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Trade-Off Between Fuel Economy and Cost for Advanced Vehicle Configurations

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Methodology

PSAT (ANL)

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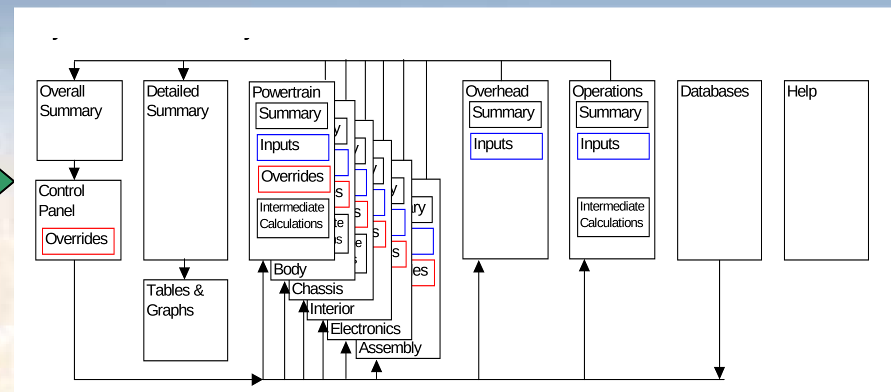
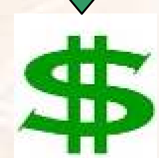




