

NGVs Past & Prologue

Lessons Learned to Create Deployment Strategies for Commercializing NGVs

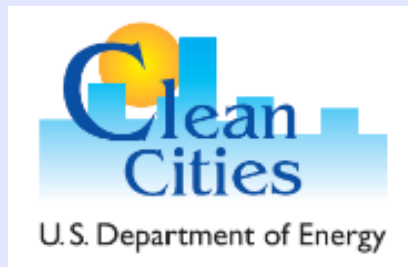
Webinar 3

Natural Gas Vehicles: Role of Government – Policymaking and Strategy Process

Dr. Jeffrey Seisler, CEO

Clean Fuels Consulting

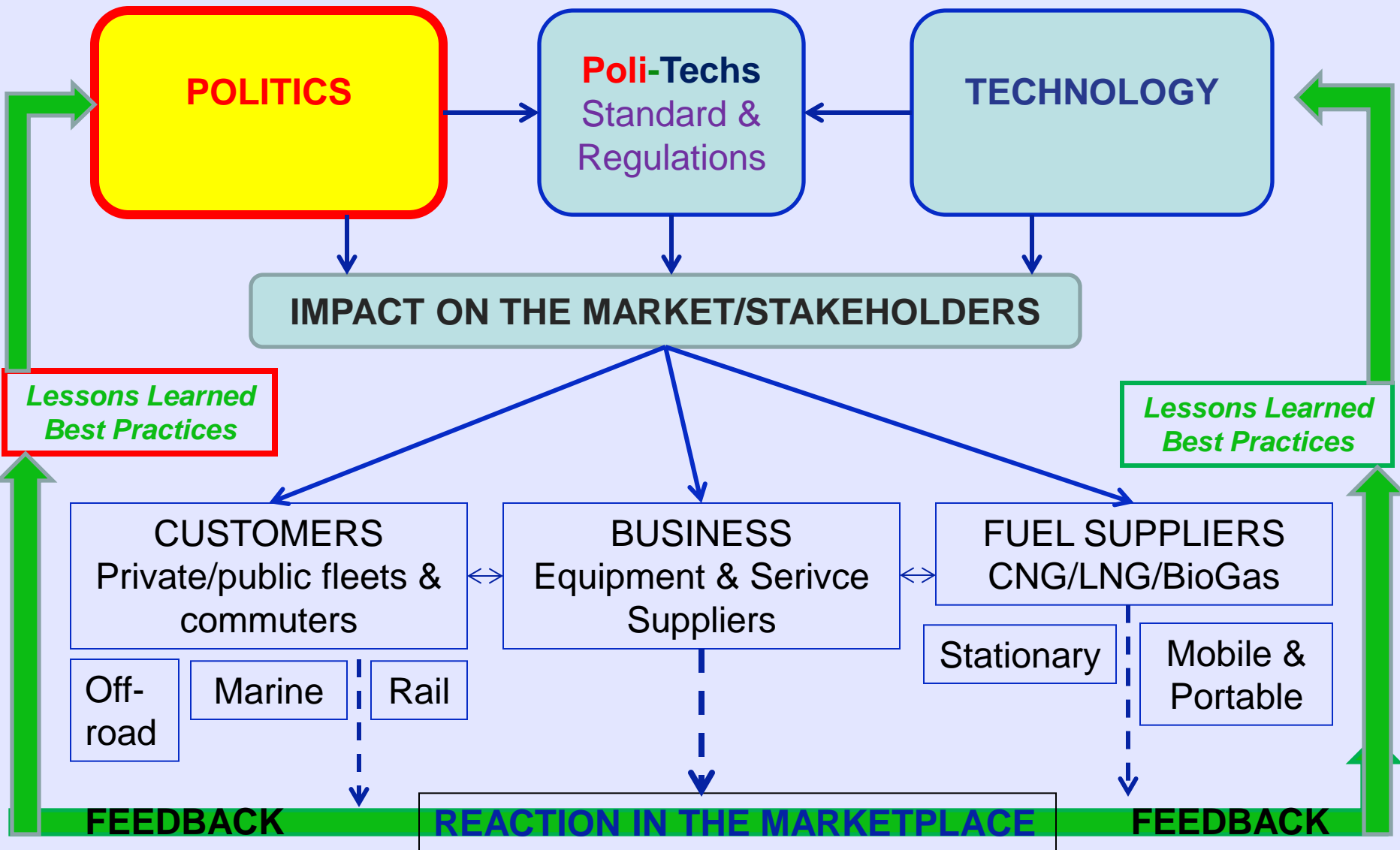
15 December 2014



Presented by:  Clean Fuels CONSULTING

Structure & Dynamics

Framework for this presentation



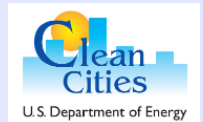
The Role of Government



Selected Summary Points

- Alternative fuel source(s) must be pursued on a timely basis as any major transition will take many years.
- Fuel transition(s) must be as few as possible, because the infrastructure change-over expense ~~may~~ will be huge.
- Realignment of ongoing fuel shifts may be necessitated by major changes in:
 - Technology
 - International affairs
 - World pricing and supply of fuels

Source: *Checklist for Transition to New Highway Fuel(s)*, Charles Risch, Danilo Santini, January 2012.



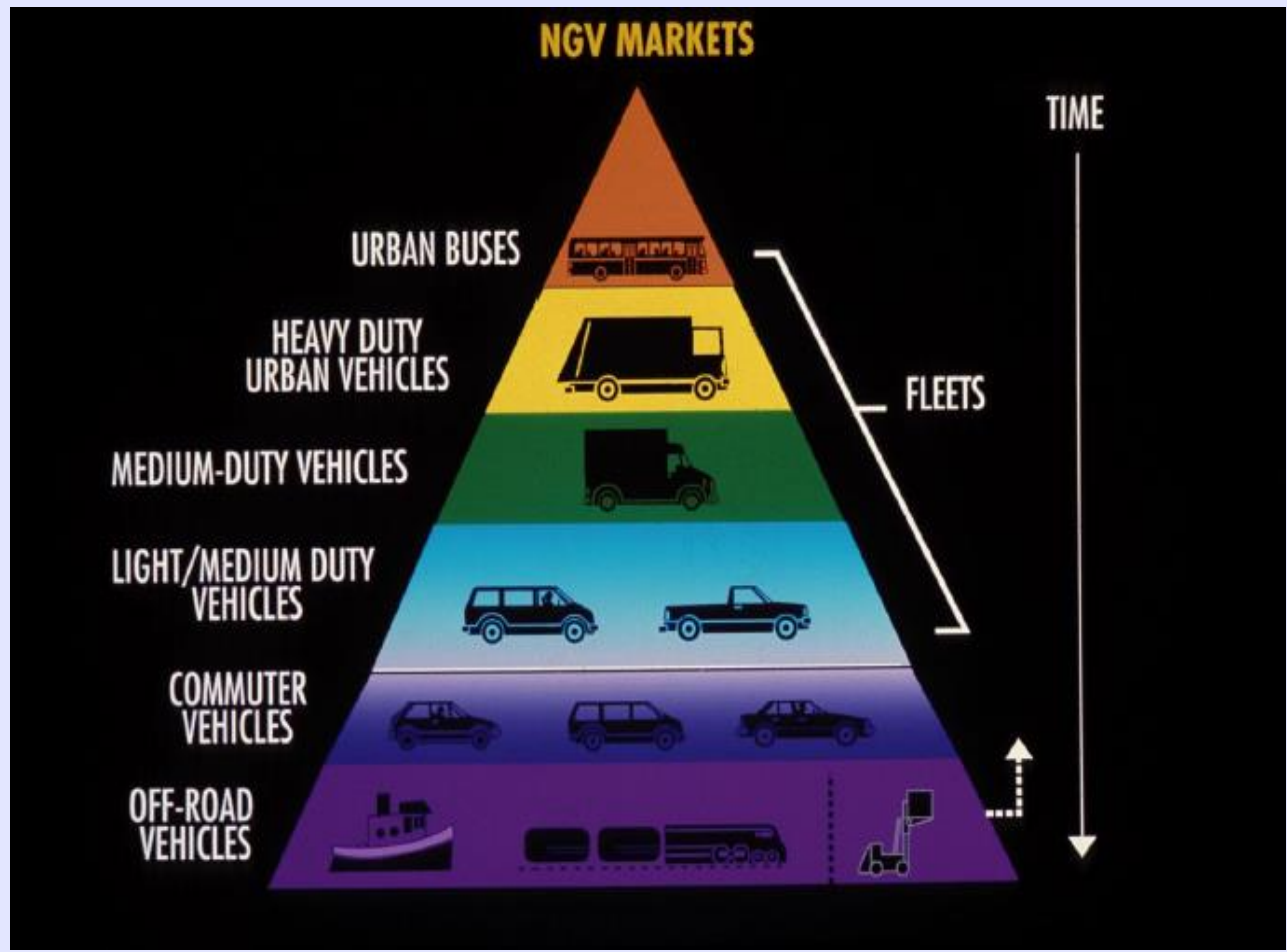
THE INVOLVEMENT OF GOVERNMENT IS ESSENTIAL*

(Strategies Supported by Specific Actions!)

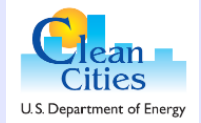
- Create incentives (financial & others)
- Enforce mandates (but *with* incentives)
- Develop standards
- Fund research & development
- Leadership by example
- PR & communications

* What's good for one alternative fuel is good for them all!

Market Expectations... Market Realities



Different approaches to NGV market development will help shape government approach to policies



France



UK



Germany

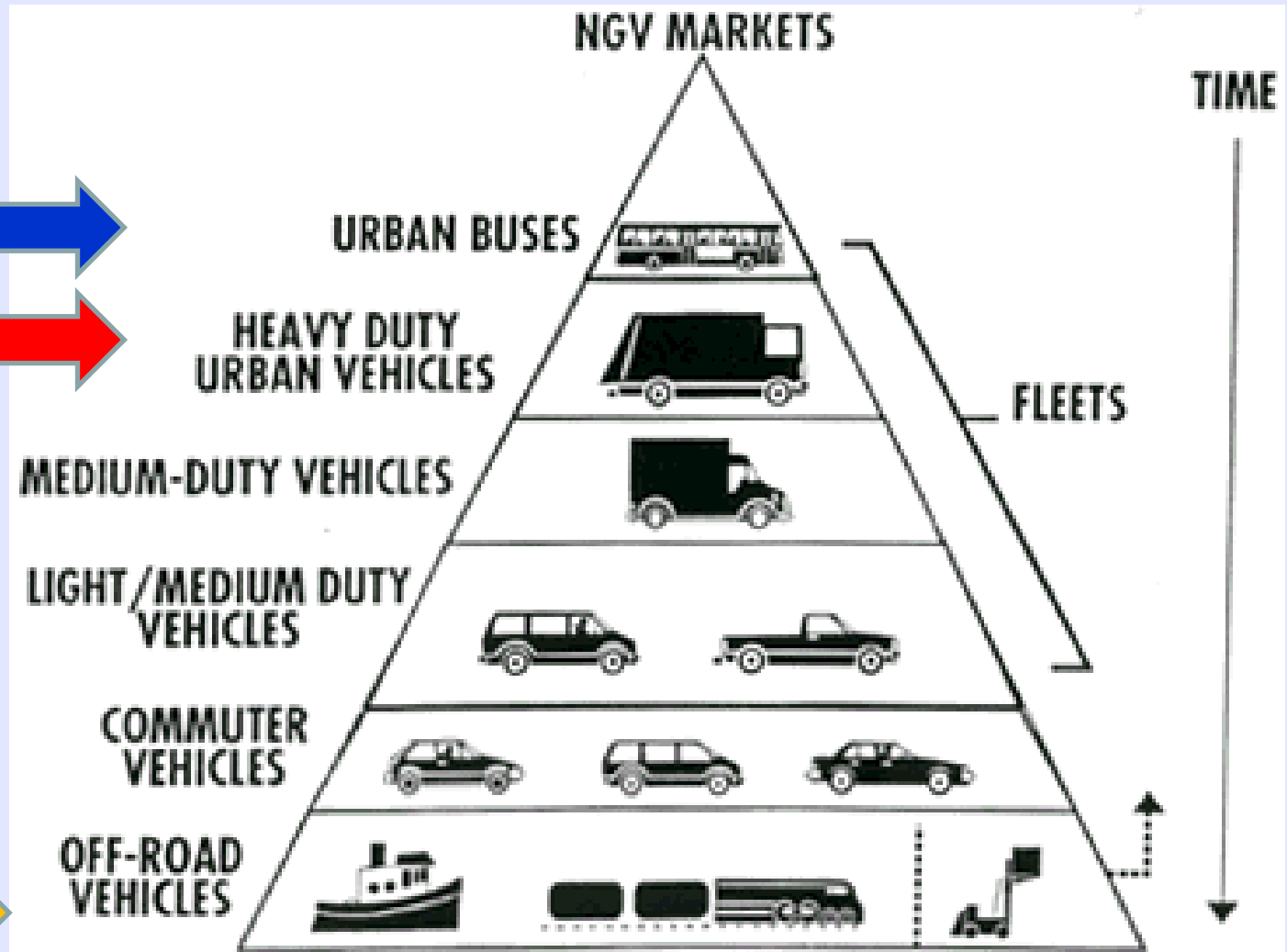


U.S.

