Alternative Transport Fuels,

Implementation Guidelines

EGNRET 36

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RDL

Coverage

- **Implementation Experience,**
- **Implementation Policies,**
- **Lessons learned**

The Research Results

Alternative Transport Fuel Classifications

Classification by Infrastructure requirements

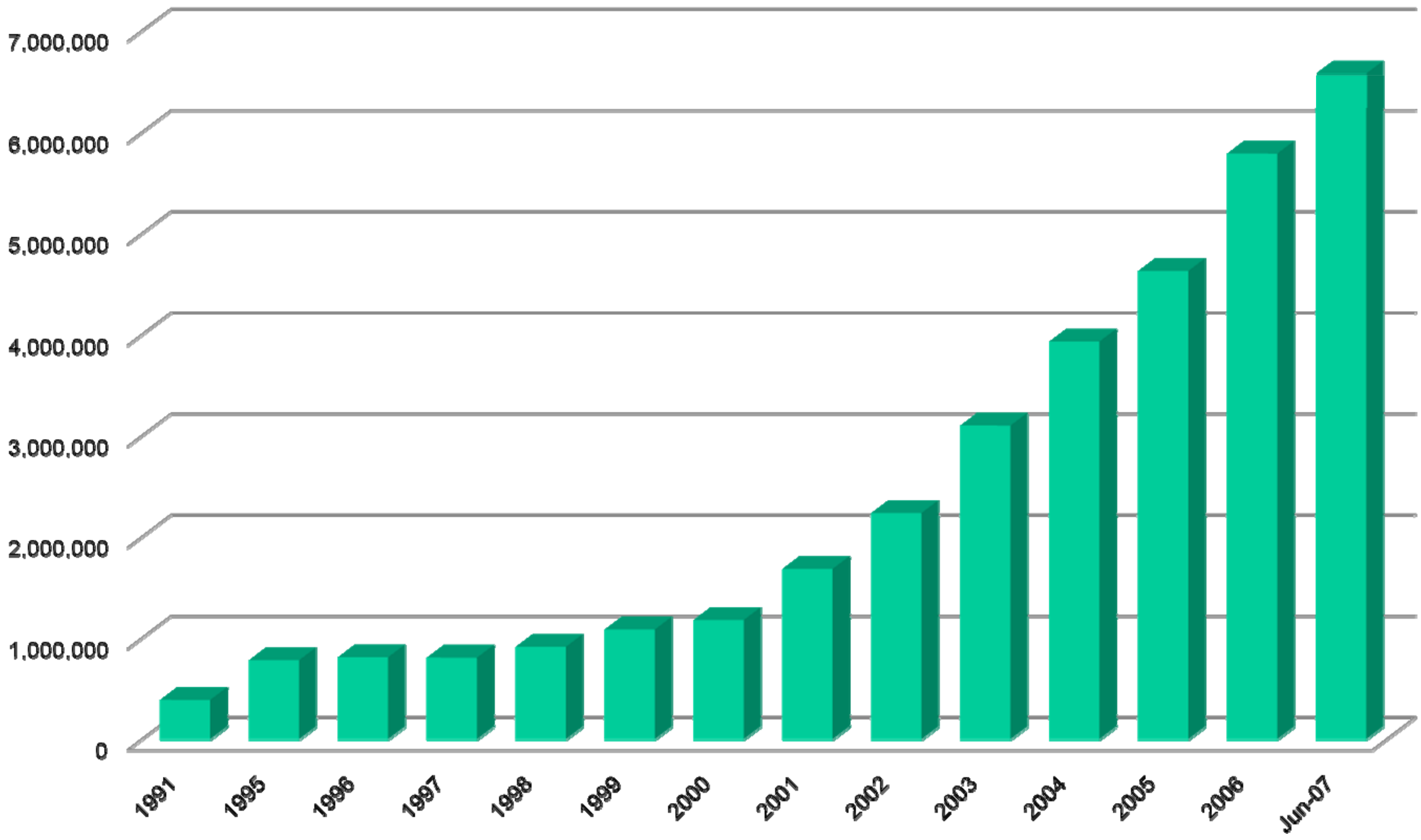
- **Gaseous Fuels:**
  - CNG, LNG, LPG, Biomethane,
- **Alcohol Fuels:**
  - Ethanol & Methanol,
- **System Compatible Fuels:**
  - Biodiesel, Synthetic Gasoline and Diesel,
- **Electricity**