Trade-Off Between Fuel Economy and Cost

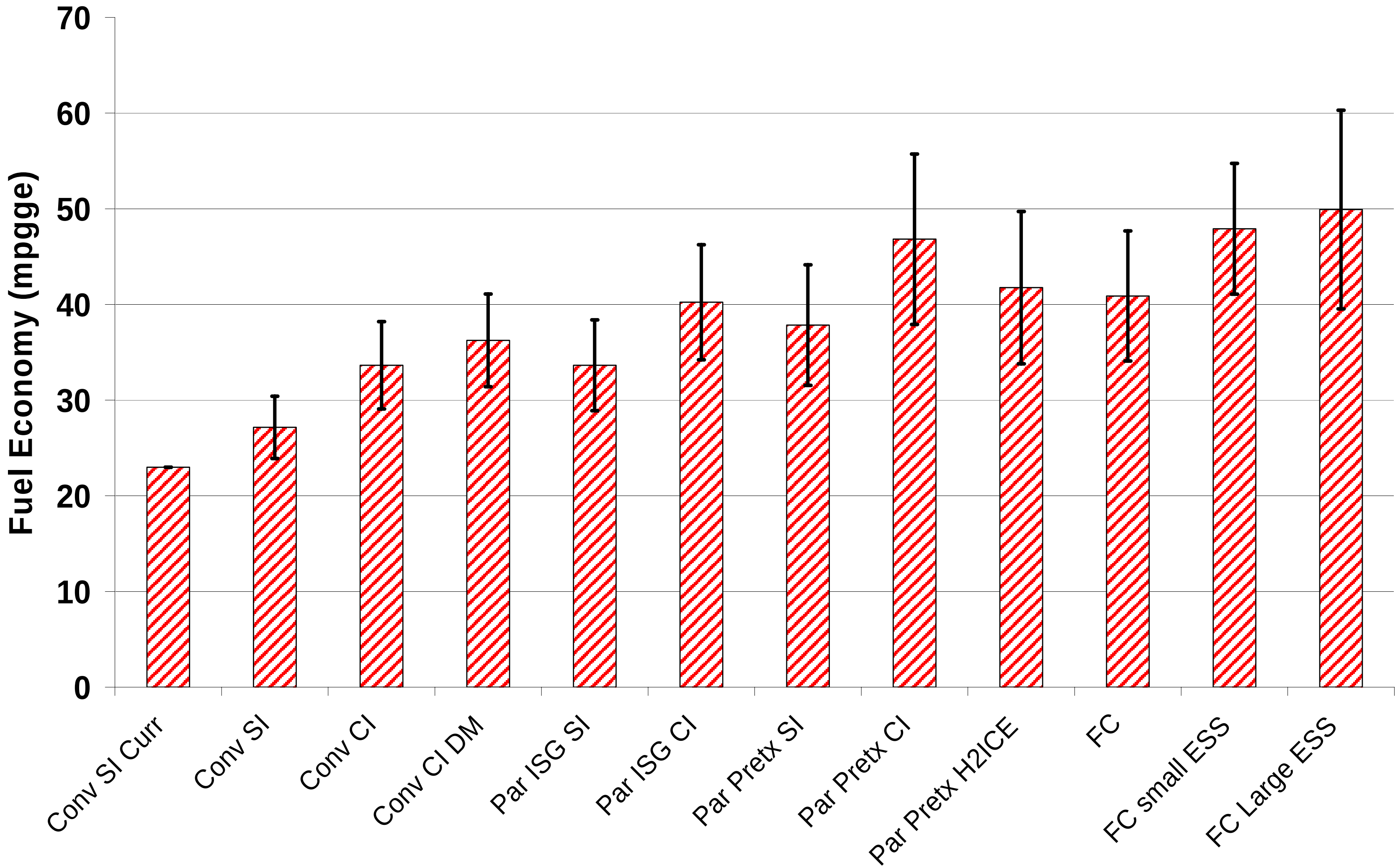
Assumptions

- SUV platform considered
- Vehicle performances were kept constant (IVM-60mph =10s)
- Uncertainties for 2010 cases were addressed using slow and fast technology development
- FreedomCAR 2010 targets were used when available for the fast technology case
- UDDS, HWFET, NEDC and Japan1015 drive cycles were simulated