Italy



Norway



MARKET BASED INSTRUMENTS

What is popular?

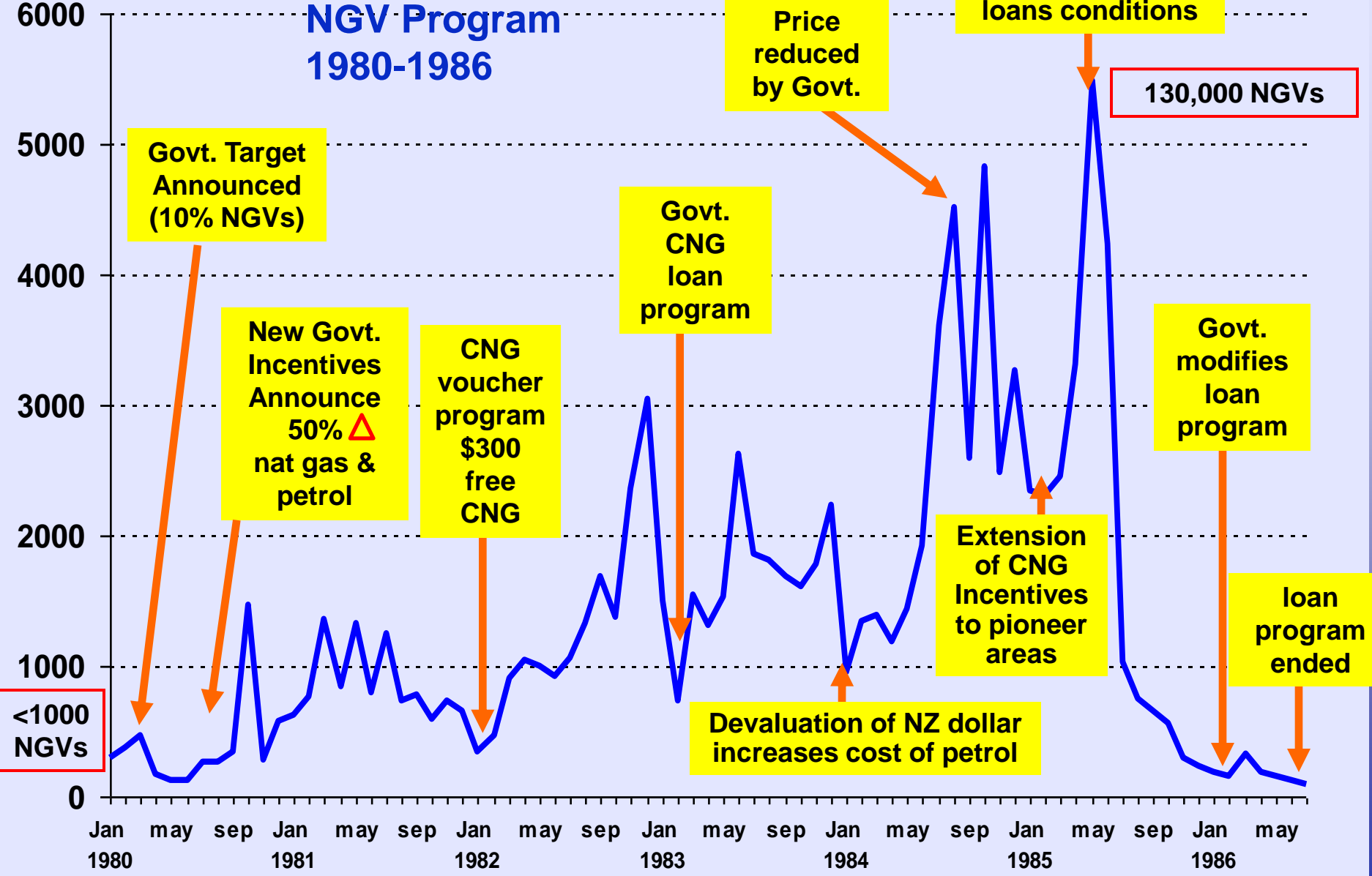
- Taxation is the most cross-cutting
 - Incentives (subsidies)
 - Penalties
 - Exemptions
- Three main options in the transport sector
 - Fuel taxes
 - Vehicle taxes (sales, import, registration)
 - Vehicle use taxes (i.e. road tolls, parking..)
- Tax *credits* or tax *deductions*
 - \$/€ 5000 *deduction* from your taxable income at 50% tax = \$2,500
 - \$5000 *credit* from taxes you owe = \$/€ 5,000!

INCENTIVES & THE NEW ZEALAND NGV EXPERIENCE

- Experience shows that conversions per month were sharply affected by government incentives
- When incentives occurred, market share increased
- When incentives were removed, market share dropped significantly
- After worldwide oil price collapse of 1985-86 program ends

Effect of Incentives on New Zealand NGV Program 1980-1986

Conversions per month

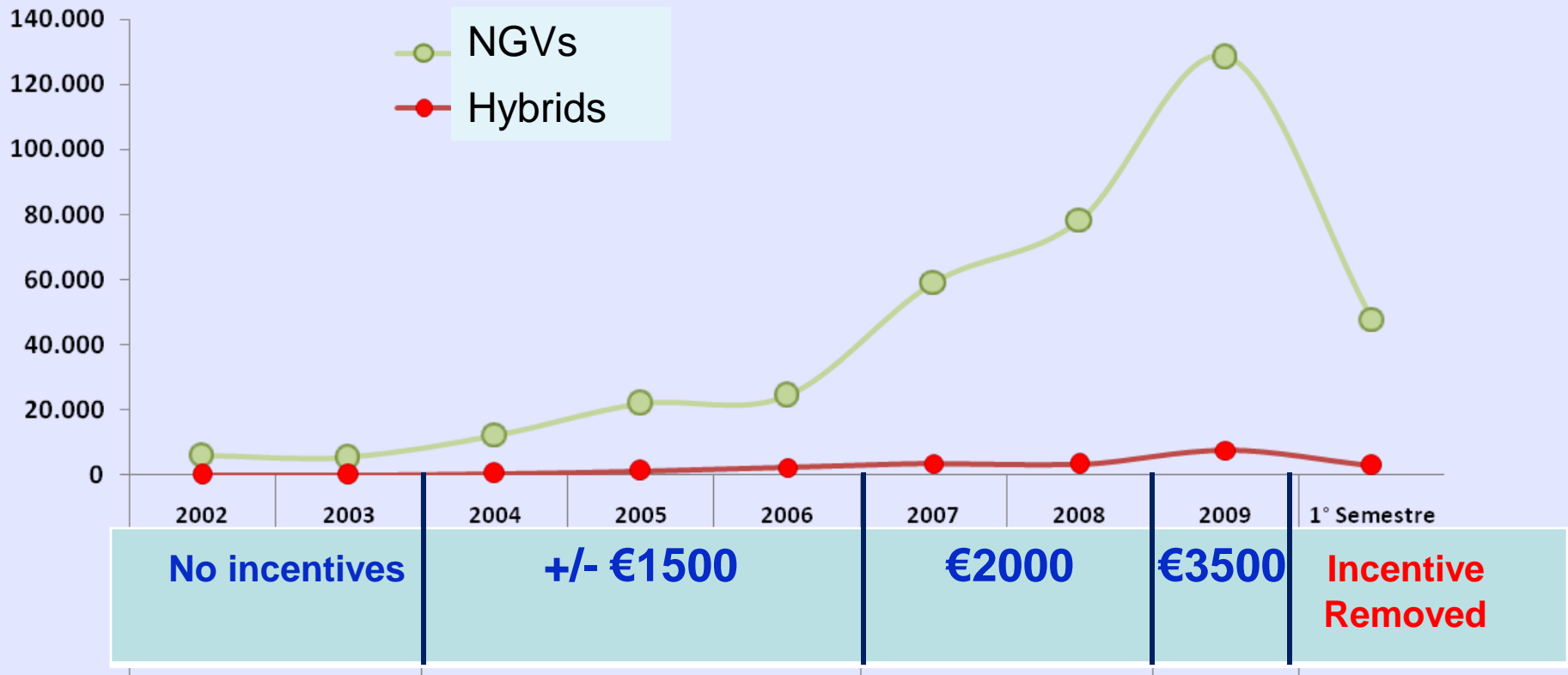


THE U.S. INCENTIVE TIPS

- Focus projects on reducing emissions or petrol use or (preferably) both
- Tax incentives must be offered for the cost *differential* between NGV & petroleum vehicle, not for *FULL* value of the vehicle!
- Programs have to be easy to administer (no refund hassle, etc.)
- Incentives are needed to support the fuelling infrastructure as well as vehicles
- Grants & cash rebates are more popular than tax credits (especially for consumers OR vehicle salespeople)
- Nonprofit organizations and local governments can be qualified for grants/cash
- **U.S. tax incentives have been too short-lived.**



