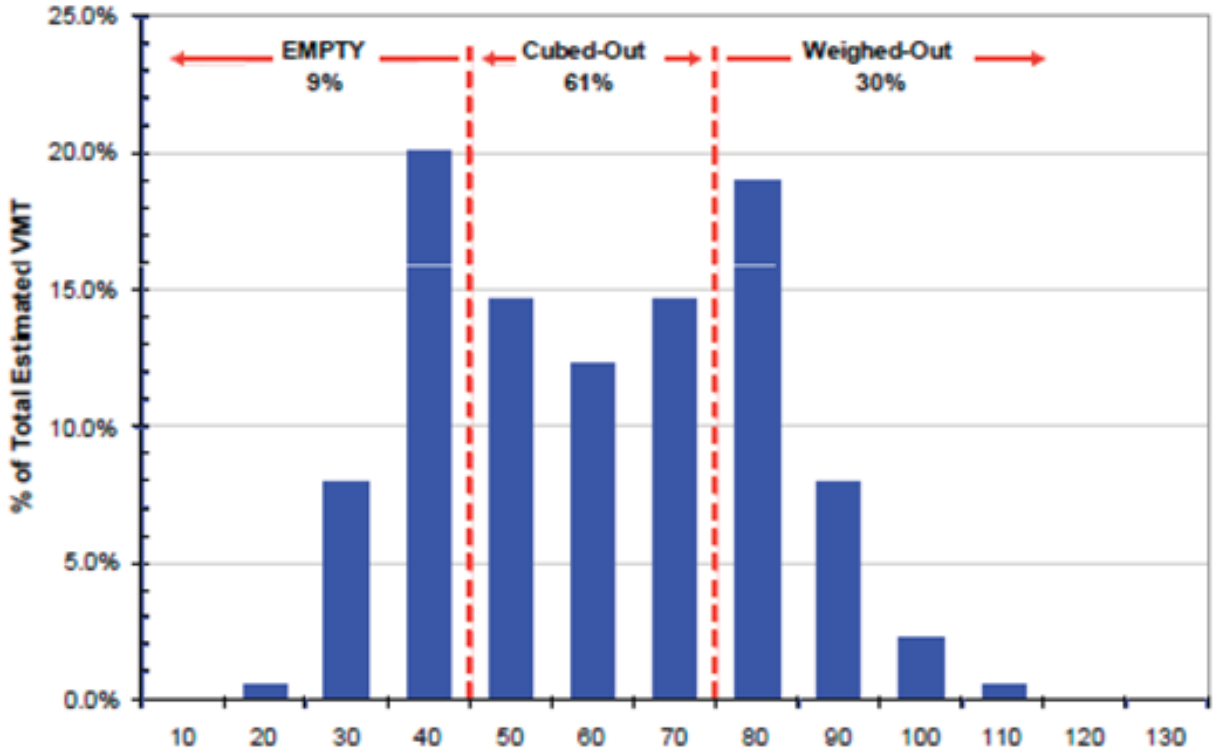
How Much Freight Is Really Carried?

- Duty Cycles Differ
- Loads Vary
- “Average” Is Not Typical
- Empty or Cubed Out

Many
Not At Max GVWR



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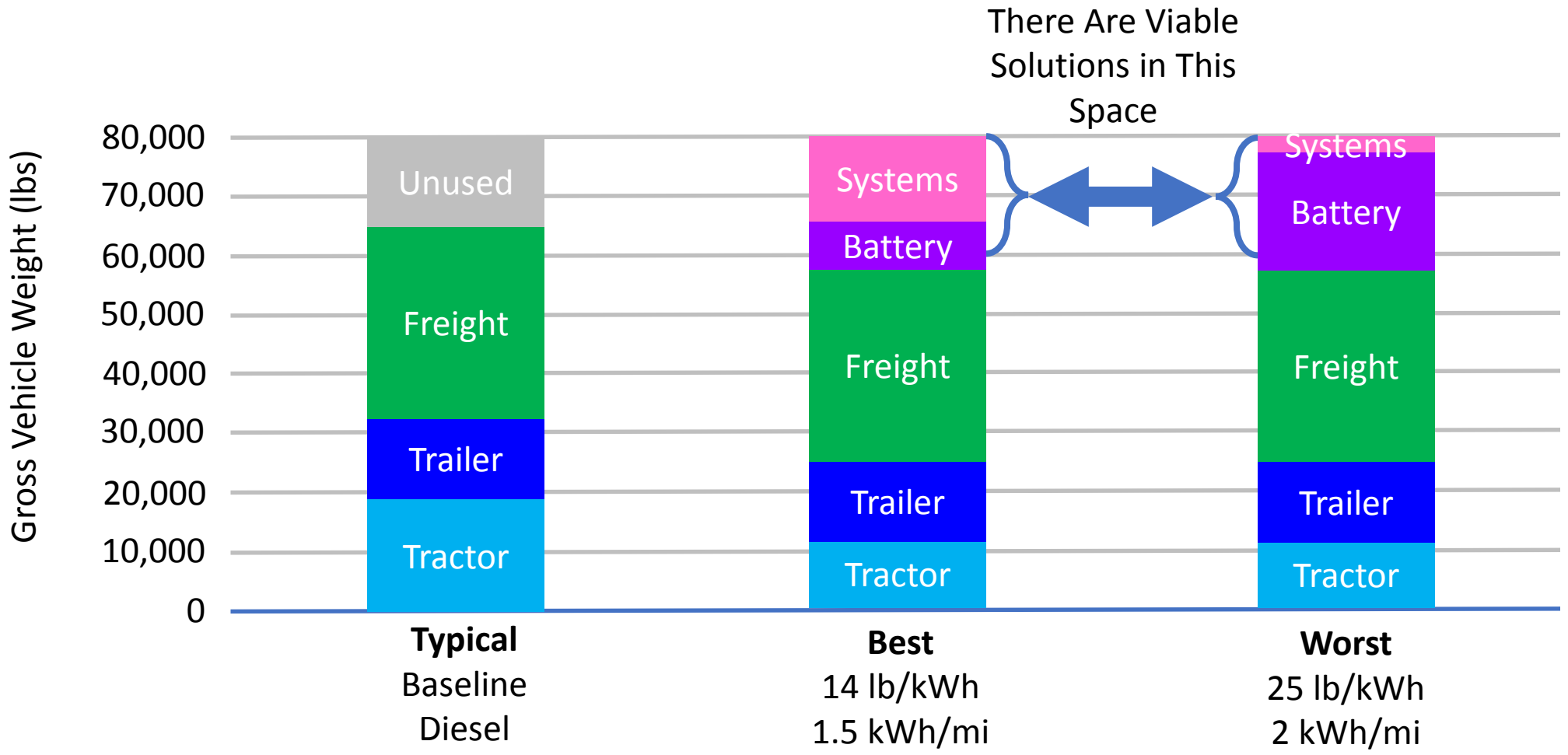
Weight Estimates