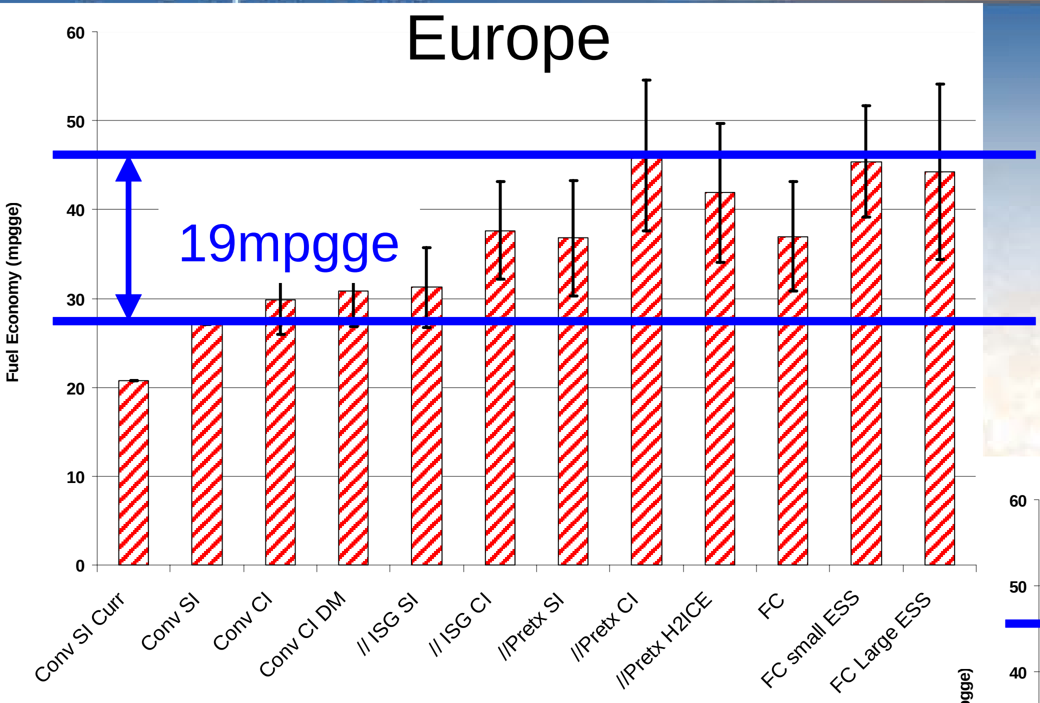
Key PSAT Assumptions

	Current	Slow Technology	Rapid Technology
Vehicle Characteristics			
Body mass (kg)	1258	1258	1063
Component Specific Power (kW/kg)			
Gasoline ICE	0.8-1.6	0.8-1.6	1-1.8
Diesel ICE	0.6-0.72	0.6-0.72	0.8-0.9
Hydrogen ICE	0.63	0.7	0.8
Fuel cell	0.23	0.28	**0.322**
Motor	1	1	1.3
Battery	0.74	0.74	1.1
Component Peak Efficiencies (%)			
Gasoline ICE	33.5	35	38
Diesel ICE	40.5	40.5	**45**
Hydrogen ICE	34	38	42
Fuel cell system	50	55	**60**
Gearbox	95	96	97

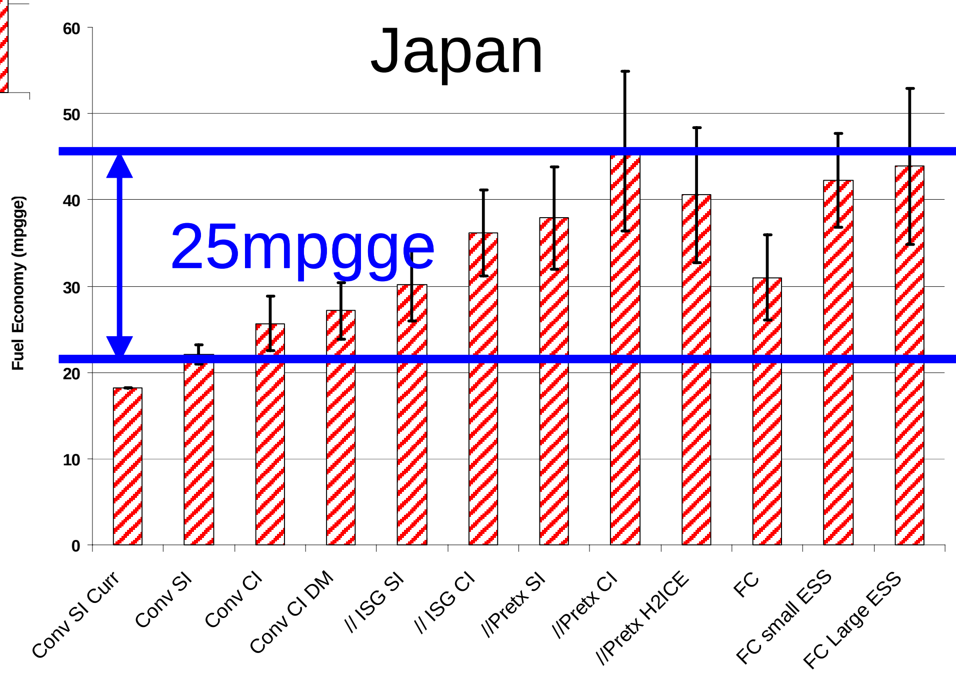
Fuel Economy Gasoline Equivalent – Combined Cycle



