VEHICLE DEPLOYMENT IN THE US – RESULTS FROM A US-TIMES MODEL

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Project Overview

Perform a micro- to macro-scale assessment of plug-in hybrid electric vehicles (PHEVs)

Key research goals:

1. Assess the circumstances under which PHEVs achieve high levels of market penetration
2. Quantify the impact of wide-scale deployment of PHEVs on electric sector planning and system-wide air pollutant emissions
3. Evaluate how driving and different recharging patterns affect fuel consumption and air pollutant emissions

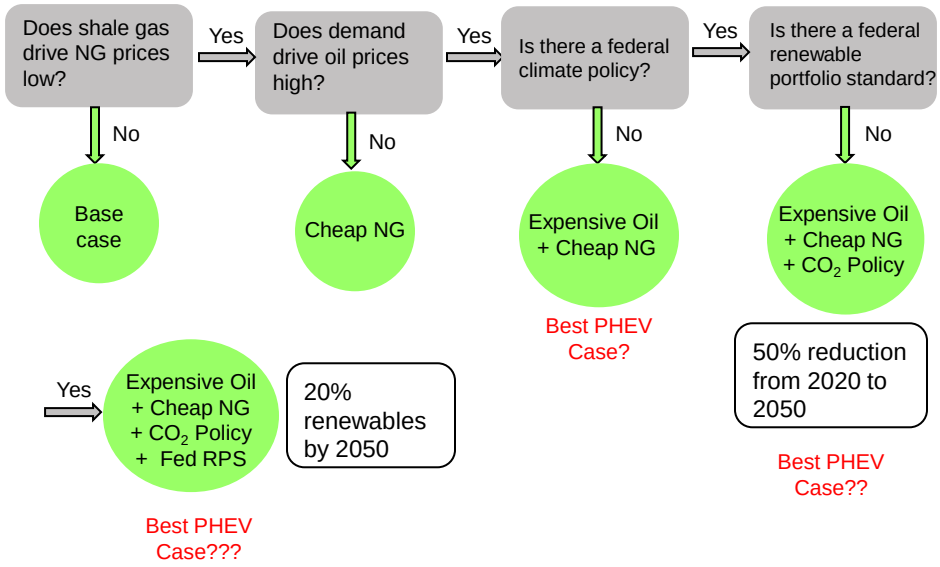
Driving Scenario Questions

Do the following scenarios push the deployment of PHEVs?

- Shale gas extraction keeps natural gas prices low
- Global demand drives high crude oil prices
- A federal CO_2 policy is instituted
- A federal renewable portfolio standard (RPS) is instituted