Refuelling System Costs predominate

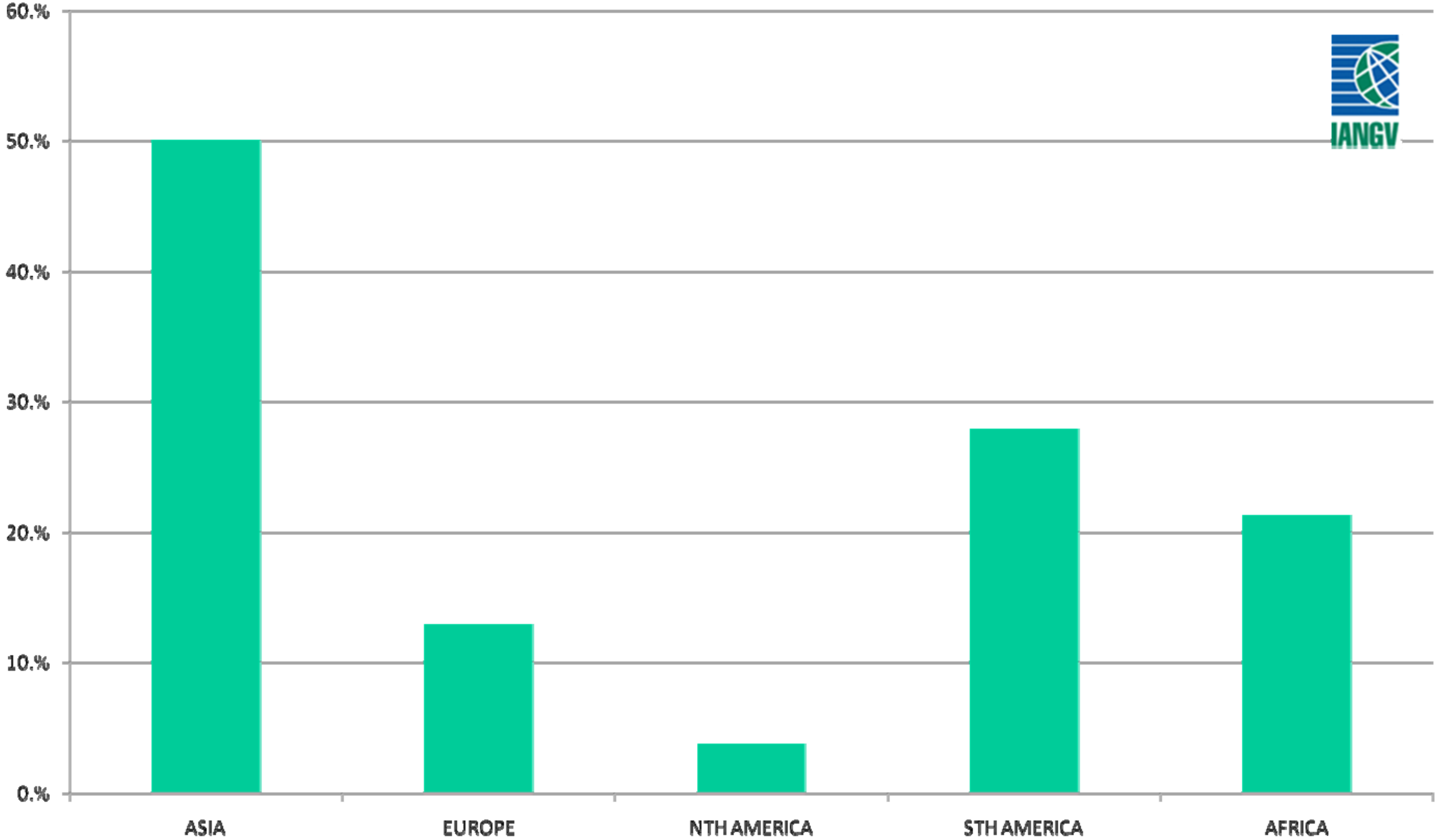
Natural Gas Vehicles

NGVs

NGV Growth Worldwide



NGV Growth since 2000 by Region



NGVs in APEC Economies

APEC Economy	Vehicles	Stations	Natural Gas Consumption (PJ/year)	Annual Growth 2002-2006 %
Australia	2,453	146	2.1	3.2
Canada	12,140	101	1.2	-2.2
Chile	8,064	15	1.5	8.4
China	336,500	1,260	160.8	29.9
Indonesia	2,453	146	0.6	-11.5
Japan	35,720	327	10.1	n/a
Korea	17,123	121	22.5	105.0
Malaysia	40,248	101	3.5	79.2
Mexico	3,037	9	0.3	14.3
New Zealand	283	14	0.0	0.0
Peru	54,829	56	4.5	n/a
Philippines	36	3	0.0	n/a
Russia	95,000	224	27.9	3.7
Singapore	2,700	3	0.2	n/a
Chinese Taipei	4	1	0.0	n/a
Thailand	117,727	253	23.6	253.5
USA	100,000	816	23.0	-2.1
APEC Totals	**828,317**	**3,596**	**282**	
APEC %	**8.7%**	**24.7%**	**25.2%**	
Worldwide	**9,563,274**	**14,550**	**1,119**	

LPG Vehicles

Autogas

Largest Autogas Markets, 2006

