

- ### Technology Evaluation
- Information sources
    - NESCAF analysis
    - Additional staff analysis
  - Staff technology assessment document
    - Released last week
  - Technology workshop
    - April 20, El Monte
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- ### Technology Evaluation
- 5 vehicle types
    - Small car, large car
    - Small truck, large truck (includes SUVs)
    - Minivan
  - Many technologies
    - Off the shelf and emerging
    - Engine, transmission, air conditioning, accessories, alternative fuels
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## Technology Evaluation

- Identify baseline emissions in 2009
- Define beneficial technology packages for each vehicle type
  - Near, mid and longer term availability
- Model GHG reductions
  - Looking carefully at combined effect
- Estimate cost and lifecycle cost



## Key Findings--Near Term 2009

- At least one off-the-shelf or near term package in each vehicle class gives
  - CO<sub>2</sub> reduction of 16-22 percent compared to 2009 baseline
  - Retail price increase: Savings to ~\$300
  - Payback of less than 5 years
- Best packages generally include
  - Turbocharging w/ engine downsize
  - Variable valve timing
  - Improved transmissions
  - Improved electric accessories



## Key Findings--Mid Term 2013-2015

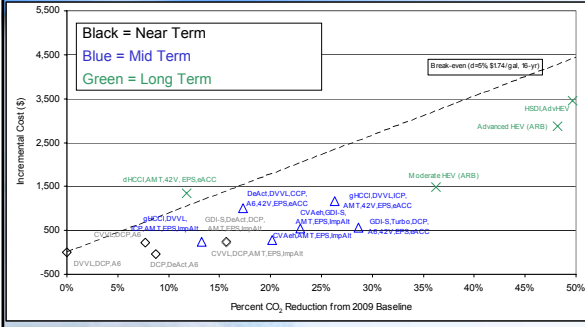
- Substantially larger CO<sub>2</sub> reductions possible
  - Up to 30 percent reduction from 2009 baseline
  - Retail price increase: Typically \$500 to <\$1000
  - Payback of less than 10 years
- Promising technologies
  - Gasoline direct injection
  - Camless valve actuation
  - 42 volt ISG
  - Improved transmissions



## Key Findings--Longer Term 2015-

- Larger CO<sub>2</sub> reductions possible
  - 35-45% reduction from 2009 baseline
  - Retail price increase: \$1000-3000
  - Payback 5 to >16 years
- Promising technologies
  - Advanced HEVs
  - HEVs available now, but not universal

## Example--Large Car



Large Car	Combined Technology Packages	CO <sub>2</sub> (g/mi)	Potential CO <sub>2</sub> reduction from 2002 baseline	Retail Price Equivalent 2002	Potential CO <sub>2</sub> reduction from 2009 baseline	Retail Price Equivalent 2009
Near Term 2009-2012	DVVL DCP A6 (2009 baseline)	315	-9.3%	\$640	0%	\$0
	DCP A6	305	-12.2%	\$479	3.2%	-\$115
	DCP CVT EPS ImpAlt	304	-12.6%	\$708	-3.6%	\$68
	DVVL DCP A6	291	-16.2%	\$694	-7.7%	\$224
	DCP DeAct A6	288	-17.2%	\$652	-8.7%	\$22
	DCP Turbo A6 EPS ImpAlt	280	-19.4%	\$266	-8.7%	-\$267
Mid Term 2013-2015	<b>CVVL DCP AMT EPS ImpAlt</b>	<b>266</b>	<b>-23.4%</b>	<b>\$873</b>	<b>15.6%</b>	<b>\$233</b>
	<b>GD-S DeAct DCP AMT EPS ImpAlt</b>	<b>266</b>	<b>-23.5%</b>	<b>\$931</b>	<b>15.7%</b>	<b>\$291</b>
	<b>GD-S DCP Turbo AMT EPS ImpAlt</b>	<b>262</b>	<b>-27.4%</b>	<b>\$369</b>	<b>20.0%</b>	<b>-\$194</b>
	gHCCI DVVL ICP AMT EPS ImpAlt	273	-21.3%	\$880	-13.3	\$240
	DeAct DVVL CCP A6 ISG EPS eACC	261	-25.0%	\$1721	-17.3%	\$1081
	CV Aeh AMT EPS ImpAlt	252	-27.6%	\$929	-20.2%	\$289
Long Term 2015+	<b>CV Aeh GD-S AMT EPS ImpAlt</b>	<b>243</b>	<b>30.0%</b>	<b>\$1188</b>	<b>22.9</b>	<b>\$548</b>
	<b>gHCCI DVVL ICP AMT ISG EPS eACC</b>	<b>232</b>	<b>-33.1%</b>	<b>\$1798</b>	<b>28.3%</b>	<b>\$1196</b>
	<b>GD-S Turbo DCP A6 ISG EPS eACC</b>	<b>225</b>	<b>-35.3%</b>	<b>\$1198</b>	<b>28.7%</b>	<b>\$556</b>
	gHCCI AMT ISG EPS eACC	278	-19.9%	\$1978	-11.8%	\$1338
	ModHEV	201	-41.7%	\$1479	-38.2%	\$839
	AdvHEV	163	-52.6%	\$2863	-48.2%	\$2223
HSDI AdvHEV	159	-54.3%	\$4088	-49.6%	\$3448	