ITALIAN NGV GROWTH PER YEAR: WITH & WITHOUT FISCAL INCENTIVES



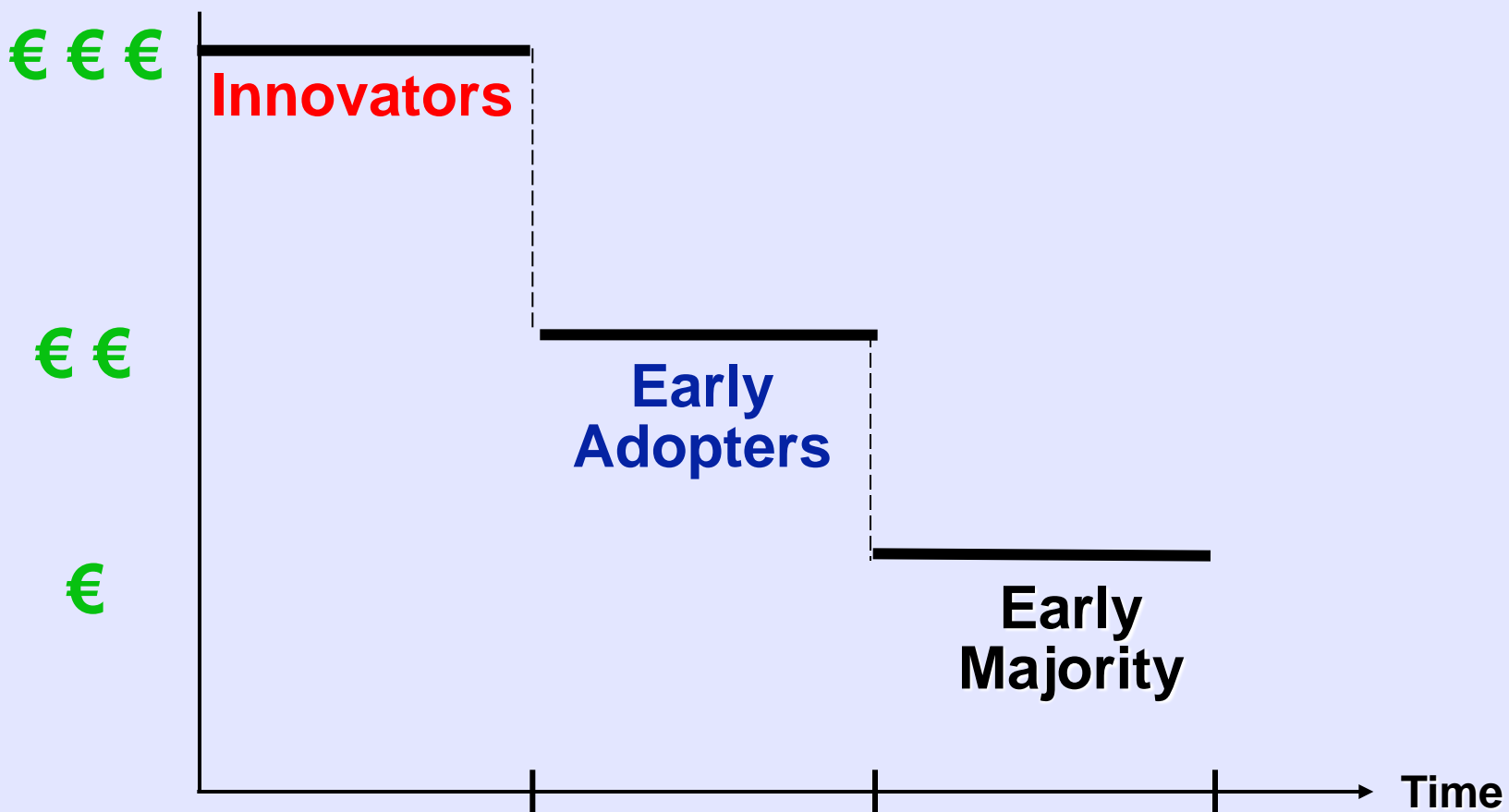
Lesson learned: Government policies need to be consistent and stable to assure customers of long term market initiatives

SUCCESSFUL BERLIN TAXI CAB PROGRAM “TUT” 1000 taxis (2001)

- **First 400 purchasers of Euro 4 taxis (2005 standard) received € 3068**
- **Second 300 purchases received € 2567**
- **The last 300 purchasers received € 2045**
- **Local gas company provided fuel vouchers ranging from €1534 to €1043 for early to later purchasers**

Reward the innovators and earliest adopters who take the most 'risk' (and leadership)

Incentive Level



Successful Market-Based Incentives

Creative Financing for Cairo Taxis



- Egyptian ‘shared savings plan’ organized by government & Nassar Bank
- No cost ‘loans’ to taxi drivers to convert vehicles: conversions provided ‘free’
- Cost repaid by paying petrol price for natural gas until loan is repaid, then fuel costs drop by 50%
- Cash flow back to bank/government is continual and can be ‘recycled’ back to new customers
- Cleaner air contribution is immediate and growing
- Revenue impact = time value of money loaned

POLICY TOOLS:

Non-Financial Incentives

- **Exemptions from ‘Bad-Air’ day traffic bans or limitations** 4 Italian cities, Paris, etc.
- **Exemptions from time-of-day traffic restrictions** i.e. London congestion charge;
- **Restrictions on commercial traffic**, such as noise limits on late night commercial traffic (bad for diesel; good for NGVs)
- **Access to carpool lanes**...United States, mainly;
- **‘No-Wait’ taxi zones** at airports & train stations. Very successful in Sweden where first initiated; challenged in Texas courts by taxi association!

POLICY TOOLS: *WHEN DO MANDATES WORK?*

- **Best with incentives. Financial ‘carrot’ helps ensure compliance**
- **Transition approach most likely for success (i.e. gradual increase of % procurements of vehicles over time)**
- **To be successful mandates *must* be implemented *AND* enforced***

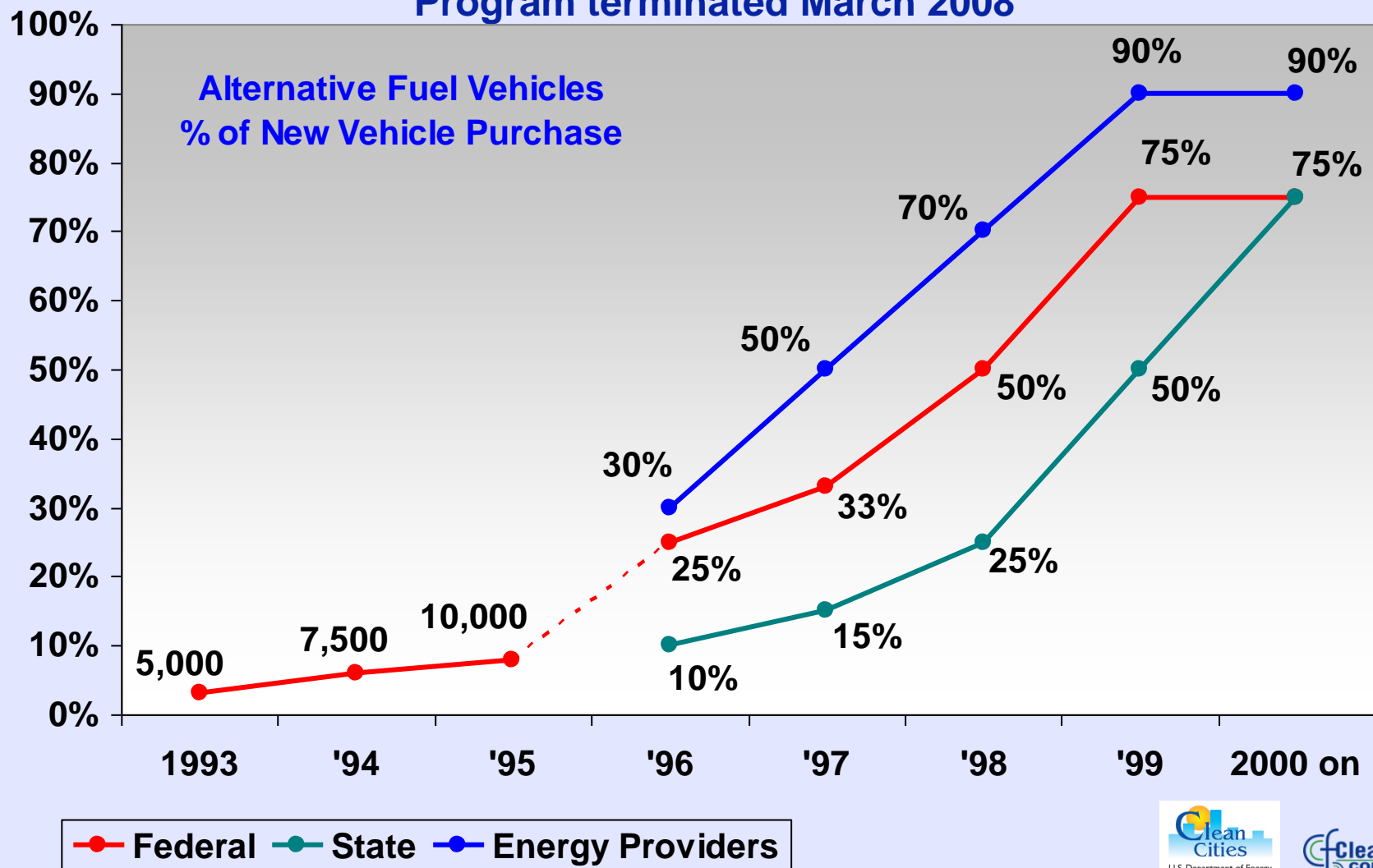
(*i.e. Mandates to sell or produce specific vehicles are unenforceable.)

ENERGY POLICY ACT 1992 (US)

Fleet Mandate Phase-in

Impacts diminished by 'unintended consequences'

Program terminated March 2008



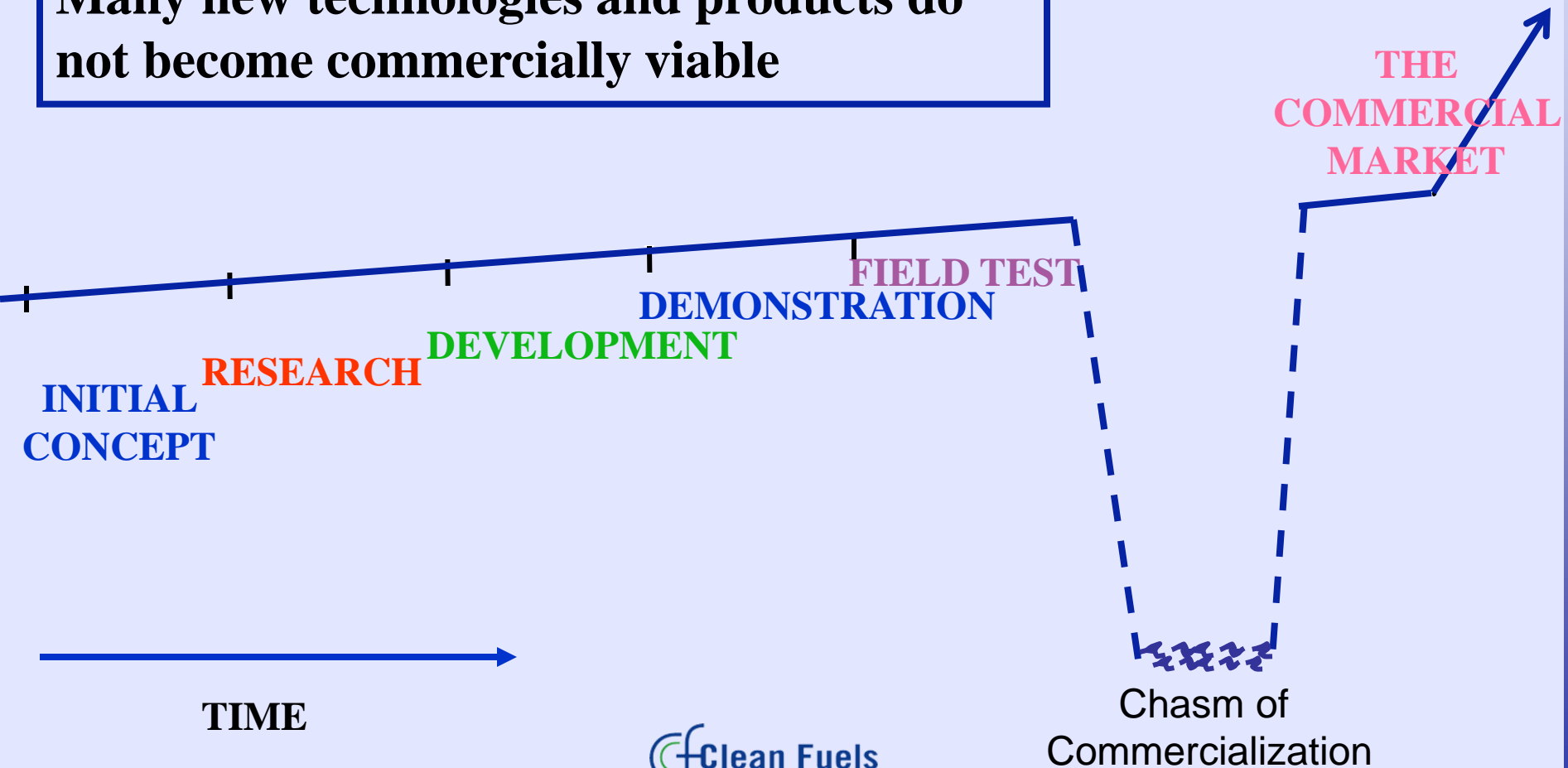
POLICY TOOLS:

Funding for RD&D

- Support can be provided to advance ‘market proven’ technologies (like NGVs) and accelerate growth
- Private sector can’t pay (all) & keep product costs low
- Over-investment in long-term alternative fuels and technologies (i.e. hydrogen & ‘battery’ vehicles) can penalize the ones that are ‘market-ready’.
- Don’t put all the government’s financial eggs in one fuel basket.