Economy	Vehicles (thousands)	Refuelling sites	Autogas Consumption (000 tonnes)	Vehicles per Station
Korea	1,723	1,242	3,841	1,387
Poland	1,100	4,500	1,700	244
Australia	492	3,240	1,657	152
Turkey	1,000	4,000	1,570	250
Mexico	450	1,400	1,410	321
Japan	290	1,900	1,307	153
Italy	1,220	2,150	987	567
Thailand (2008)	1,200	355	660	3,380
China	134	285	531	470
Russia	550	470	424	1,170
United States	190	4,300	372	44
Rest of the World	2,401	16,439	3,722	146
APEC total **APEC %**	**3,829** **40.2%**	**12,837** **32.2%**	**9,542** **54.5%**	
World Total	**9,531**	**39,926**	**17,521**	**446**

Alcohol Vehicles

Ethanol

Ethanol Blends used in APEC Economies

Economy	Ethanol
Australia	E10
Brunei Darussalam	n/a
Canada	E5 (Ontario), E7.5 (Saskatchewan), and E8.5 (Manitoba); limited offer of E85
Chile	E5 trials
China	E10 in 5 provinces, 27 cities
Japan	E3
New Zealand	E10 at three Auckland sites
Peru	E7.8 (2010)
The Philippines	E10
Chinese Taipei	E3
Thailand	E10, E20
United States	E10, E85