Fuel Economy Gasoline Equivalent for NEDC and Japan1015



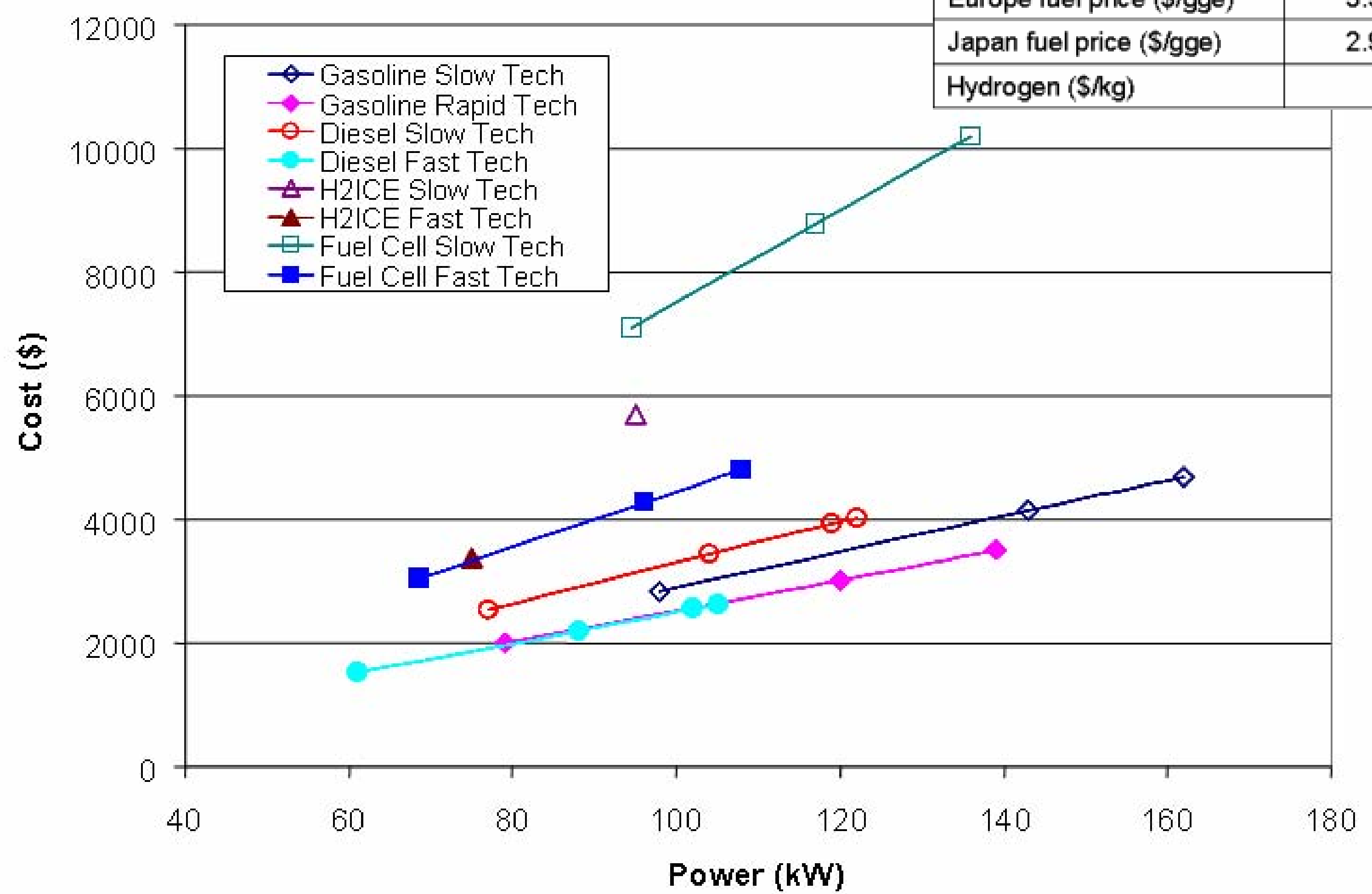
Japan1015 Average Fuel Economy lower by 3 mpgge