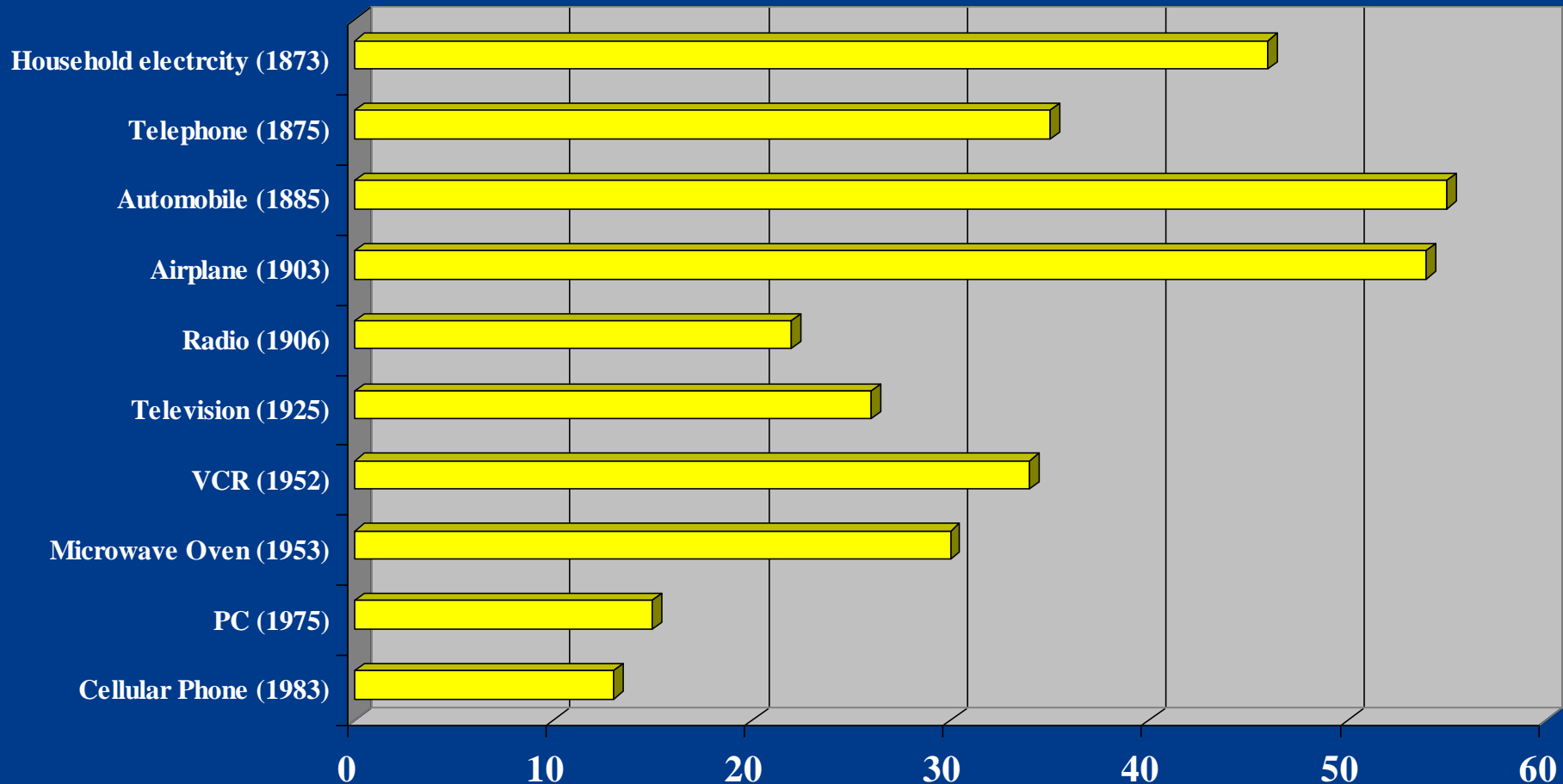
The Chasm of Commercialisation

Many new technologies and products do not become commercially viable



Time Taken to Introduce New Technologies Requiring Infrastructures

(# of years to spread to 25% of the U.S. population)



Source: Transportation and Climate Change: Options for Action, Canadian Transportation Association, November 1999

POLICY TOOLS:

Leadership by Example

- Governments purchasing clean vehicles can motivate industry (safety, Environmentally Enhanced Vehicles, renewables, etc.) by helping to create a critical mass needed to reach economies of scale
- New initiatives fostered by *innovators* (*champions*), followed by the rest of the 'bell-shaped-curve
- New initiatives fostered by innovators and satisfied early adopters, leading to early majority market take off.

Historical 'NGV Leadership by Example'



Bill Clinton 1994



**Cong/Gov. Bob Wise's
'New NGV'**



**Queen Silvia, Sweden
in her NGV**



**PM John Major with his
'fleet' NGV**



**Boone Pickens' Backyard FuelMaker
with the Bushes 1992**



**G.Bush Sr. NGV @
the White House
1993**

THE POLICY MAKING & STRATEGY PROCESS

How to decide what to do and in what order of priority



A comprehensive AFV policy is very important



We already have this.



We prefer this.

Roadmaps can provide direction

- **Roadmaps help avoid ‘disjointed incrementalism’**
 - ‘Incremental’ is OK
 - ‘Disjointed’ is inefficient and less effective than coordination
- Short & mid-term planning lays the foundation for longer term infrastructure development (fuel)
- **More certainty in policies** (if possible from the roadmap) encourages commitment for investors, vehicle and equipment suppliers, & customers.

Roadmap: Where the rubber meets the road.....and getting traction instead of spinning the wheels

- Situation
- Goals
- Gaps & Challenges
- Action Items
- Priorities & Timelines

- Milestones

- Where we are today
- Where we want to be
- What is in the way
- What has to be done
- What is most important to do & in what order
- Landmarks & measures of success

The NGV Roadmap

Each Stakeholder has a Role to Play

- GOVERNMENT(S), 
- ENERGY SUPPLIER(S), 
- VEHICLE & EQUIPMENT SUPPLIERS 
- COMMERCIAL FLEET OWNERS & OPERATORS 
- RESEARCH INSTITUTES 
- EDUCATIONAL INSTITUTIONS 
- ENVIRONMENTAL GROUPS 
- NON-GOVERNMENTAL ORGANIZATIONS 

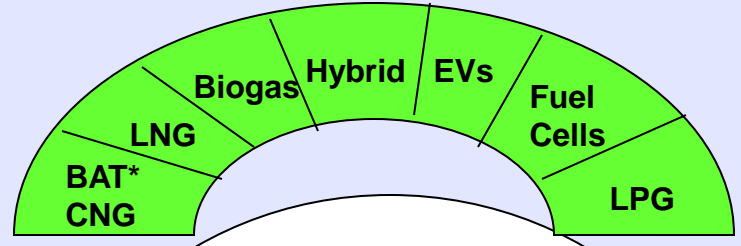
ALTERNATIVE FUELS IN URBAN TRANSPORT

A Blue Print for Implementation (Clean Cities)

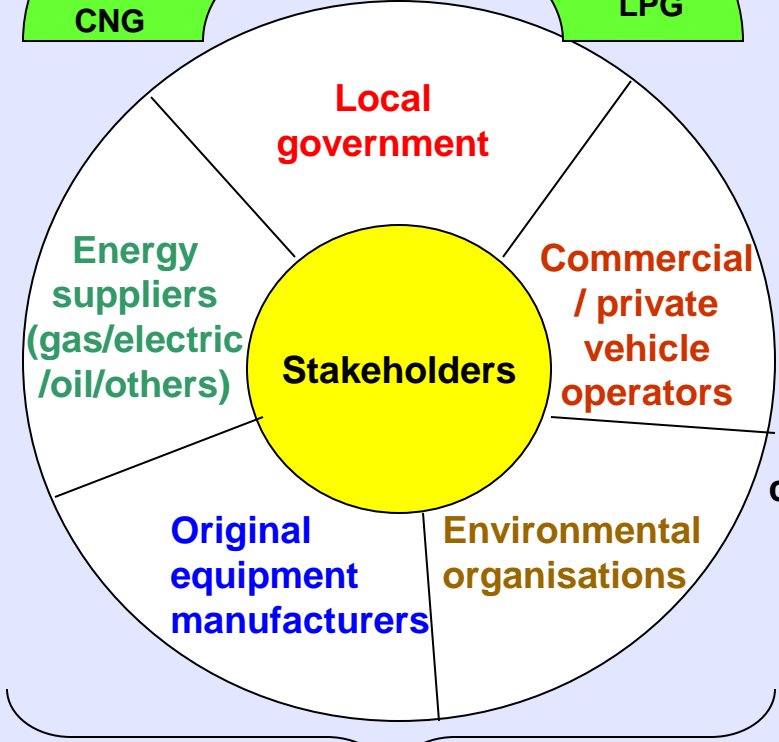
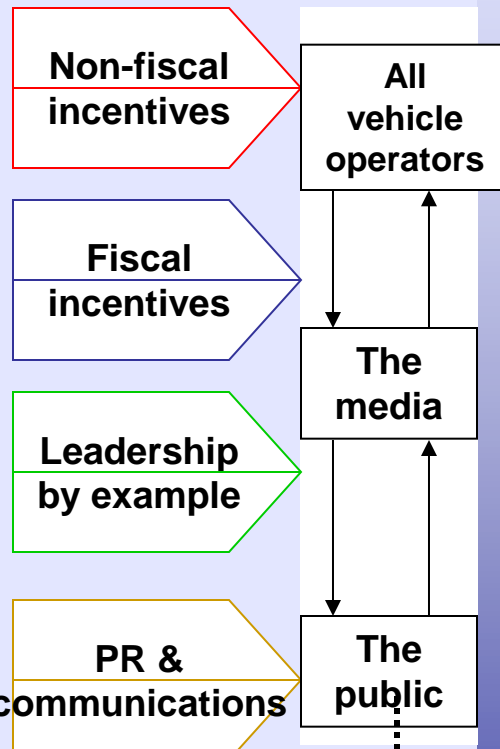
PUBLIC & PRIVATE INPUT & SUPPORT

- Emissions analyses →
- Well-to-Wheel analyses →
- Cost benefit analyses →
- Decision support tools →
- Tighter emissions standards →
- Technology availability →
- Fuel availability →
- Fuel costs →

NEW TECHNOLOGY INTRODUCTION



THE MARKET



*Best Available Technology



feedback

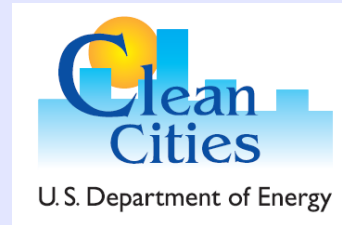
INTO THE FUTURE: WHAT CAN BE LEARNED FROM THE ROADMAP EXPERIENCES?