Viable For Many Duty Cycles

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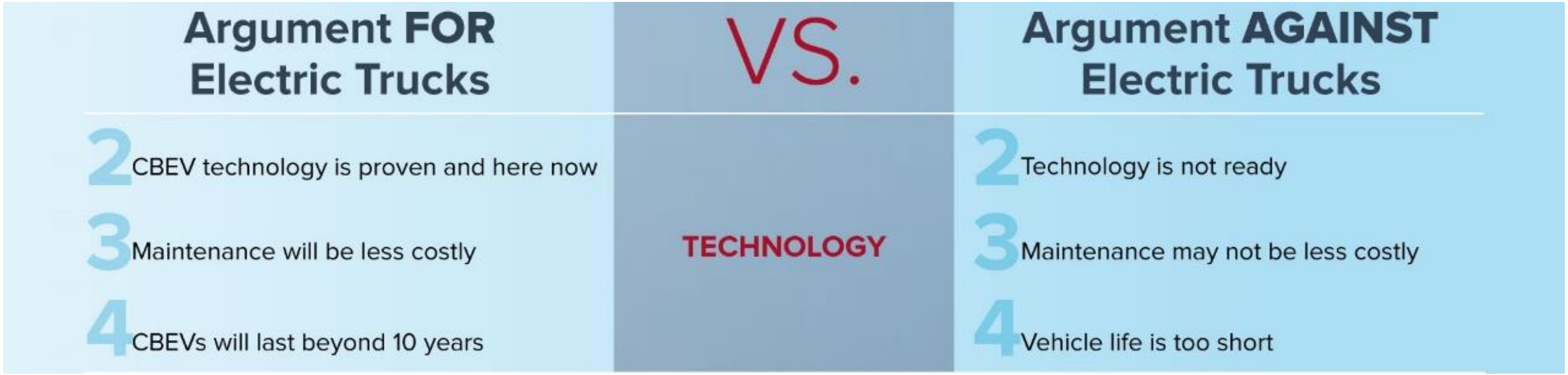
Technology



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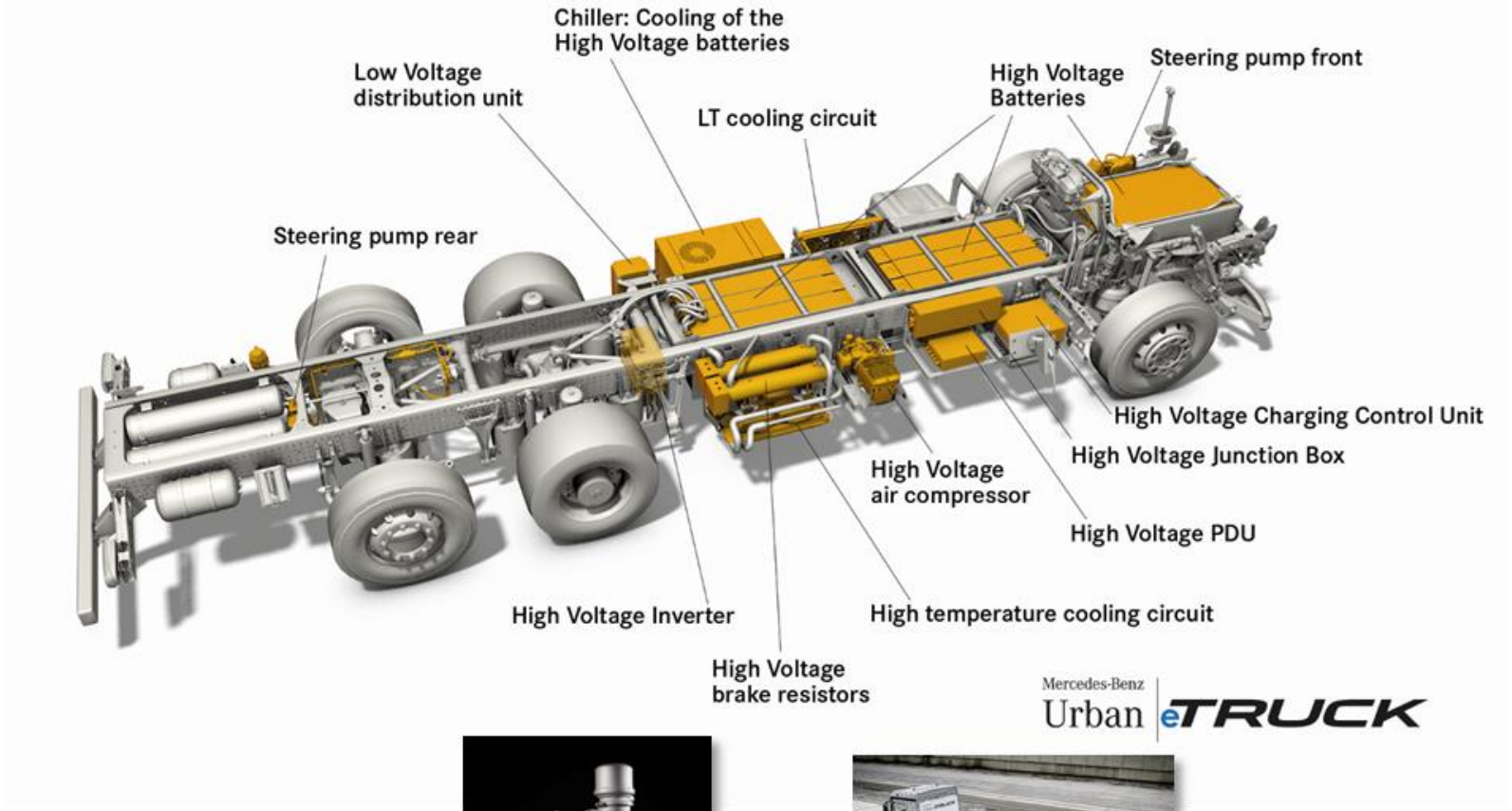
Is The Technology Ready?