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## Standard Development

- Define maximum feasible and cost-effective reductions for each vehicle type
  - Feasible--capable of being successfully accomplished within the time provided, taking into account environmental, economic, social and technological factors
  - Cost effective--economical to an owner or operator, taking into account the full life-cycle costs of a vehicle

## Standard Development

- Translate vehicle-level results into standards applicable to manufacturer fleet
  - Performance-based (will not require specific technologies)
  - "Bubble" all on-vehicle climate change pollutants and sources (CO<sub>2</sub> equiv. gram/mi.)
  - Consider differences in upstream emissions for alternative fuel vehicles



## Possible Approaches: Standard Development

- Single fleet average emission standard for all manufacturers
- Separate fleet average emission standards for different vehicle categories
  - LEV categories (PC, LDT)
  - Size-based
  - Weight-based



## Alternative Compliance

- AB 1493 requires regulations to allow alternative methods of compliance
  - But...
- Must not dilute the requirements or emission benefits of regulations
- The goal is to improve the vehicles themselves



## Preliminary Staff Approach

- Allow averaging, banking, trading
- Allow aggregation across pollutants
- Apply standard criteria for emission credit trading
  - Emission reductions must be real, quantifiable, surplus, enforceable, permanent



## Preliminary Staff Approach

- Additional limitations on generation and use of credits
  - Must be sponsored by auto manufacturer
  - Must involve light duty vehicles or alternative fuels
  - Cap on use of credits
  - No increase in criteria pollutant or toxic air contaminant emissions



## Credit For Early Action

- Regulations must grant credit for reductions achieved prior to operative date
- Staff approach still under development



## Environmental Impacts

- Emission impacts (EMFAC)
  - Climate change emissions
  - Criteria pollutant emissions
- Multimedia impacts



## Economic Impacts

- Potential impacts on state economy
  - Job creation
  - Business creation, elimination or expansion
  - California business competitiveness
  - Auto workers and affiliated businesses
  - Cost to state and local agencies
- EDRAM modeling



## Community Impacts

- Potential impact on minority and low-income communities
  - Environmental impacts
  - Economic impacts on community
  - Ability to maintain and attract businesses

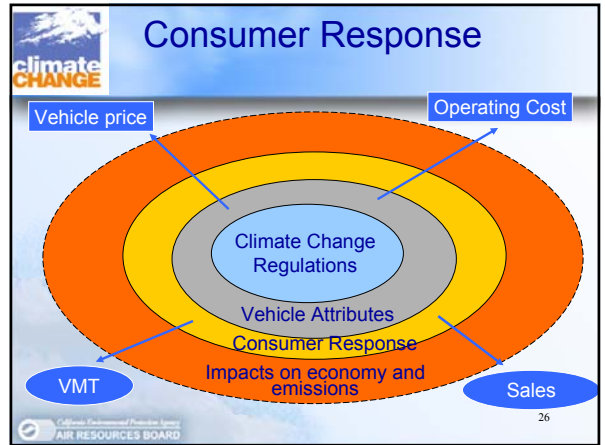
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## Other Considerations

- Manufacturer response
  - e.g model availability
- Consumer response
  - Vehicle sales (price elasticity)
  - VMT (rebound effect)
- Societal benefits

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## Next Steps

- April 20      Technology workshop
- May            Release draft staff report
- June            Workshops on draft staff report
- August 6      Release final staff report
- Sept. 23      Board hearing

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## AB 1493 List Serve

- Provides subscribers with automatic email notification
  - Notice of workshops and meetings
  - Posting of documents on ARB website
- To subscribe, go to ARB website and follow prompts
  - [www.arb.ca.gov/listserv/cc/cc.htm](http://www.arb.ca.gov/listserv/cc/cc.htm)

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