International Energy Agency



European Commission



U.S. DOE



Canadian Ministry of Natural Resources



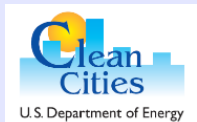
German Energy Agency



California RD&D Roadmap



City of Almaty Kazakhstan









All 'Roadmaps' are different depending on the entity, objectives, timeframe, etc.

- **Federal governments/countries**
 - Recommendations
 - Mandates
- **States:** similar to federal level
- **Cities:** foster consensus amongst stakeholders & the community

Critical Actions Identified

German NGV Roadmap



- 
 • Increase OEM NGV offerings
- 
 • Continue energy tax reduction & differentiation by CO2 output beyond 2018
- 
 • Demand oriented development of CNG network (*not 'build it and they will come'*)
- 
 • Fuel pump price display CNG in petroleum equivalents
- 
 • Capacity utilization of fuelling stations needs to be increased (vehicles per station) (April 2014 = 105 NGVs/station)
- 
 • Increase biomethane & develop certification system

Canadian Roadmap NGV Market Focus



- Focus on high fuel consuming, centrally fuelled fleets
 - Heavy duty & medium duty/OEM
 - LDVs retrofit (but not commuter vehicles)
- Short sea shipping (LNG) (1 ship = 50 trucks)
- Rail applications (1 locomotive = 20 trucks)
- Create collaborative environment with stakeholders to move forward

Infrastructure Concepts & Strategies

- Cores, Rings & Corridors
- Blue Corridors & Gas Highways

Who are the best partners to invest in the fuel infrastructure?

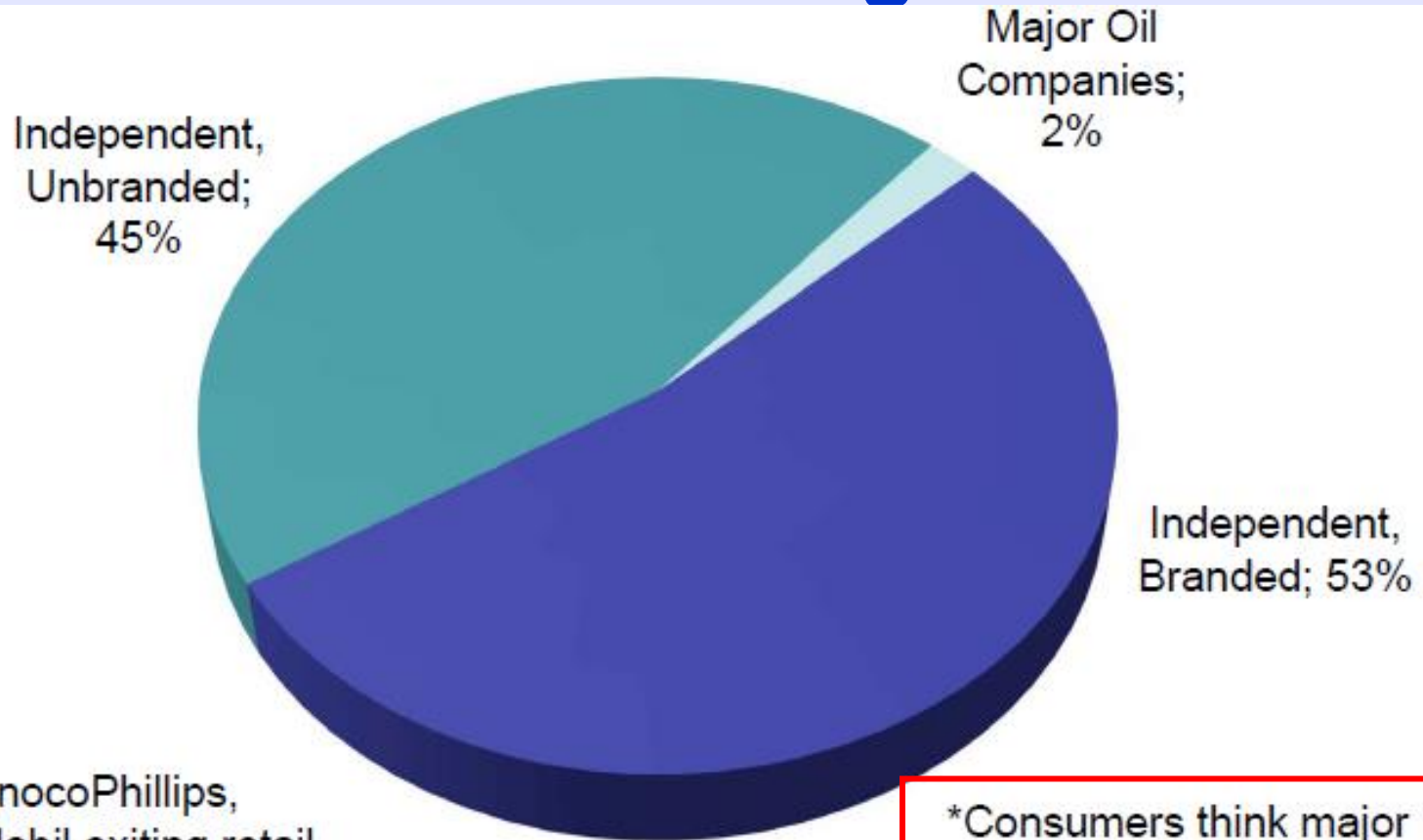
Who Owns Gasoline Retail?

And is there profit in alternative fuels?



The Association for Convenience & Petroleum Retailing

In the U.S. the *convenience industry* sells 80% of the gasoline

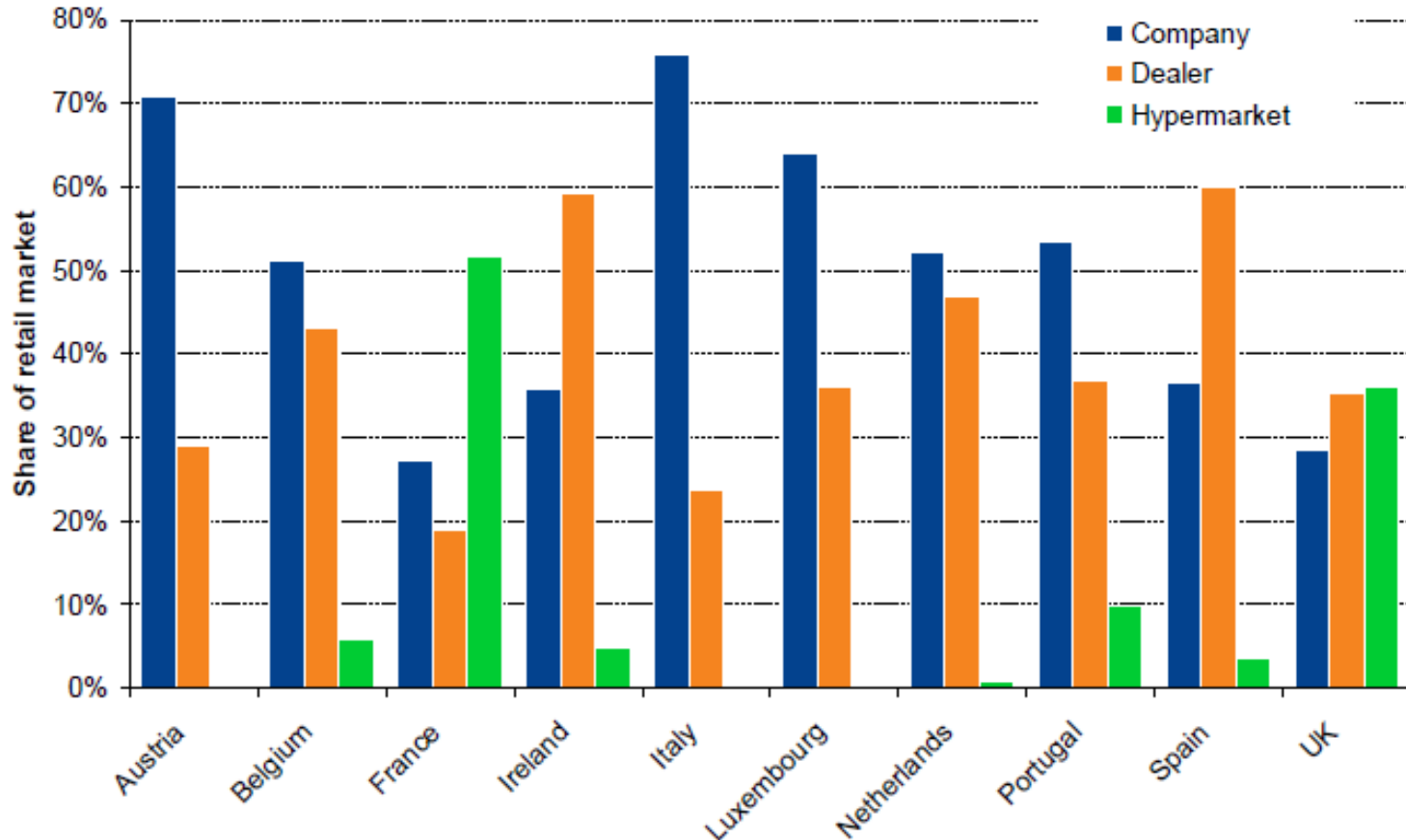


*BP, ConocoPhillips, ExxonMobil exiting retail

*Consumers think major oil owns 63% of stores

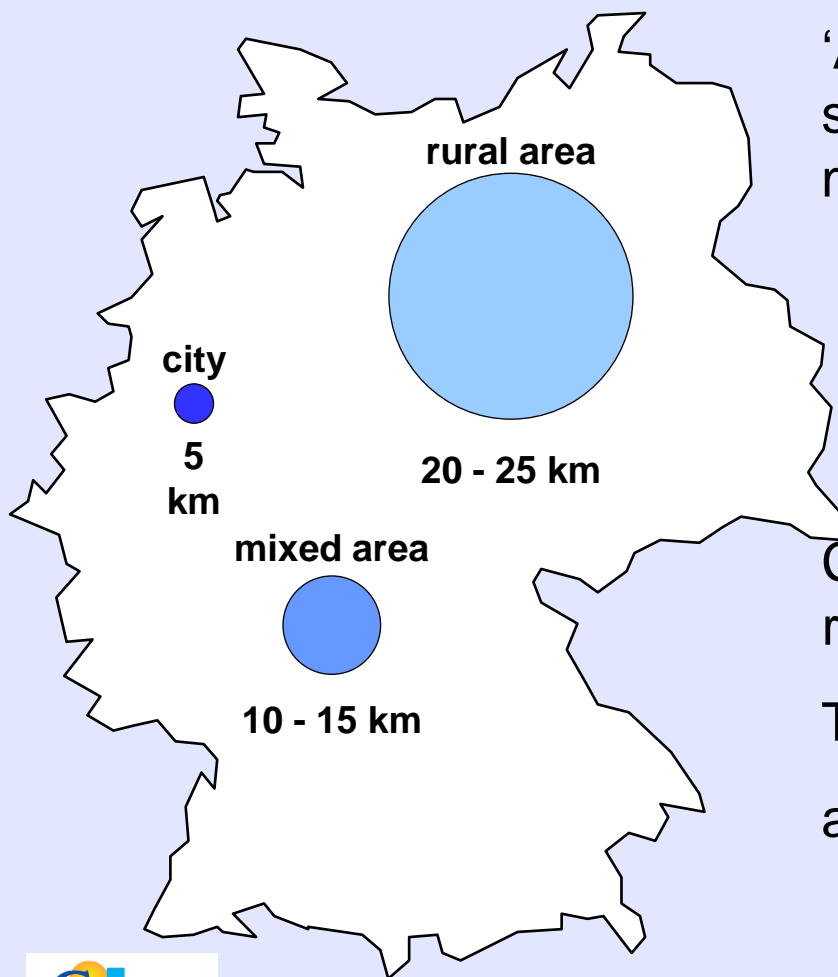
The Association for Convenience & Petroleum Retailing