Ethanol Vehicles manufactured in Brazil

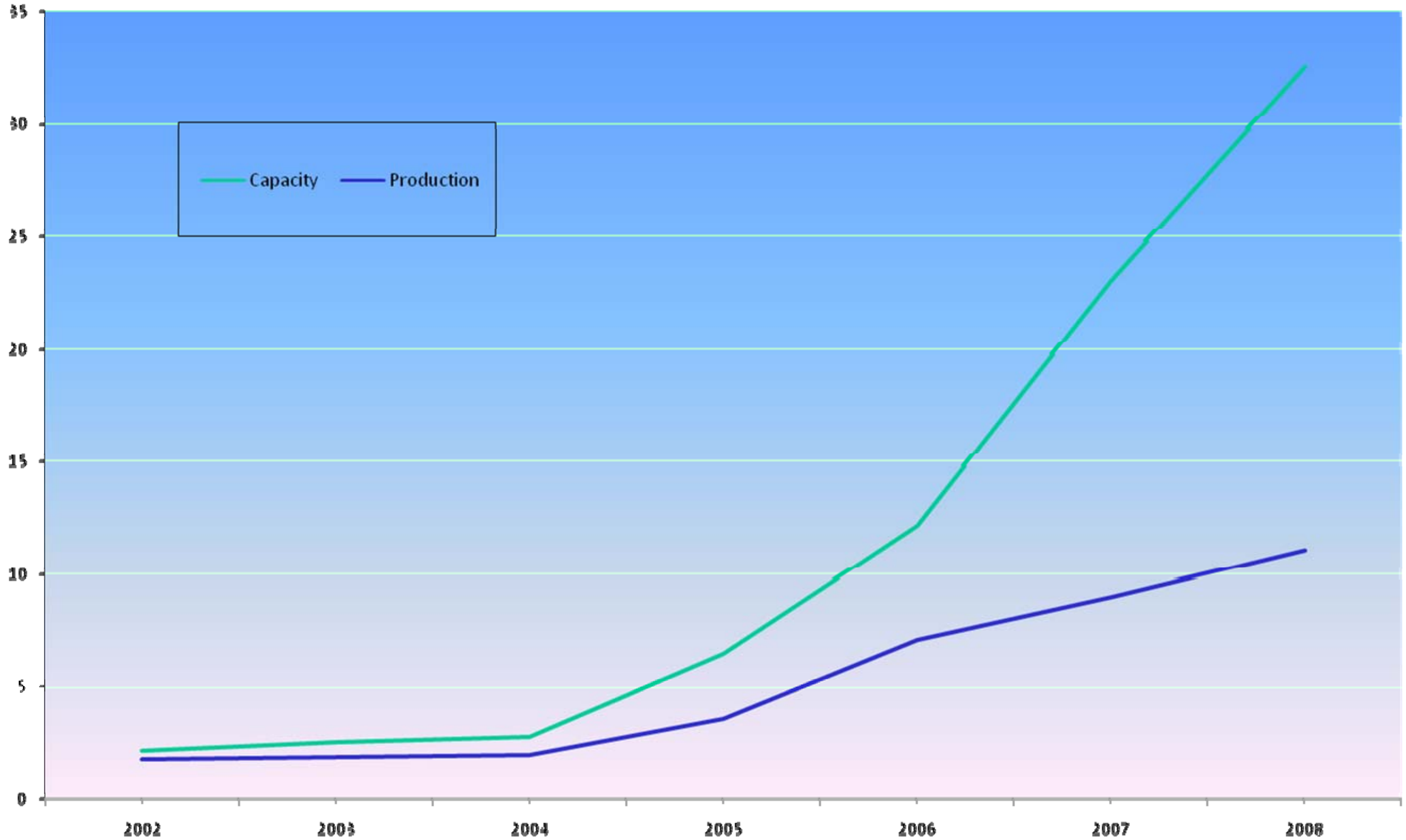
Year	Pure Alcohol (E100)	Flexible Fuel (E20-E100)	Total Light Vehicles	Ethanol Vehicles as % of Total Light
1979	4,614	-	1,022,083	0.5
1980	254,001	-	1,048,692	24.2
1983	590,915	-	854,761	69.1
1986	697,731	-	960,570	72.6
1988	569,189	-	978,519	58.2
1990	83,259	-	847,838	9.8
1993	264,651	-	1,324,665	20.0
1998	1,451	-	1,501,060	0.1
2000	10,106	-	1,596,882	0.6
2002	56,594	-	1,700,146	3.3
2003	34,919	49,264	1,721,841	4.9
2004	51,012	332,507	2,181,131	17.6
2005	51,476	857,899	2,377,453	38.2
2006	775	1,391,636	2,471,224	56.3
2007	3	1,936,853	2,801,011	69.1
October 2008	12,836	2,048,607	2,732,888	75.4
Totals	**5,671,185**	**6,616,766**	**42,753,054**	**28.7%**