SAE J1772 Level 2



Mercedes-Benz Urban eTRUCK

Yes, But…

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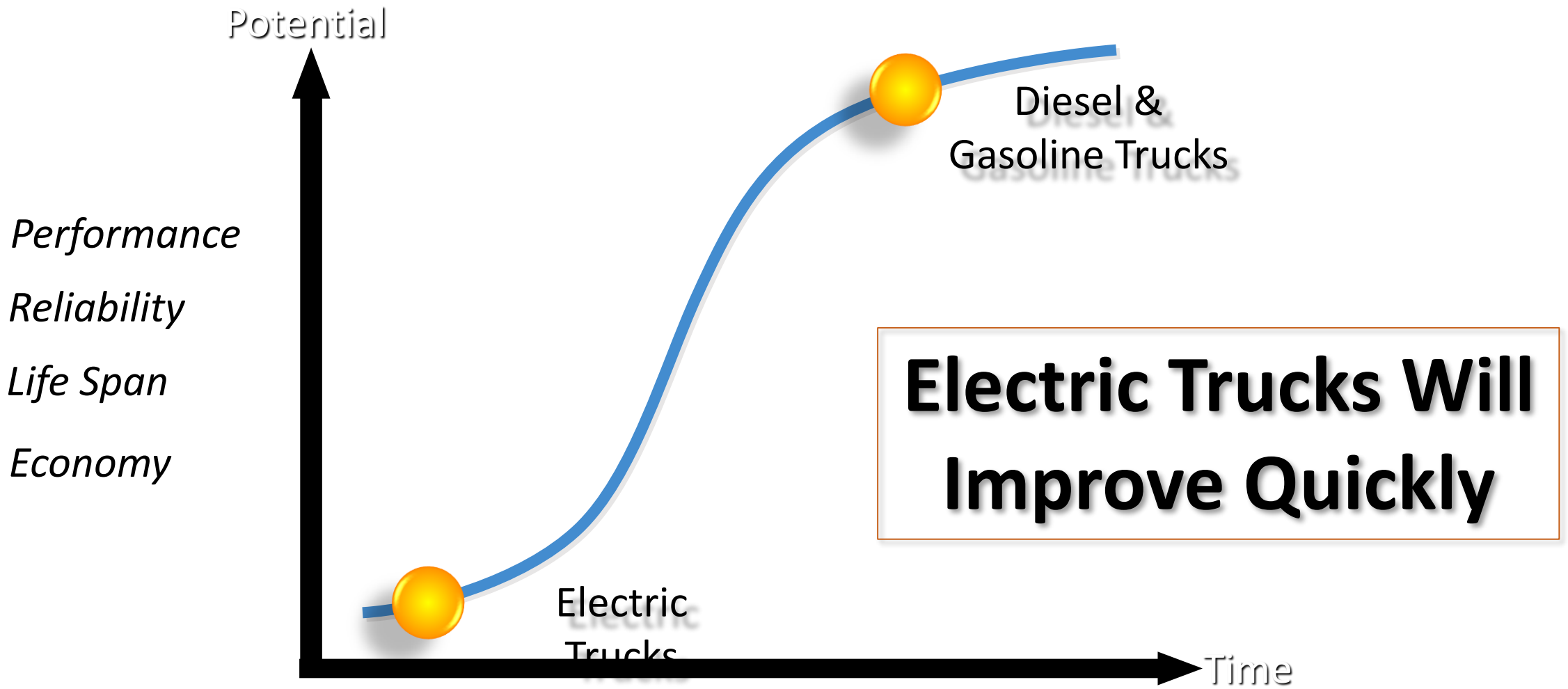
Technology S-Curve