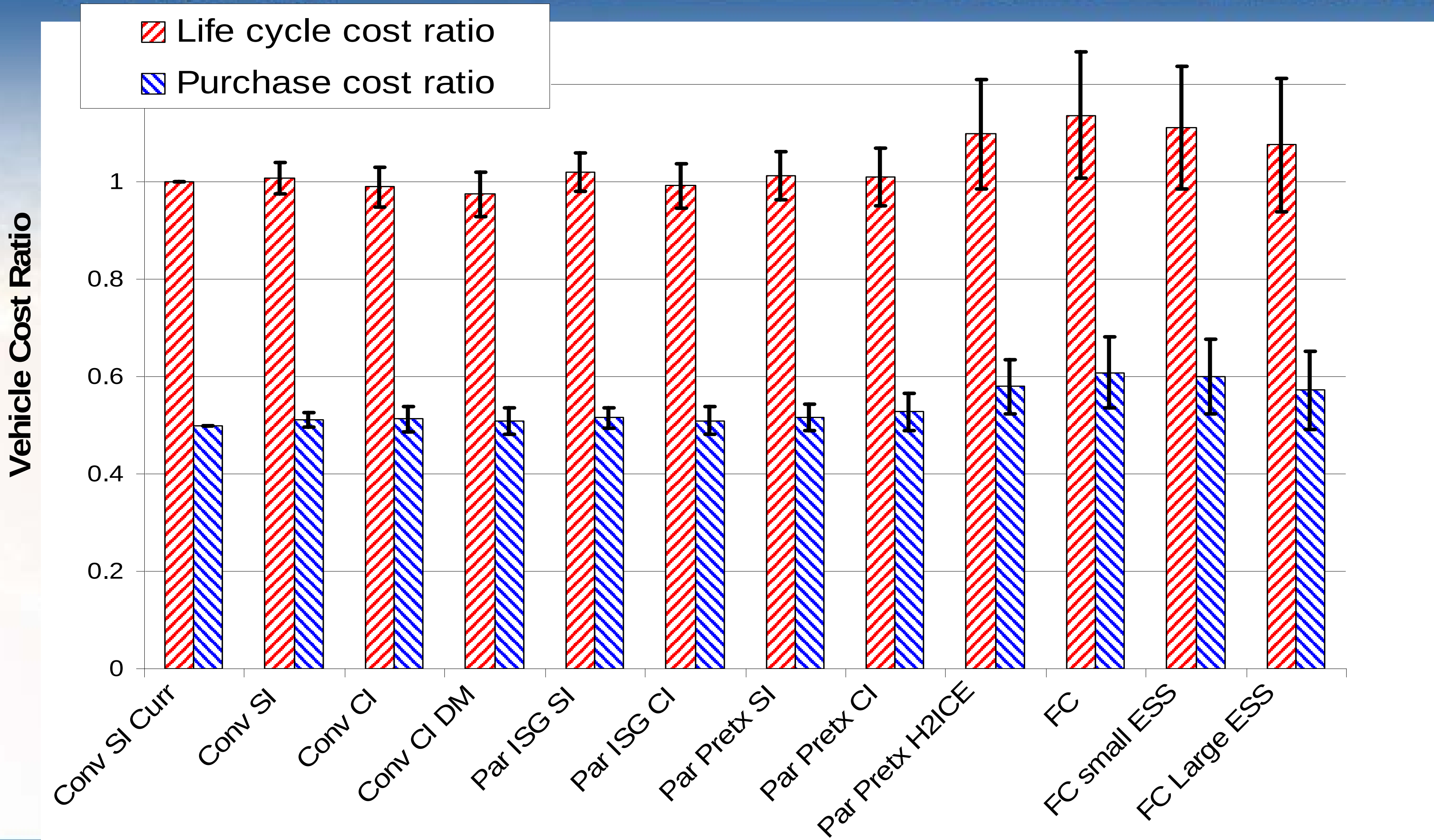
Parallel and Fuel Cell HEVs are less sensitive to drive cycle characteristics than conventional and fuel cells