FFVs manufactured and in use, USA

Year	Light-Duty E85 FFVs produced	Light-Duty E85 FFVs increase	Total fleet E85 FFVs in use
1998	261,165	171,422	**171,422**
1999	426,724	357,450	**528,872**
2000	600,832	528,315	**1,057,187**
2001	581,774	533,458	**1,590,645**
2002	834,976	793,575	**2,384,220**
2003	859,261	837,357	**3,221,577**
2004	674,678	670,794	**3,892,371**
2005	735,693	735,693	**4,628,064**
2006	866,194	866,194	**5,494,258**
2007	974,095	974,095	**6,468,353**
Aug-08	793,354	793,354	**7,289,908**

Biodiesel

World Biodiesel Capacity & Production, (million tonnes)

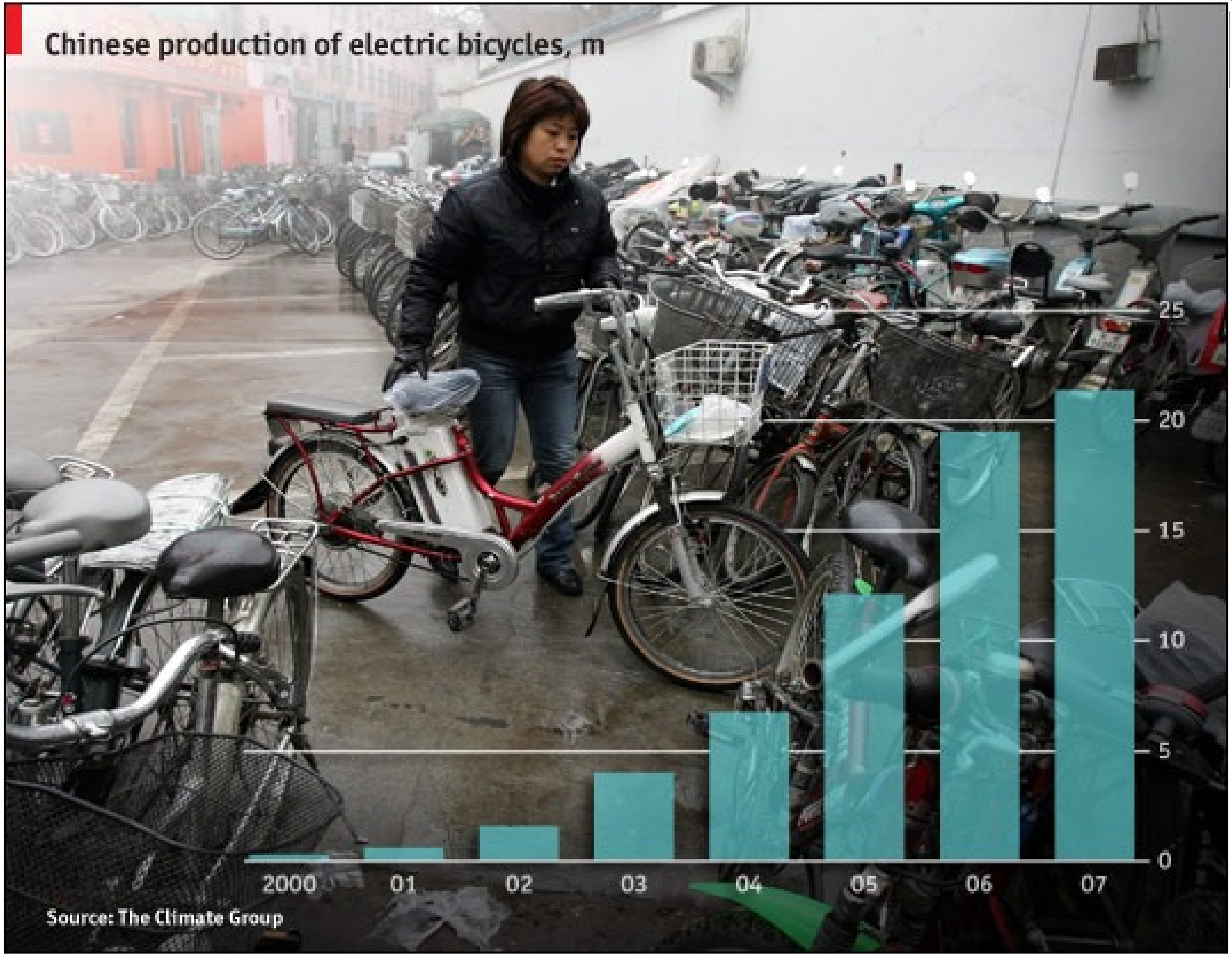


Electric Vehicles

EVs, HEVs, PHEVs

Electric and Hybrid Vehicles in APEC

Vehicle Type	EV	HEV
Canada	21	25,783
China	45,000,000	n/a
Taiwan	106,000	n/a
United States	120,000	1,006,301
APEC totals APEC %	45,226,021 99.90%	1,032,084 95.70%
World Totals	45,261,209	1,078,144


Chinese production of electric bicycles, m
25
20
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Source: The Climate Group

Electric Vehicles in China

HEVs in the USA

Date	Vehicle Sales	Market Share %	Number of Models
2000	10,000		2
2004	88,000	0.52	8
2005	212,000	1.19	11
2006	260,000	1.53	17
2012	**780,000**	**4.20**	**52**

Summary – Market Penetration, 2007-08

Alternative Fuel	Vehicles			Consumption (PJ/year)		
	World (000)	APEC (000)	APEC %	World	APEC	APEC %
Gaseous Fuels						
CNG/LNG/Biomethane	9,076	790	8.7	1,119	280	25.0
Autogas (LPG)	9,531	3,829	40.2	871	474	54.5
Alcohols						
Ethanol	14,706	7,576	51.5	828	459	55.4
System Compatable Fuels						
Biodiesel				361	135	37.4
Synthetic hydrocarbons				355	0	0.0
Electricity						
Battery Electric Vehicles	45,261	45,226	99.9	109	109	99.9