In Europe the oil majors and their dealers represent a large share of retail fuel stations and are target partners for NGVs



Source: Experian Catalist 2008 & 2009

German market research identified customers' tolerances travelling to CNG stations



'Acceptable' distance between refuelling stations was determined through customer market research

- towns and cities approx. 5 km
- mixed areas approx. 10-15 km
- rural areas approx. 20-25 km

Construction of approx. 1,000 new CNG refuelling systems at public petrol stations

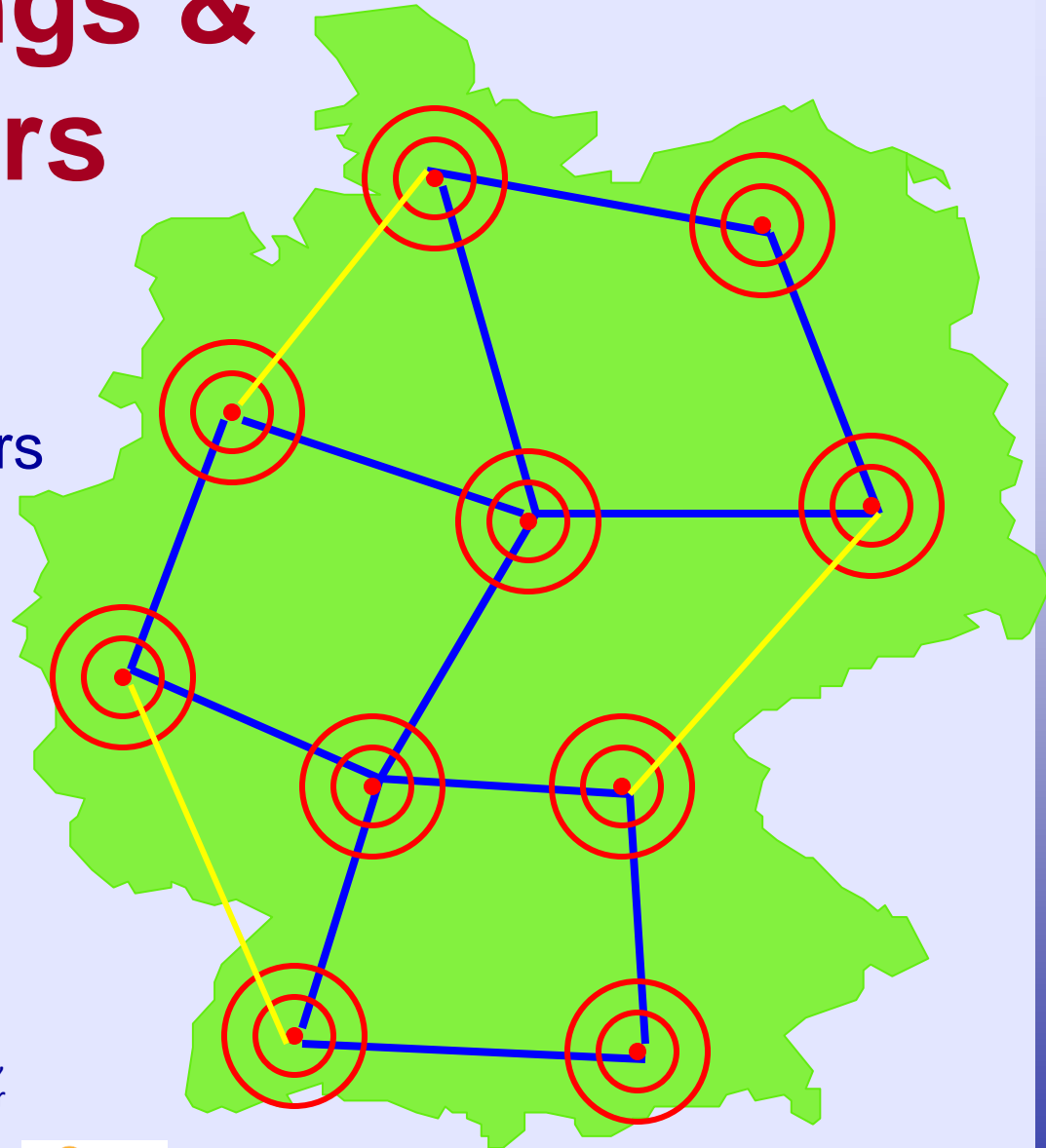
Total capital expenditure:
approx. € 250 million

Cores, Rings & Corridors

Growth strategy for natural gas refuelling station networks in Germany is providing CNG to customers across the country

Legend:

- Cores
- Rings
- Corridors



Source: Jeffrey M. Seisler, European NGV State of the Union, 11th ENGVA Annual European NGV Conference & World Fair NGV & H2V, Bolzano June 2005

LNG Fuelling Station Strategies

- Central fuelling for fleets returning to base
- “Selling through the fence” (maybe easier with CNG)
- Fuelling at LNG truck terminus locations
- Connect the dots: LNG corridors
- (L-CNG in corridors to promote CNG too!)



41 LNG stations Southern California (2011)

TEN-T NETWORKS (plan to 2020/25/30)

2014 Directive

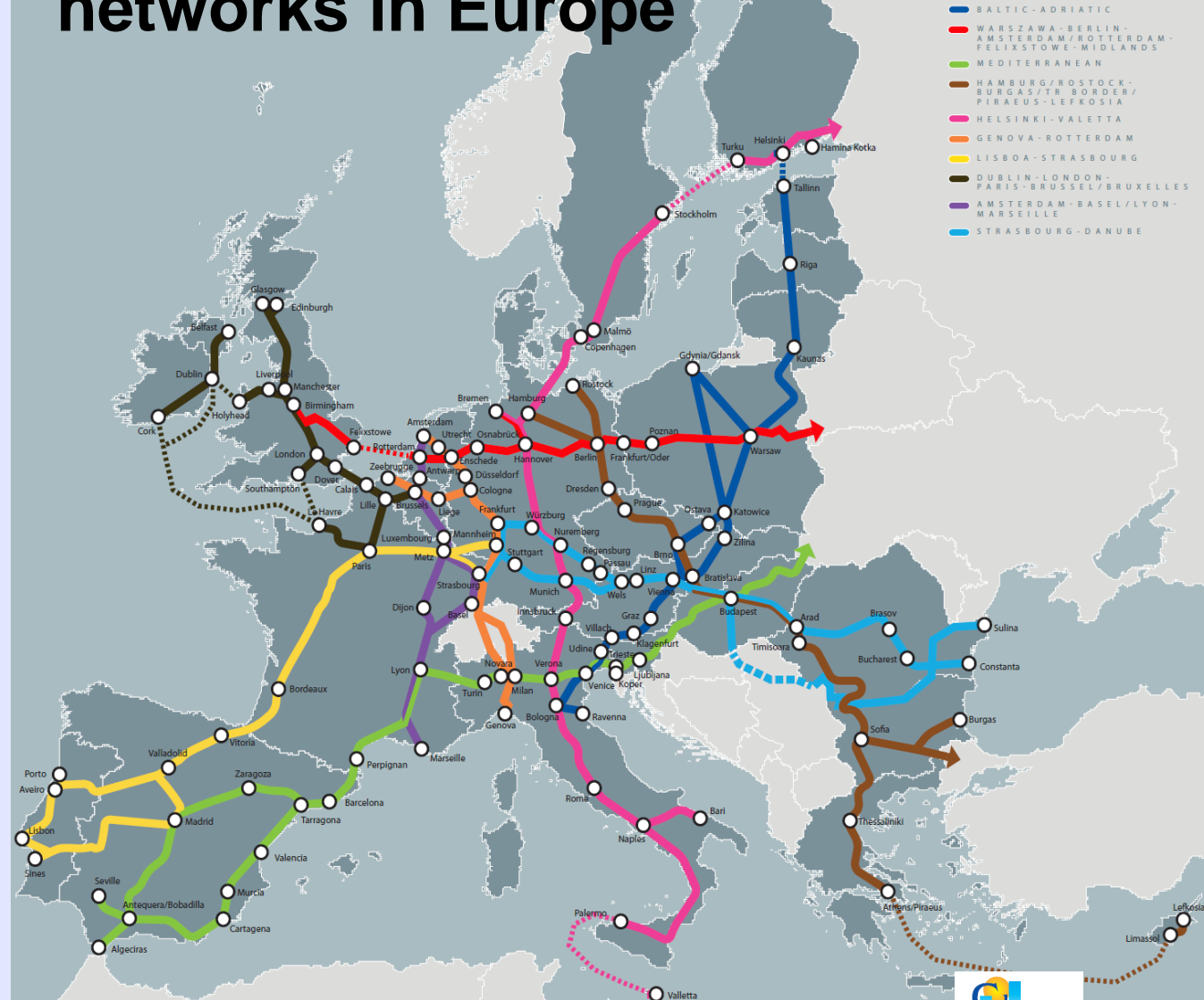
'Deployment of the Alternative Fuels Infrastructure'

originally specified development of CNG & LNG stations for road and ports; also EV charging points.

The specific targets were removed in the final version.

Still the mandate exists to 2020, 2025 and 2030 to install 'appropriate numbers' of fuelling stations.

Clean Power for Transport: Ambitions for alternative fuel networks in Europe



Sources: EU documents Ten-T; AFV Infrastructure policy impacts; etc.

Main Points/Concerns about infrastructure policy

- Private sector investment alone will not achieve all the targets; financial incentives are required.
- Historical evidence suggests that public/private partnerships are the most successful (policy development & financing)
- Engagement of the traditional and independent fuel suppliers for niche market road transport fuels is challenging but essential.

All the alternative fuels, to one degree or another, have to deal with some form of
THE CHICKEN AND THE EGG

**WHICH COMES FIRST?
THE ANSWER IS:**

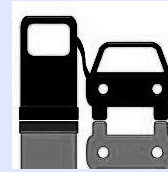
**They both have to come
at (roughly) the same time:
fuelling and vehicles.**