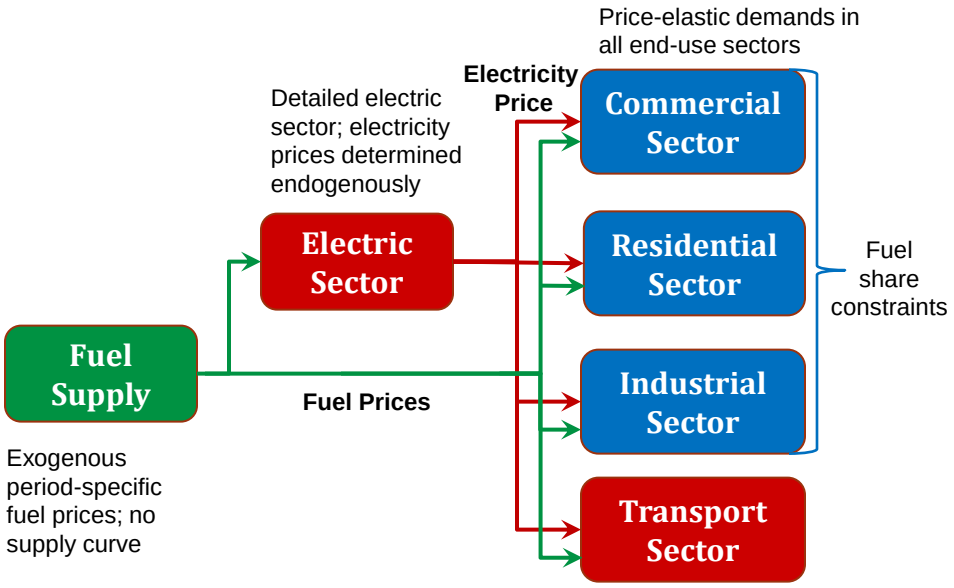
3

Scenario Map



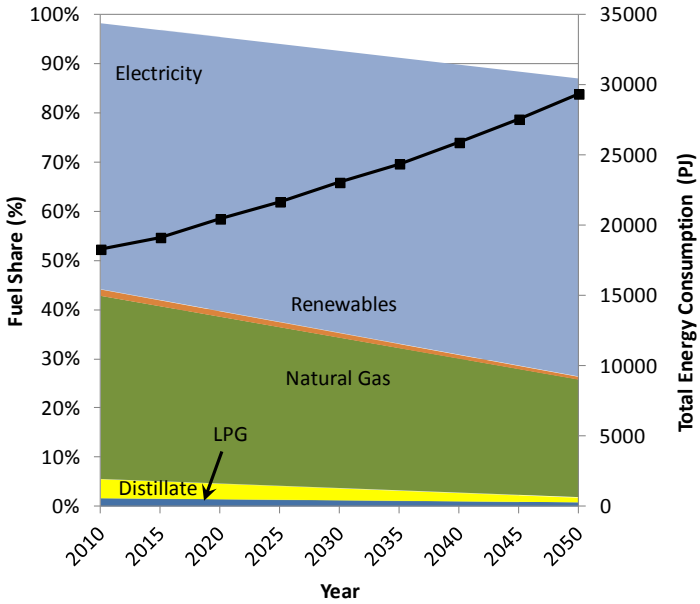
4

System Representation



5

Commercial Sector Representation in TIMES



6

PHEV Representation in TIMES

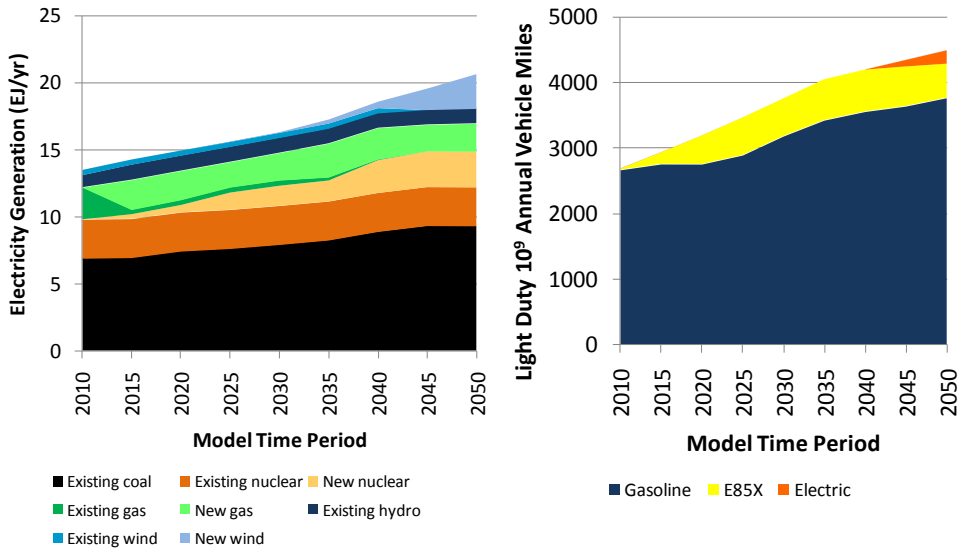
Graver BM, Frey HC, Choi HW (2011) "In-Use Measurement of Activity, Energy Use, and Emissions of a Plug-in Hybrid Electric Vehicle", *Environmental Science & Technology*, in press.