Electric Trucks Will Improve Quickly

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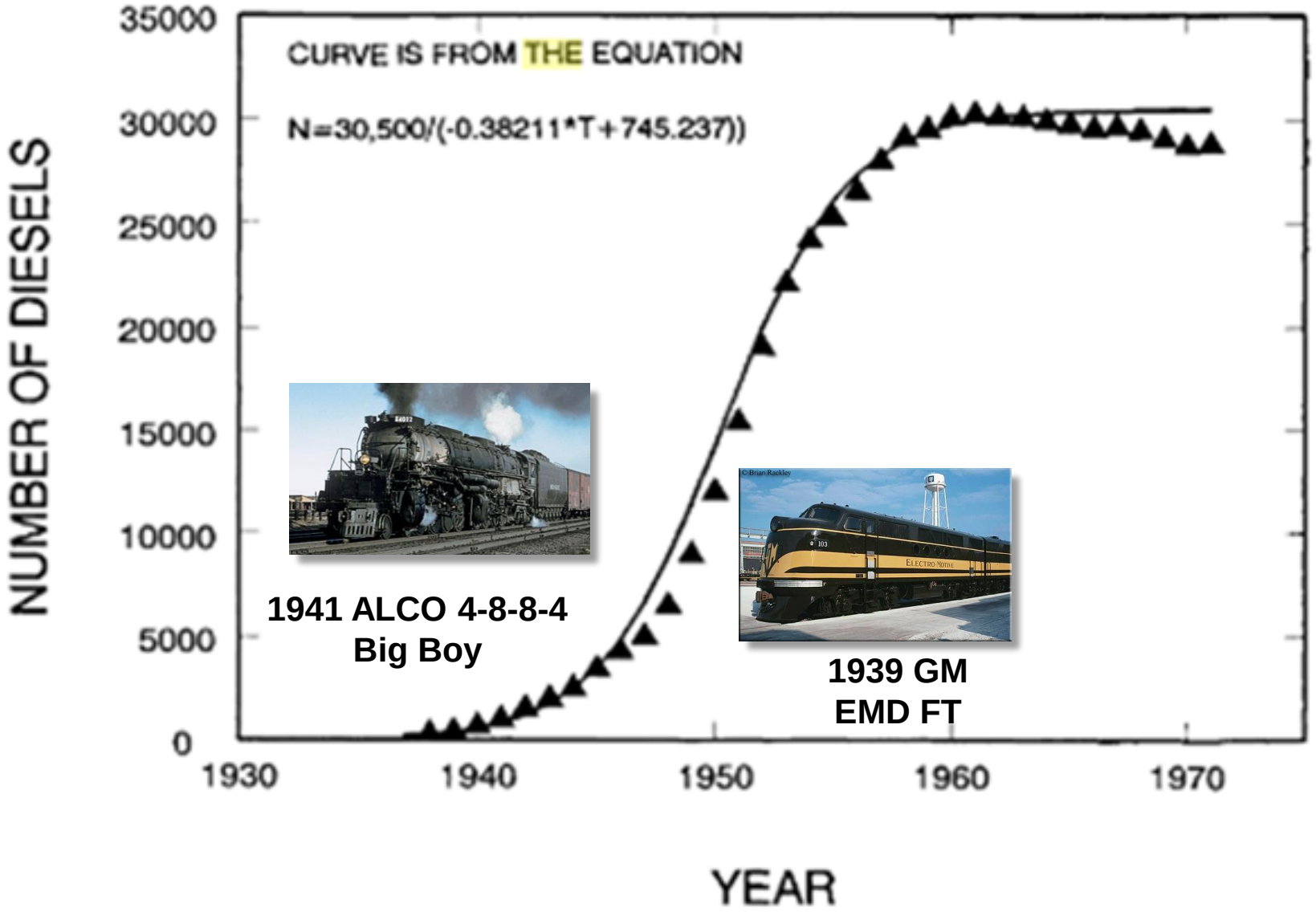
Historical Precedence



Innovation Diffusion 20 Years

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Vehicle Cost

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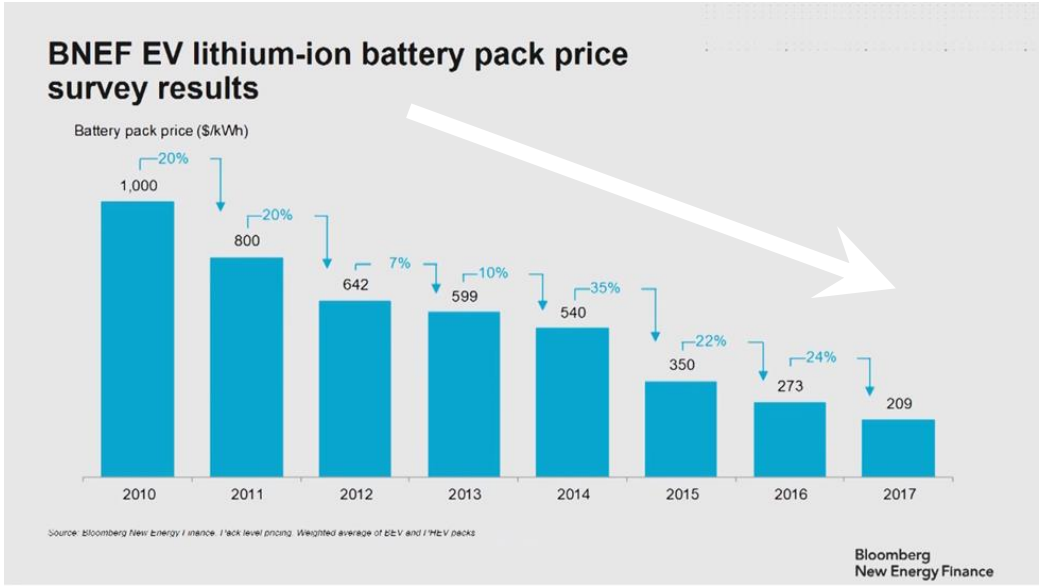
Cost Trends