Key ASCM Assumptions

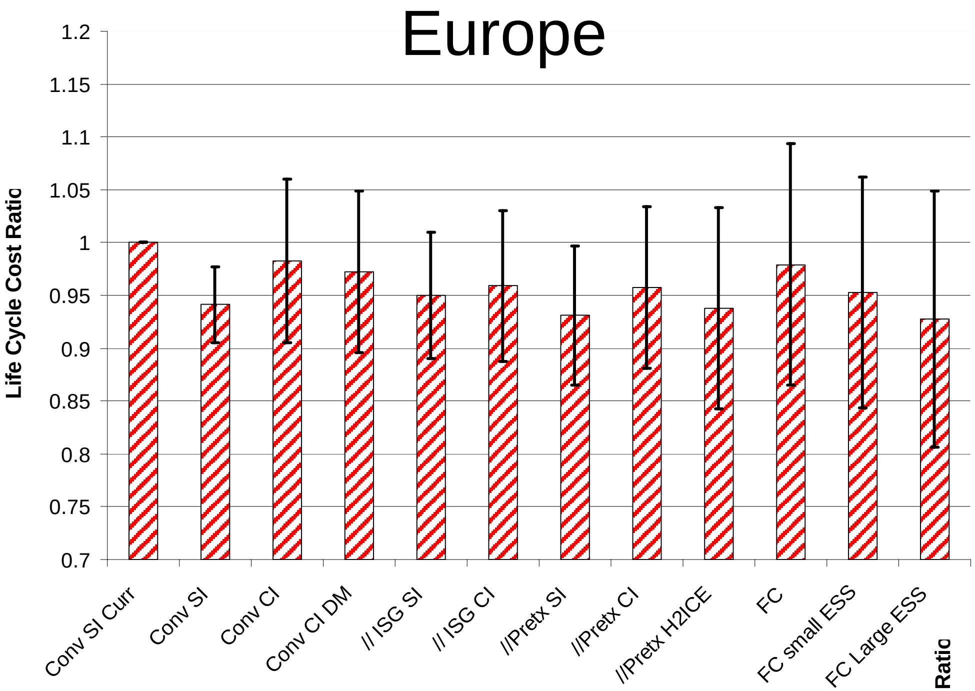
	Slow Technology	Rapid Technology
U.S. fuel price ($/gge)	1.40/1.21	1.37/1.17
Europe fuel price ($/gge)	3.31/4.44	2.64/3.53
Japan fuel price ($/gge)	2.94/2.14	2.32/2.13
Hydrogen ($/kg)	2.50	1.50