Best Strategies

Avoid Past Mistakes; Learn from Creative
Successes

Politics - Markets - Technology



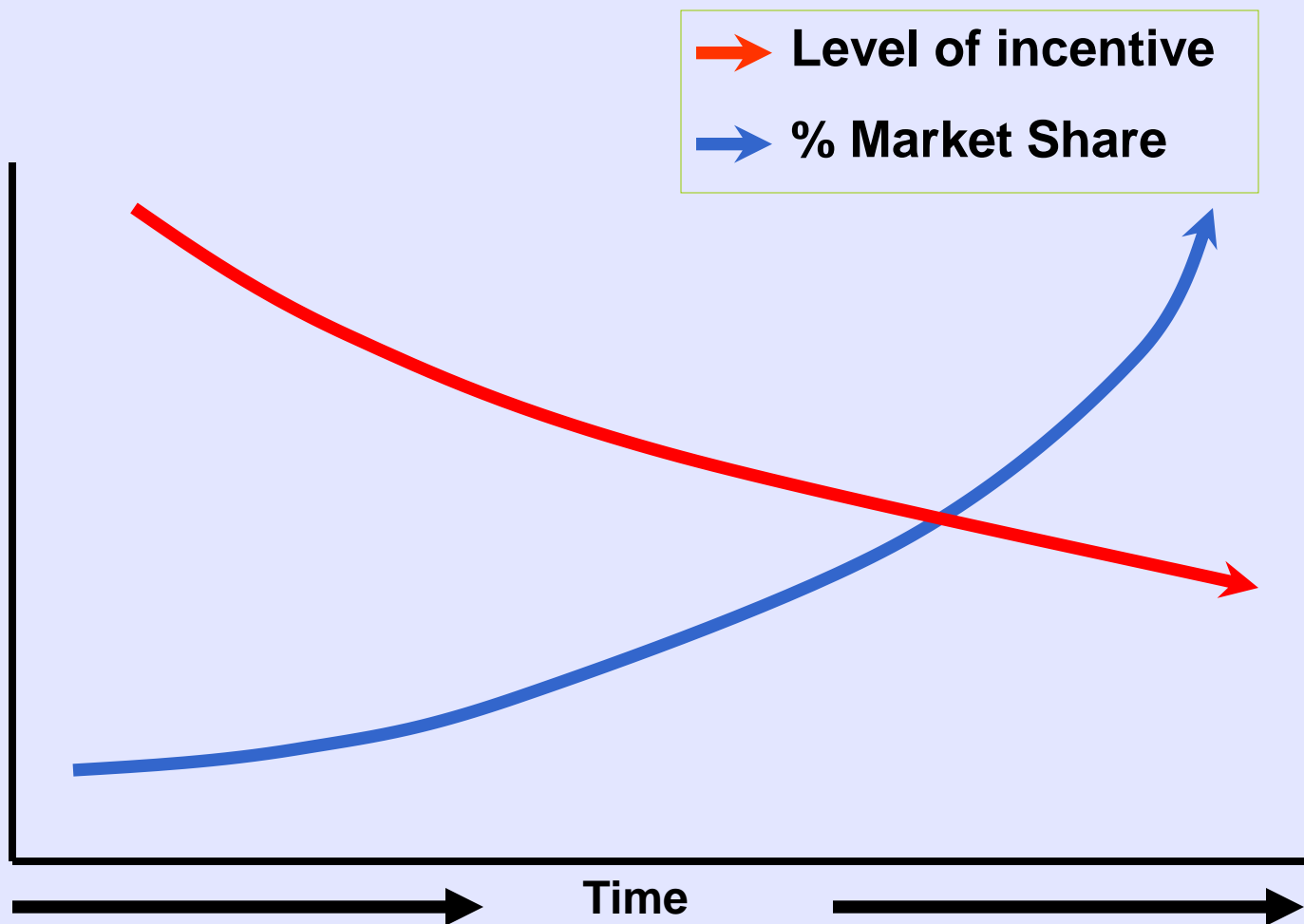
Best Strategies

Institutional Requirements



- Vast opportunities to ‘incentivize’ markets exist
- *All* tools should be promoted to ensure long-term sustainability of strategies
- Incentives (rewards) **or** mandates both can work but sticks are always better *with* carrots) ***Balance!***
- Government should understand the cost/benefit of environmental & health impacts (value of a cost per ton reduced pollution)
- Energy security is enhanced by diversifying from petroleum transportation fuels to alternatives
- When market shares rise, corresponding incentives can be reduced..... But *gradually*

Government incentives based on market share can be attractive from a *revenue impact* perspective and promote *longer lasting policies*



Best Strategies Institutional Requirements



- **Positive-sum (win-win) approach is advisable**
- **Stakeholder input (consensus?) is best for policy sustainability**
- **Reporting & feedback mechanisms allow for mid-stream corrections, improvements & sustainability**
- **Pro-active is better than re-active**

Best Strategies



Market-Building: the process

- **Strategic roadmaps** (with flexible milestones) can be helpful.
- **Consensus-building** amongst all key NGV stakeholders is a proven technique. (In particular, bring together the chickens & the eggs.)
- **Understand the customers' fuelling needs** (public & private) & the nature of the fuelling infrastructure business.

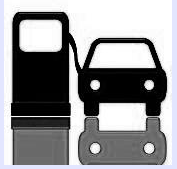
Best Strategies



Market-Building: strategic targets

- Entry strategy targeting high fuel users have been the logical first targets – fleets...or others: Taxi cabs & buses can help establish critical mass of stations
- Hub & spoke (including ‘blue corridors’) is a proven, logical strategy
- Ports are ready-made hubs for NGVs: airports and seaports (trucks & ships)

Best Strategies

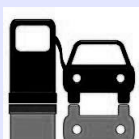


Technology Considerations

- No matter how much money you invest in research & technology, product development to Tier 1 quality takes *time, time, time*
- Beware of ‘hype before hardware’: premature market entry (& without adequate downstream service & support) can be disastrous
- Standards and regulations are the foundation of technology progress
- With safety in mind, implementation & enforcement of regulations is critical for global growth
- “Cheap is not safe.”



Politics



Technology

Lessons Learned



Marketing



Communications

Create & support AFV associations

- AFV associations have been lightning rods and catalysts for AFV growth
- Associations provide a focus for advocacy work (especially national), market strategy & development and technology advancement.
- Stakeholders need to continue and expand their support of the associations as it elevates the commercialization efforts.

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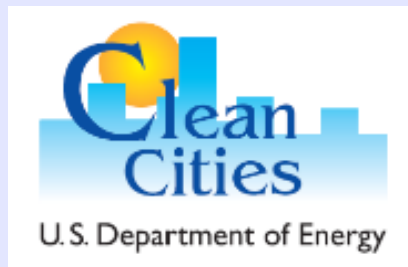
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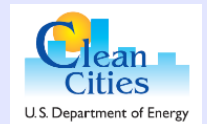
**APPENDIX SLIDES TO
FURTHER SUPPORT POINTS
MADE IN THE
PRESENTATION**

Government Considerations Regarding Alternative Fuels

- **Environment (incl. public health impacts)**
- **Energy Efficiency**
- **Energy Independence and Energy Security**
- **Feedstock Adequacy and Reliability**
- **Taxpayer Affordability**
- **National Economic Impacts**
- **International Considerations**
- **Political Continuity (will this policy get us elected..and re-elected?)**



Source: Adapted from: *Checklist for Transition to New Highway Fuel(s)*, Charles Risch, Danilo Santini, January 2012.



U.S. NGV Development 1965-2010 (characterized in 4 stages)

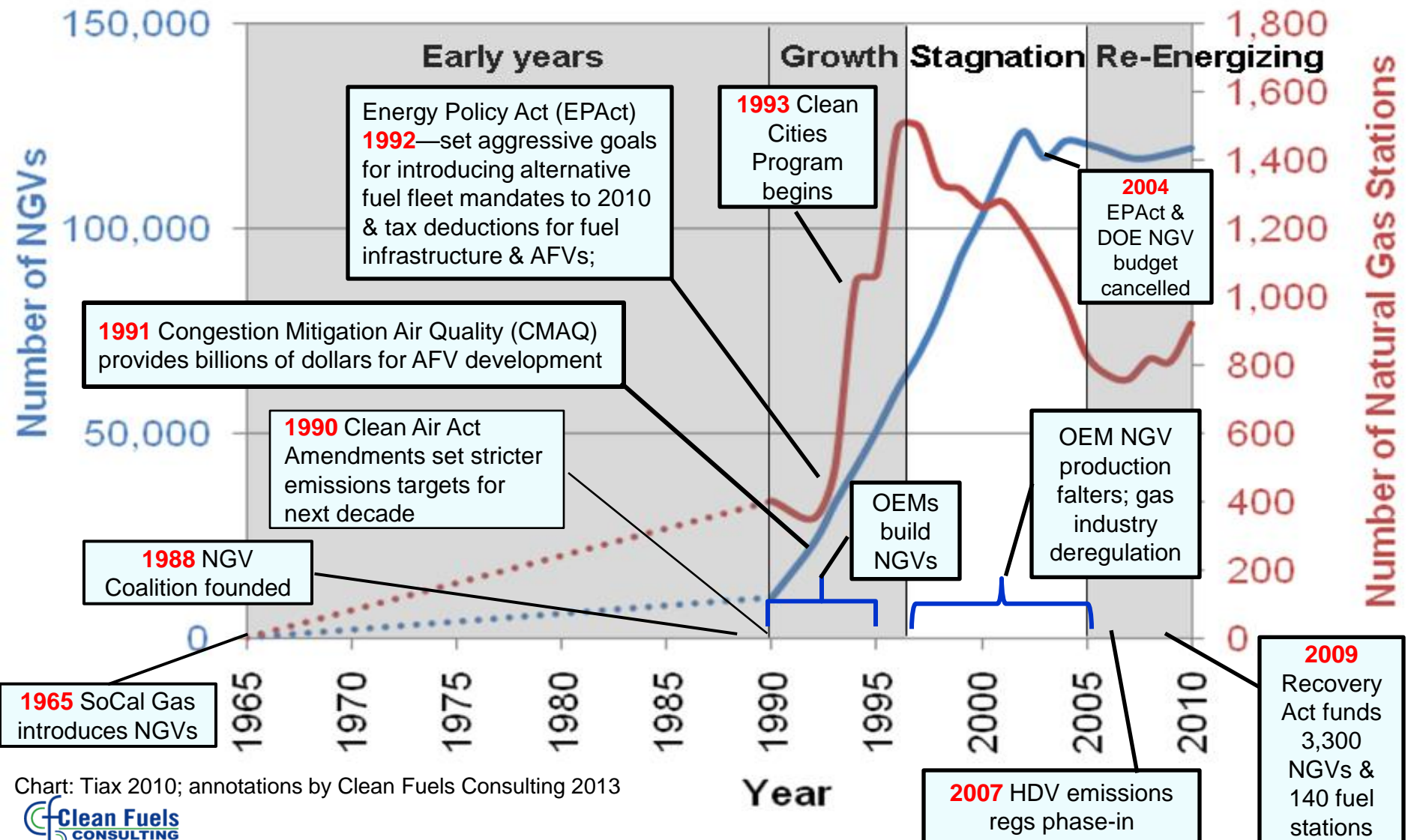


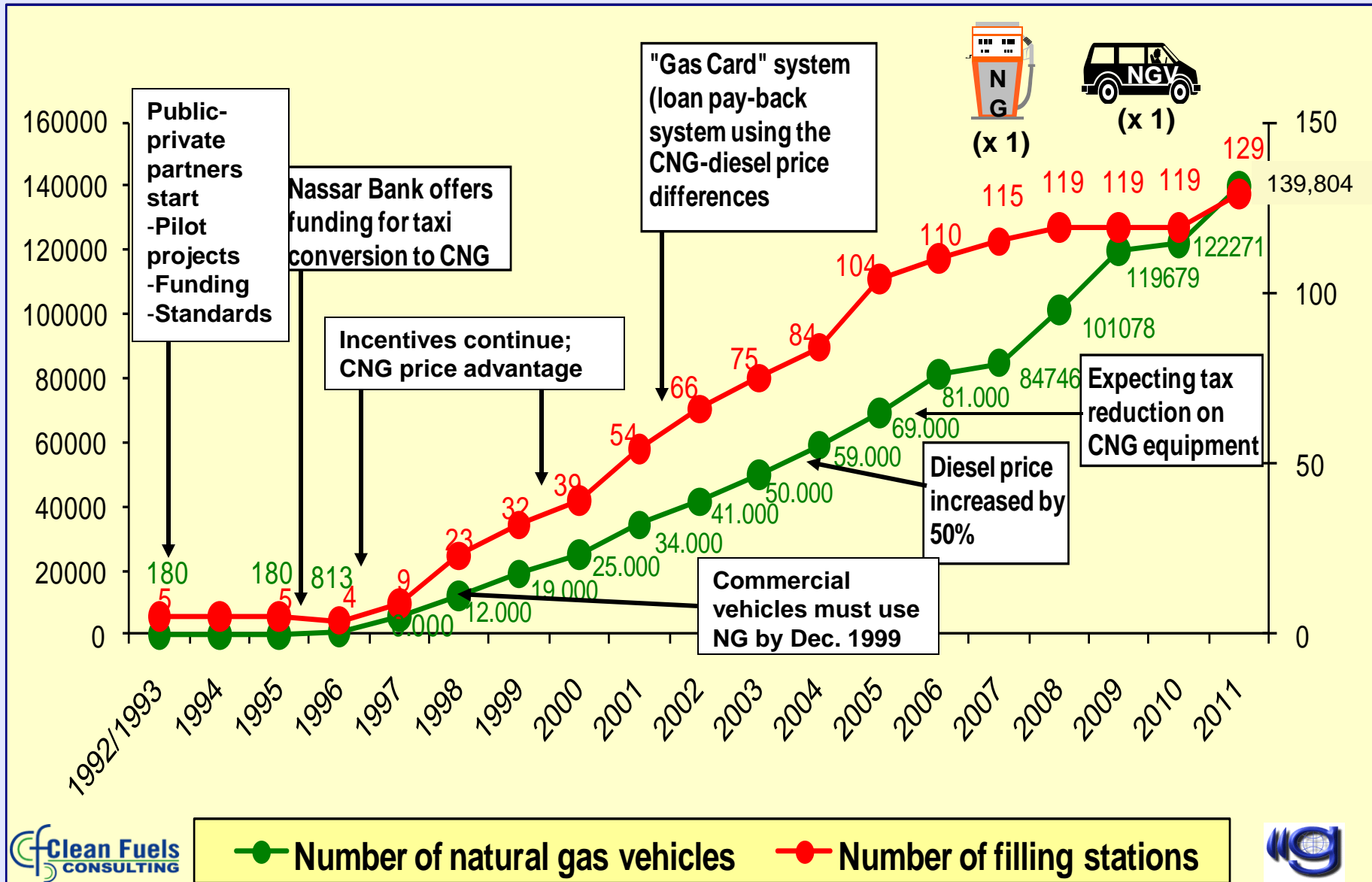
Chart: Tiax 2010; annotations by Clean Fuels Consulting 2013