- Less costly / more capable every year
- Cost equalizers - Incentives, grants, tax breaks
- “Clean sheet” designs vs. component replacement mentality
- Improved manufacturing efficiencies w/scale
- Potential less service costs & higher reliability
- Unknown residual market pricing

$ Downward



UPS & Workhorse New BEV - “It’s also an industry first because the acquisition cost is comparable to gas and diesel.”

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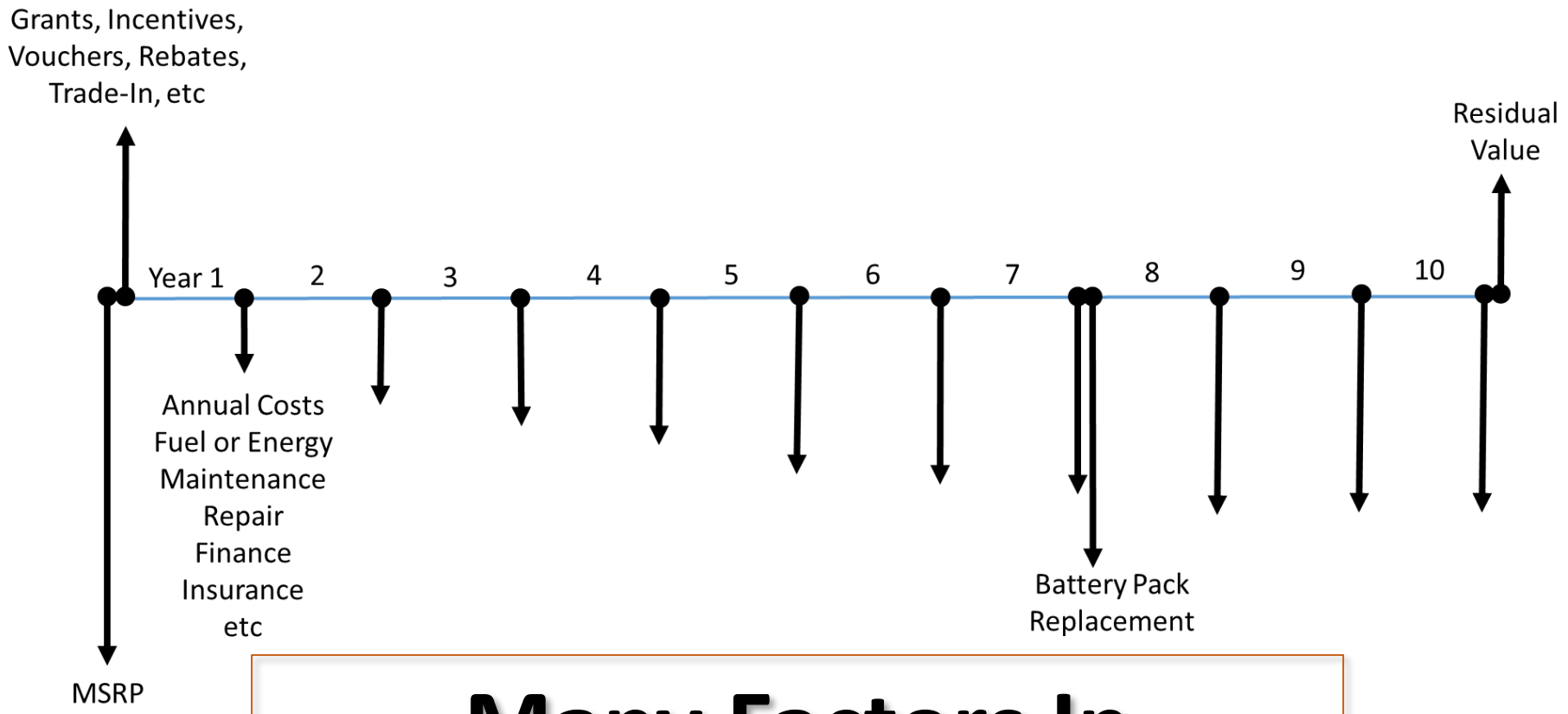
NACFE TCO Calculator