- Hymotion traction battery (5 kWh)
- 33 miles Plug-In battery charge

Route	Mode	Total Dist (km)	Total ELEC (MJ)	Total GSL (MJ)	EFF (bnvmt/PJ)	GSL input share (%)	Elec input share (%)
A	CD	79	71.69	71			
	CS	119	0	208	0.351	79.6	20.4
B	CD	60	57.78	56			
	CS	175	0	298	0.355	86.0	14.0
C	CD	24	21.4	28			
	CS	211	0	361	0.356	94.8	5.2
D	CD	19	14.98	28			
	CS	81	0	154	0.316	92.4	7.6
E	CD	5	4.28	6			
	CS	19	0	38	0.310	91.1	8.9
1	CD	35	25.68	45			
	CS	282	0	535	0.325	95.8	4.2
2	CD	43	26.75	52			
	CS	356	0	631	0.349	96.2	3.8
3	CD	43	24.61	56			
	CS	295	0	518	0.351	95.9	4.1

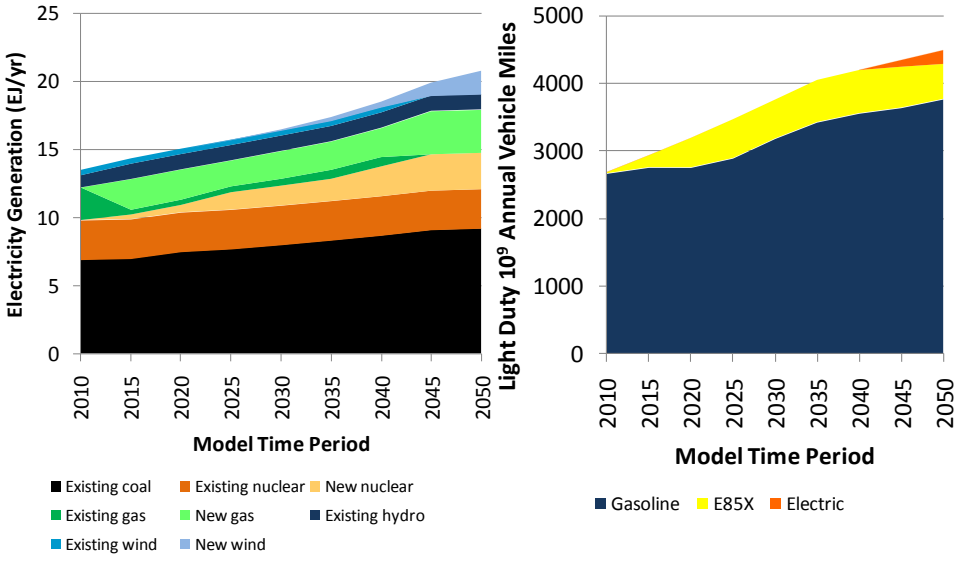
7

Base Case Results



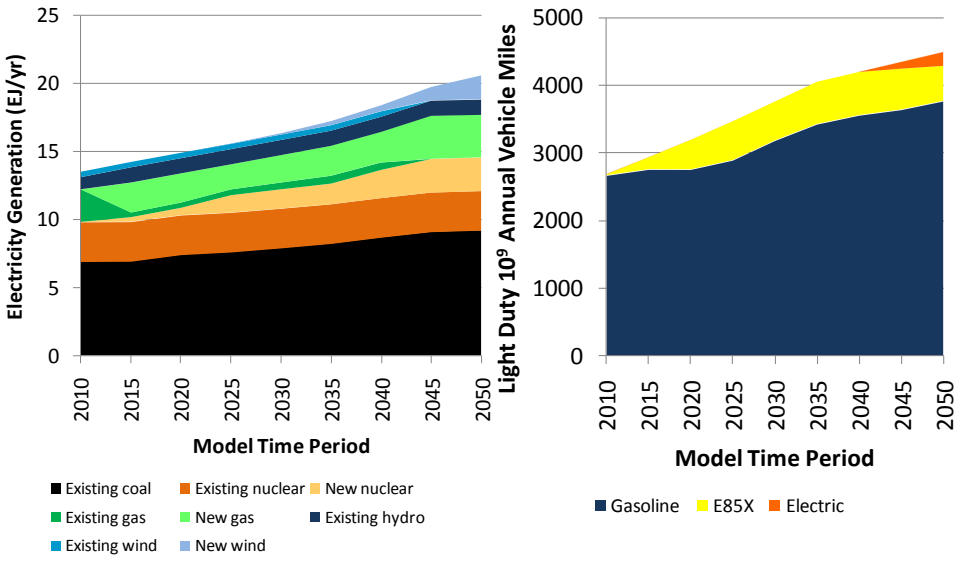
8

Results: Cheap Natural Gas



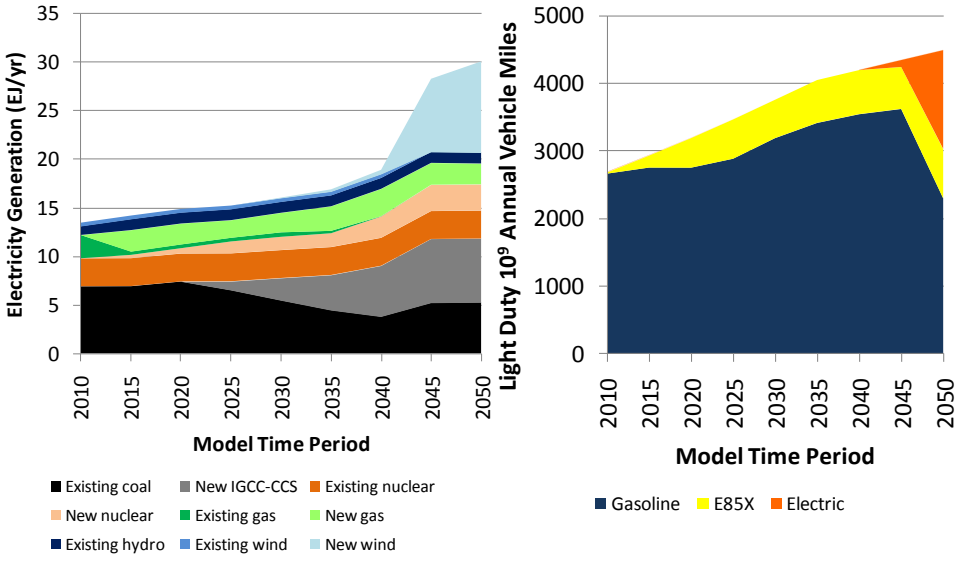
9

Results: Cheap Natural Gas + High Oil