Hybrid Electric Vehicles	1,078	1,032	95.7	8	7	95.7
Totals	**79,652**	**58,453**	**59.2%**	**3,650**	**1,464**	**52.6%**

Drivers

Governments:

- Energy Security, GHG emissions,

Local Authorities:

- Local Air Quality,

Alternative Transport Fuel Industry:

- Economics, Government incentives,

Consumers:

- Fuel savings, Green Image.

Different for each Stakeholder

Impediments

- Inadequate Drivers,
- No Champion!
- Inadequate Fuel supply and Refueling outlets,
- Access to Refueling outlets (electricity),
- Lack of Standards, Codes and Regulations,
- Cost of Conversion or OEM purchase,
- Lack/Loss of Public Acceptance/Confidence

Can Seriously Impede Market Growth

Implementation Policies

Promotional Policies and Measures

Fiscal/financial	Regulatory	Other
Fuel tax exemption or rebate	Mandated sales/purchase for fleet vehicles (enforced)	Government vehicles use alternative transport fuels
Road/registration-tax exemption or rebate	Harmonised refueling facility standards and codes	Information dissemination; public awareness campaigns
Vehicle sales-tax exemption or income/profit tax credit (purchasers and OEMs)	Vehicle conversion standards and industry codes of practice	Voluntary agreements with OEMs to develop and market alternative fuelled vehicles
Investment tax credits for distribution infrastructure and R&D	Health and safety regulations	Direct RDD & D funding for alternative fuelled vehicles and technology
Grants/tax credits for vehicle conversion/acquisition	Exemptions from vehicle use restrictions	
Rapid depreciation for commercial vehicles and distribution infrastructure		
Parking/Road User charge exemptions		