Many Factors In Total Cost Of Ownership Comparison

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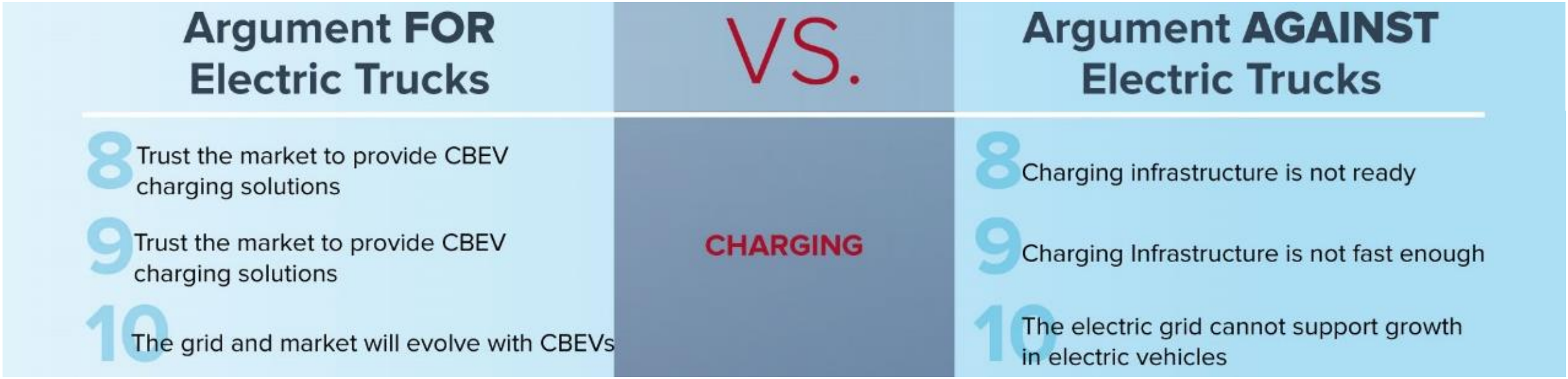
Charging



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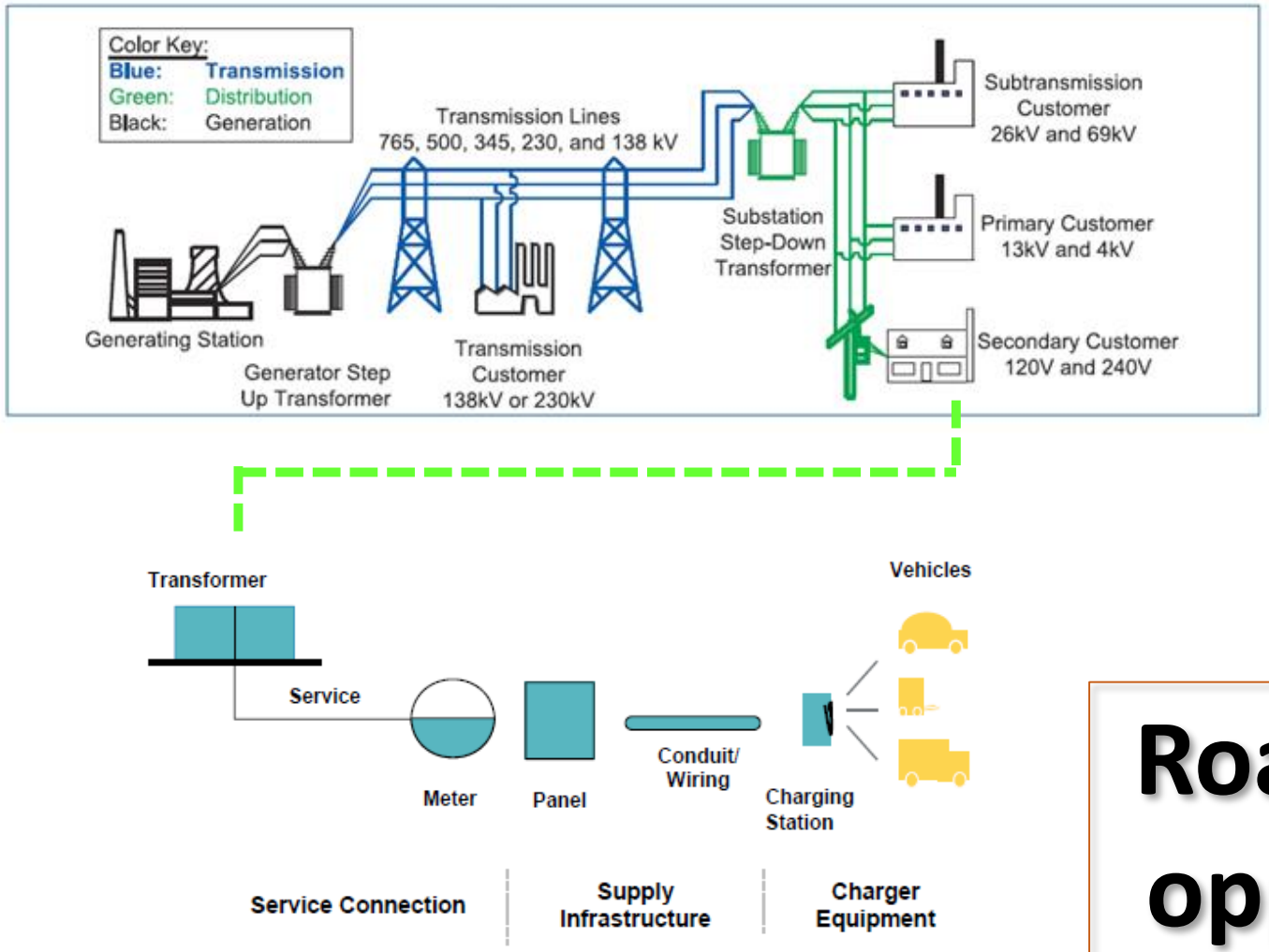
Charging Infrastructure