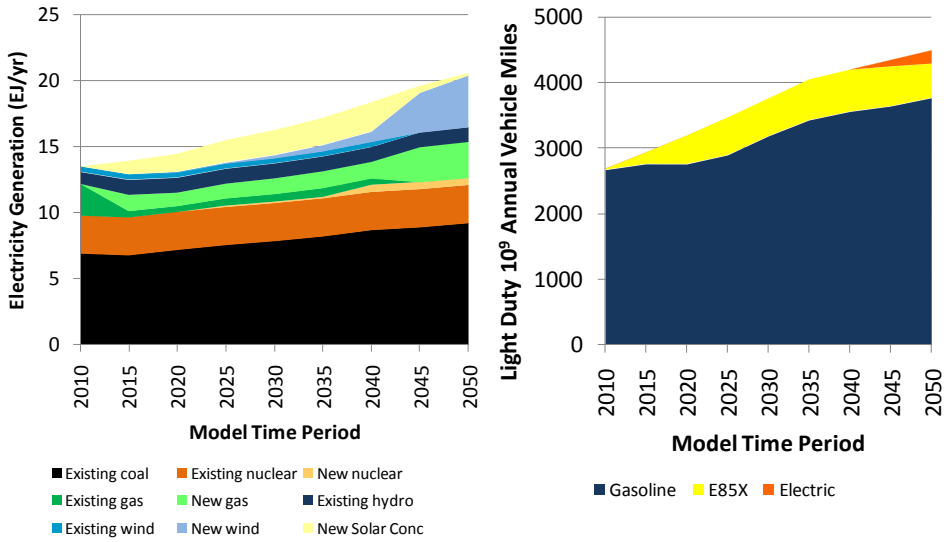
10

Results: Cheap Natural Gas + High Oil + CO_2 Policy



11

Results: Cheap Natural Gas + High Oil + RPS



12

Conclusions and Next Steps

PHEVs appear to be less competitive than electric cars in compact size class → review vehicle costs and perform sensitivity analysis

A stringent CO_2 constraint results in a high deployment of wind and IGCC-CCS as the electric sector is decarbonized

The RPS provides no additional renewables deployment when implemented with the CO_2 policy

CO_2 policy pushes electric vehicle deployment more than cheap natural gas or expensive oil → Review the Annual Energy Outlook fuel price scenarios, esp. reference vs. high oil case; perform sensitivity analysis

13

Questions and Comments …?

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14


15