Financial Incentives

Fuel Tax reduction,

- Excise tax, other taxes and levies,

Vehicle Tax reduction,

- Tax deductions and credits are different!

Vehicle Use Cost reductions:

- Road User charges, Road tolls, Parking costs,
- Access to parking, Car-Pool lanes,
- “Bad-Air” day and congestion exemptions,
- Participation in Emissions Trading Schemes, (ETS), in Europe.

Plenty of Options

Regulatory Actions

Mandates,

- Purchase mandates for Private vehicle fleets,
- Purchase mandates for Govt/Municipal fleets,
- Bans on polluting vehicles in congested areas,
- Best in Conjunction with Financial Incentives!

Development of Institutional Infrastructure,

- Standards, Industry Codes of Practice,
- Regulations,
- Administration framework

Institutional Infrastructure is Essential

Other Measures

RD & D Funding,

Public Education,

Leadership by Example:

- Conversion of Government/Municipal fleets,

Transport Control Measures:

- Driving behavior modification (Car-Pool lanes)
- Traffic pattern modification (Congestion avoidance)

Public Awareness and Engagement a Key

Policies and Measures in APEC Economies

Economy	Fuel taxes	Vehicle taxes	Vehicle conversion	Refuelling stations	Mandates	Other measures
Australia	Yes		Yes		Yes	Yes
Canada	Yes	(Yes)	Yes	Yes	Yes	Yes
China	Yes				Yes	
Hong Kong	(Yes)		Yes	Yes	Yes	
Japan	Yes		Yes	Yes		Yes
Korea	Yes	Yes	(Yes)	Yes		Yes
Mexico	Yes	(Yes)				Yes
New Zealand				Yes		
Russia	Yes					
Thailand	Yes	Yes			Yes	Yes
United States	Yes	Yes	Yes	Yes	Yes	Yes

Summary

Incentives are Essential for Implementation,

Governments provide most Incentives:

- Primarily through Fuel Price manipulation,

Mandates provide Direction:

- Best in conjunction with Financial Incentives,
- "Stick and Carrot" Philosophy – it Works!

Public Engagement is essential:

- The Public must be aware!

Incentives and Public Awareness are the Keys!

Lessons Learned

No Universal model,

Government involvement is essential:

- **Must have a Champion**

Developing economies have often done better!

Standards, Codes and Regulations early,

Incentive policies required:

- **Fuel price manipulation very effective**

Don’t “over cook” the market!

Lessons Learned (continued)

High fuel use fleets are prime targets:

- Government fleets

Consumers require < 2 year payback,

High technical quality necessary:

- Early involvement of OEMs,

Incentives phased out once market established,

Maintenance of Consumer Confidence:

- It was lost in New Zealand,

Fuel Price incentive Impact

Alternative Fuel	Economy	GDP/capita US$	Gasoline		
			Differential %	Differential USc/litre(e)	% GDP/cap Savings
CNG	**New Zealand**	20,800	50.0	47.3	**4.5**
	Malaysia	8,900	44.8	20.6	**4.6**
	India	2,600	37.5	40.5	**31.2**
Autogas	**Australia**	27,900	40.2	40.1	**2.9**
	Japan	28,400	58.0	47.1	**3.3**
	Korea	18,700	49.3	44.5	**4.8**
	Thailand	7,200	47.4	26.7	**7.4**
E85	**Brazil**	9,500	59.0	33.6	**7.1**
	USA	37,800	79.9	32.8	**1.7**

Thank You!