Roadblocks to some are opportunities to others

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Mixed Technology Fleets

Mixed Tech Fleets Are The Norm

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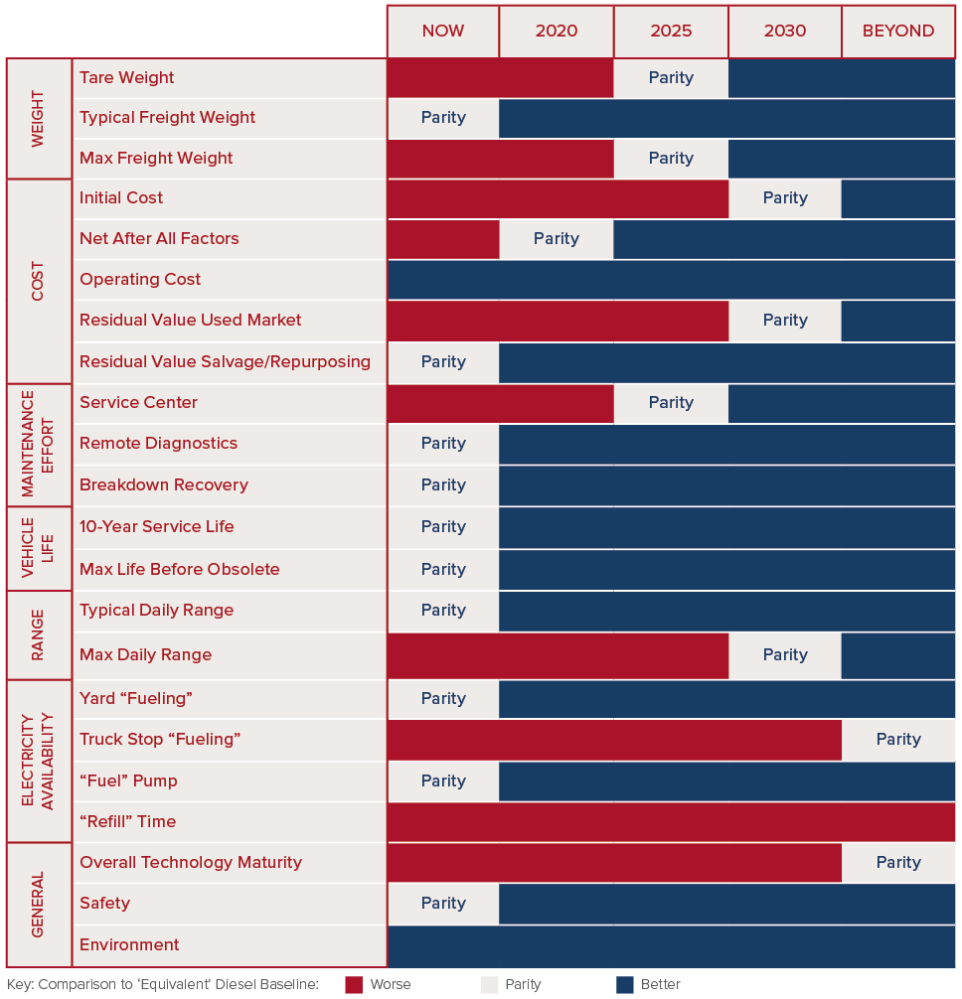
22 Points Of Parity

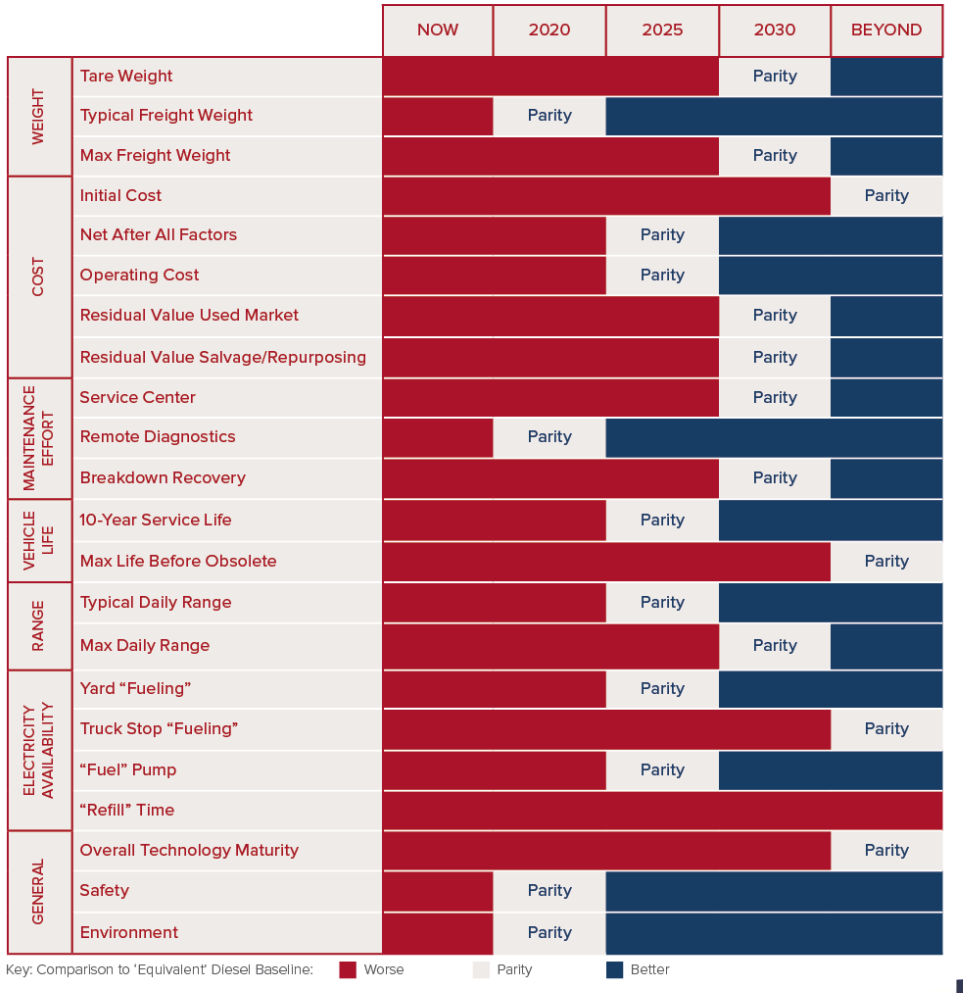
Medium Duty Class 3-6

CLASS 3 THROUGH 6 CBEV PARITY VS. DIESEL SYSTEM (NACFE)