Market-Based Incentives

German Tax Rules for Natural Gas & LPG

- 1996-2009 CNG tax reduced by 61% (from DM 47.6 kWhr to DM 18.7 kWhr)
- 2002 benefits extended to 2020
- March 2006 tax rules provide break for LPG and CNG: to 2009 for LPG; 2020 for CNG
- June 2006 Bundestag adapts law to make both tax breaks apply through 2018.
- ***Lesson learned: Government policies need to be consistent and stable to assure customers of long term market initiatives***

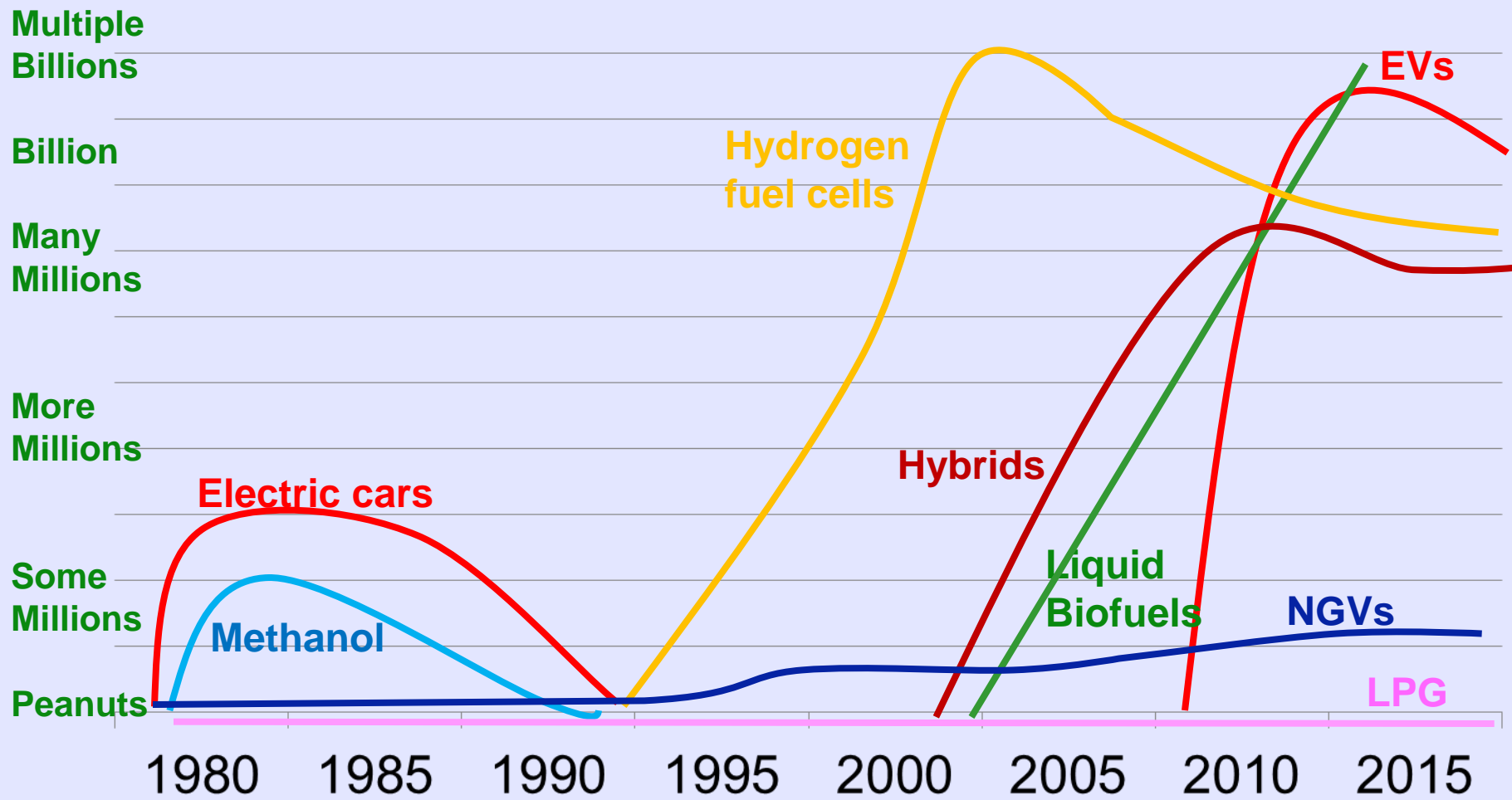
EGYPT



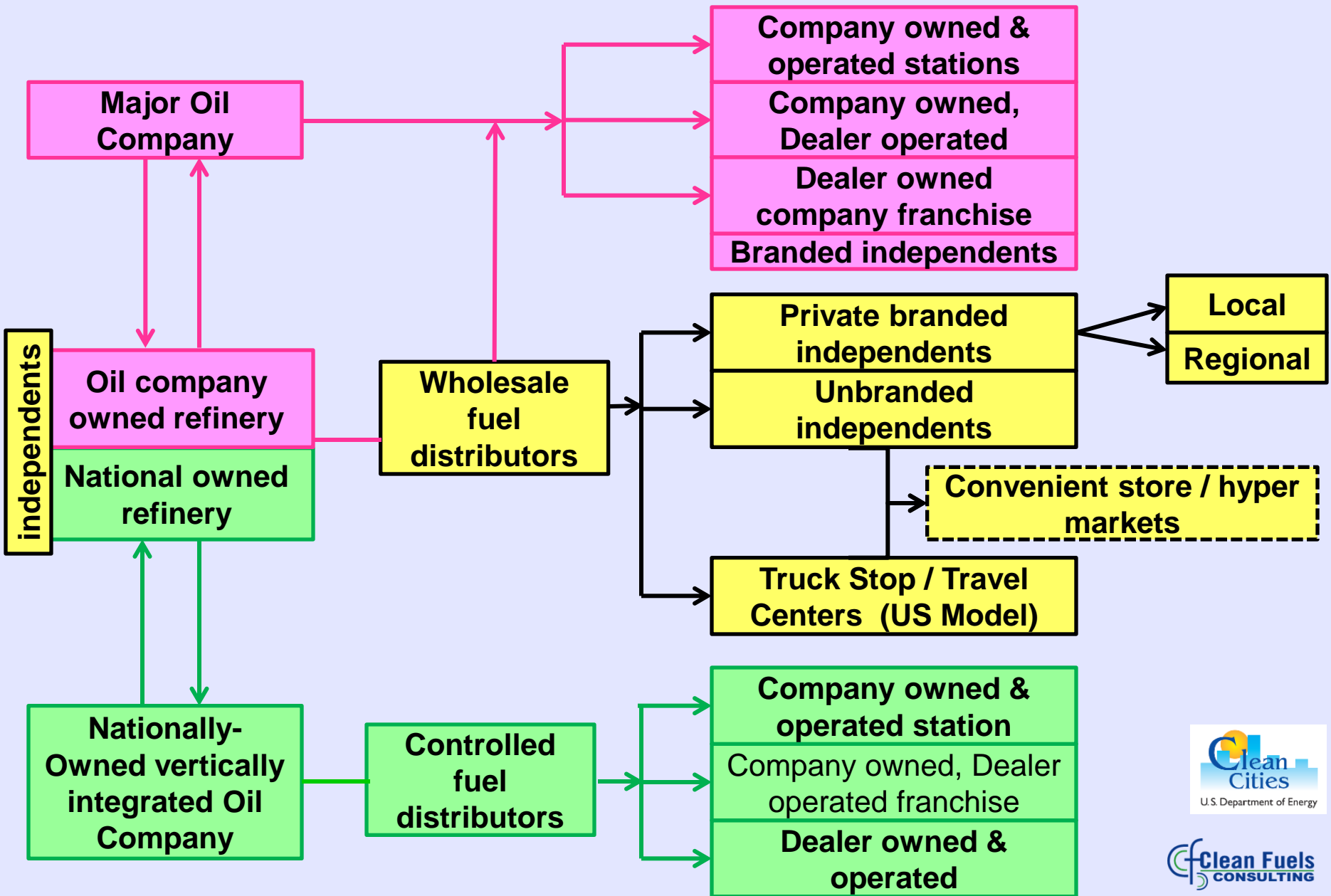
THE INDIA EXPERIENCES WITH NGV MANDATES

- 1998 decree that *public* vehicle convert to NGVs by 2001
 - Supreme court enforced deadline although majority of buses remained on diesel (only 6 CNG fuelling stations installed).
 - Public unable to get to work; riots occurred & 6 buses were burned. Deadline was prolonged.
 - The govt. adopt “Command & Control” & “Market Mechanism” approaches (fines & follow-up).
- ***Lesson learned: Gradual phase-in implementation & an enforceable plan are needed***

Alternative Fuel R&D Hype Cycle (*Fuel du Jour* RD&D Funding 'Concept')



Petroleum Retail Product Chain is Complex



Other fuel strategies take into account gas availability (or lack thereof)

- Virtual pipelines and ‘mother-daughter’ stations can now bring gas to areas where there is no gas infrastructure (yet)
- Home fuelling brings CNG to NGV operators whose residence is suited to this option



Raufoss Type IV



M-D (India)



GE chilled NG for home compression

Incentives should be reduced gradually over time to avoid market shocks and 'dislocation'

Gradual reductions keep markets intact for a 'soft landing'

Sudden end to incentives can kill the market, (even if the end date is known)

\$ - € - ¥

Solar energy tax credits U.S (1985)
New Zealand tax incentives ('84-85)
Tax breaks for LPG, U.K. (2008)
Cash incentives for NGVs, Italy (2009)
Etc. Etc.



Broken eggs & dead chickens

Best Strategies

Institutional Requirements



- Policies should be long term and consistent over time ('knee jerk' reactive decisions kill the market): vision-strategy-focus
- **Pro**-active is better than **re**-active
- Rewarding early adopters works
- Credits & deductions on cost *differential* of the vehicle/fuel station, not *full* cost
- Exemptions from traffic & pollution restrictions work well (and are economic for government!)
- Free parking and special 'clean vehicle' access lanes costs little and motivates markets through increased visibility