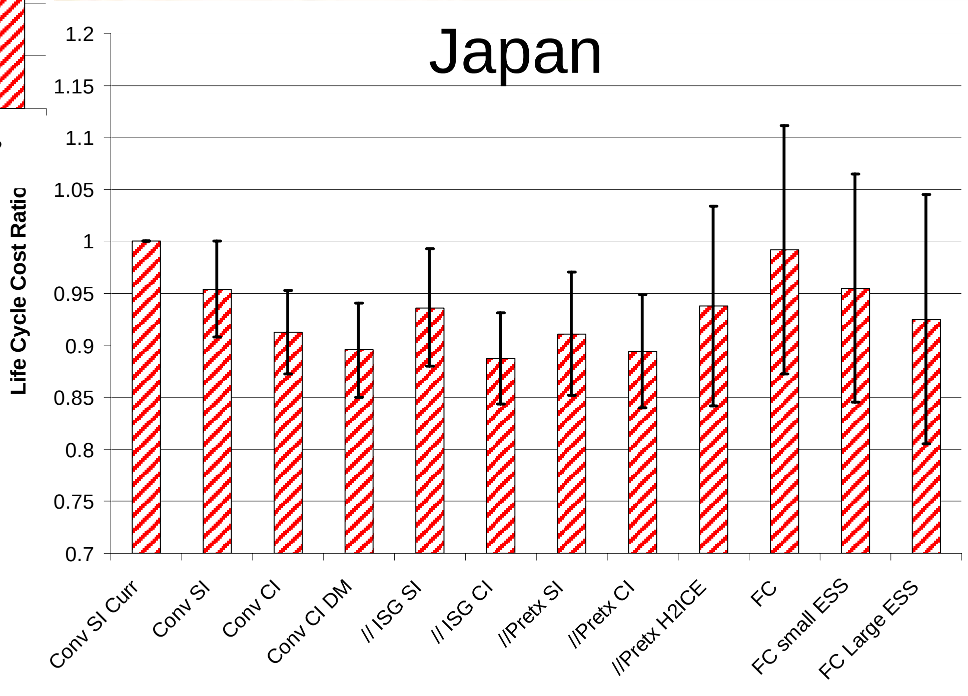


Vehicle and Life Cycle Cost Ratios

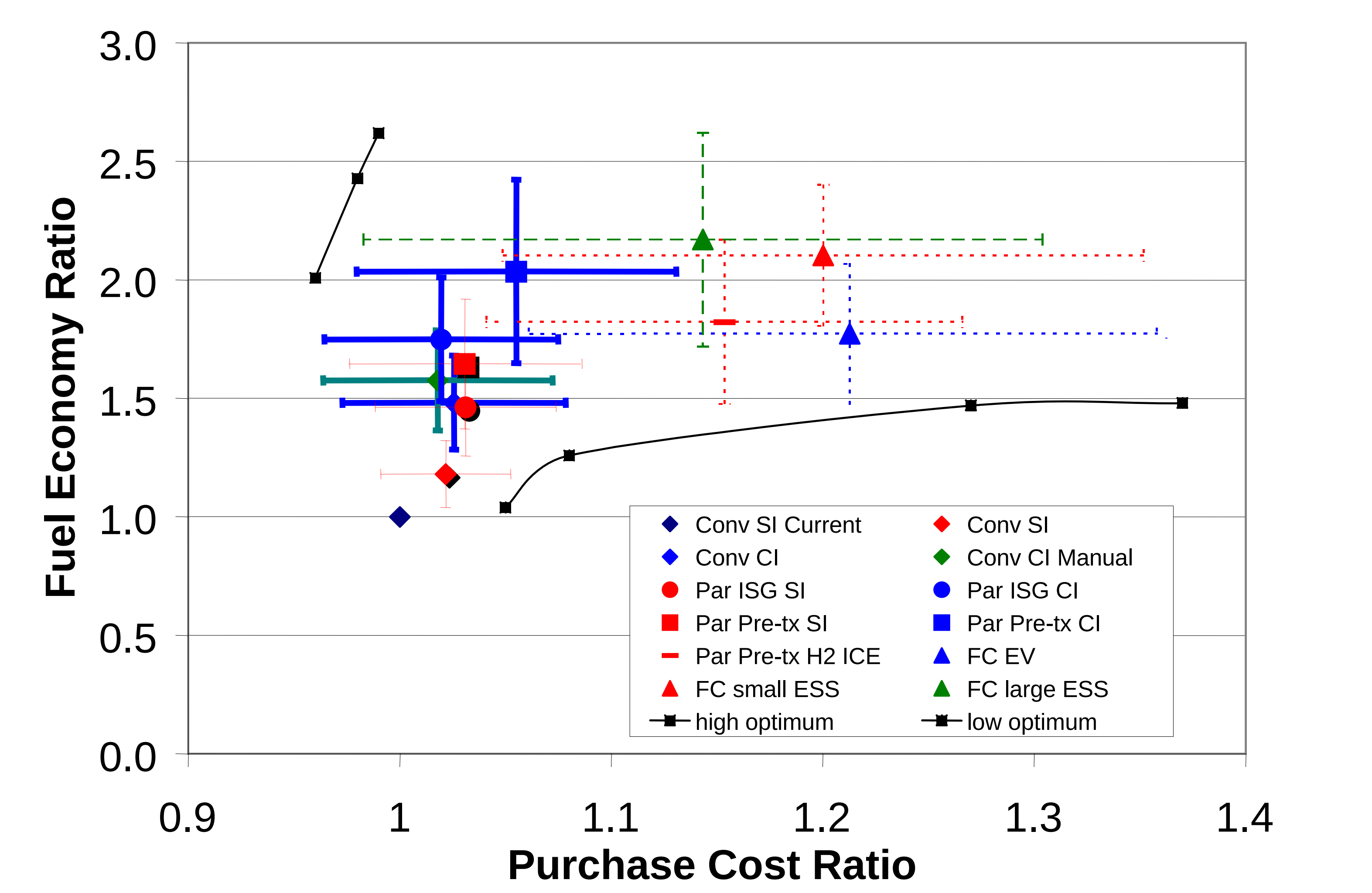


Vehicle Life Cycle Cost Ratios for NEDC and Japan1015





Trade-Off Between Fuel Economy and Purchase Cost



Conclusions

- The FreedomCAR goals support and enhance the chances of the emergence of fuel cell technology.
- The assumptions favor diesel compared to gasoline ICE.
- Fuel cell configurations with a high degree of hybridization provide higher fuel economy and lower cost.
- A substantial fuel economy change is required to influence the relative cost-effectiveness of all vehicle configurations.
- When considering an average technology growth, ICE hybrids appear competitive from a cost point of view compared to conventional configurations.
- When considering the rapid technology case, fuel cell hybrid vehicles achieve a lower cost ratio than the ICE hybrids.