Heavy Duty Class 7-8

CLASS 7 AND 8 CBEV PARITY VS. DIESEL SYSTEM (NACFE)



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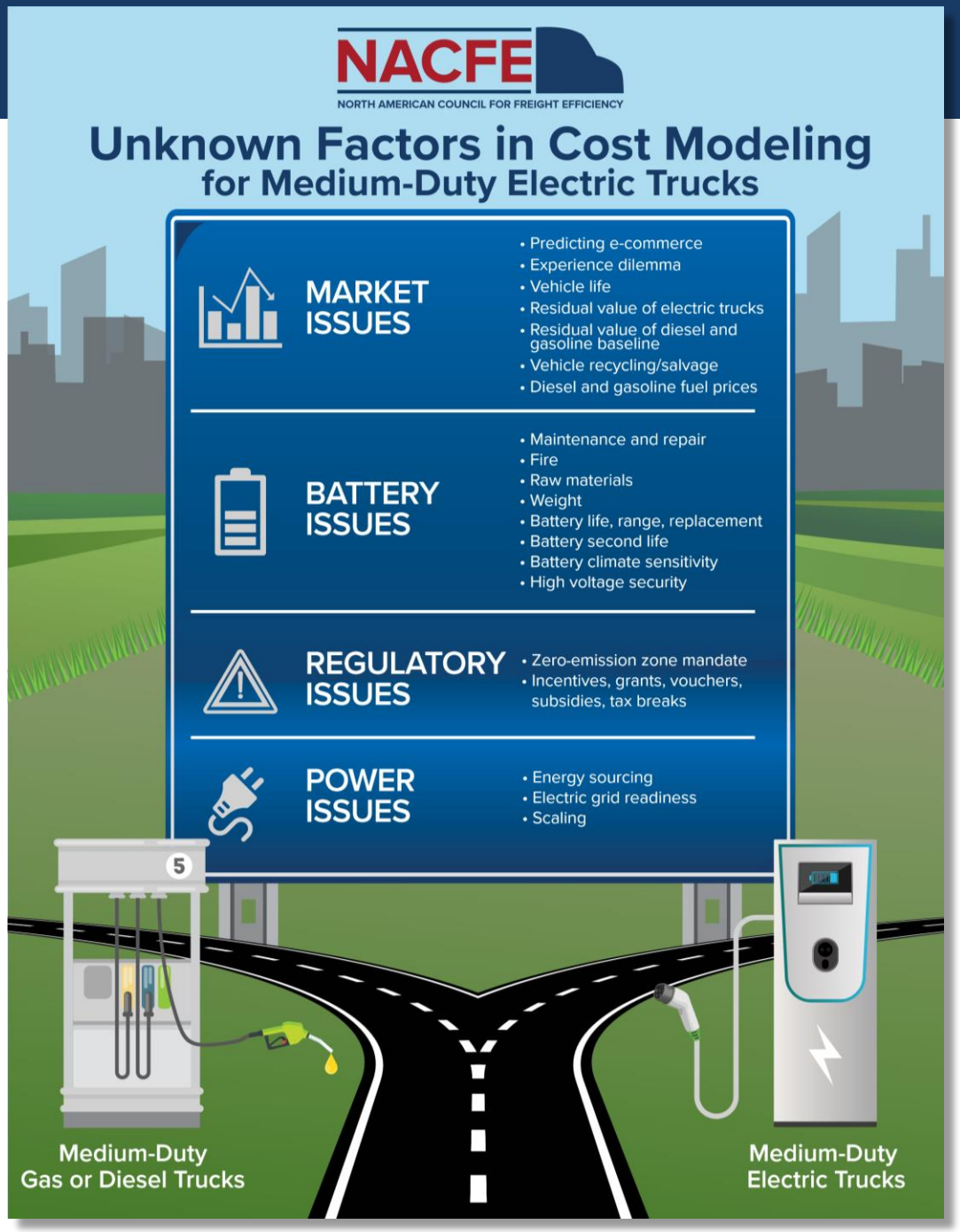
Knowns & Unknowns

- Market Issues
- Battery Issues
- Regulatory Issues
- Power Issues



Summary

Electric trucks will succeed or fail under
the intense spotlight of the marketplace

Electric trucks are not for every market
but they are viable in some

Innovation is rapid in this space
not just for trucks, but for infrastructure and
business models

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Thank You

More Details - www.NACFE.org

NACFE Guidance Reports-

Electric Trucks – Where They Make Sense	May 2018
Medium Duty Electric Truck Total Cost of Ownership	Oct 2018
Amping Up: Charging Infrastructure for Electric Trucks	Mar 2019
Class 7/8 Regional Alternatives	Fall 2019
Class 8 On-Highway Alternatives	Winter 2019

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THANK YOU