

CLEARING THE PATHWAY TO A PURE EV PARADIGM

Transnational transitions (1), trends and tensions to clean energy transportation and constructing an ideal pure electric vehicles environment by 2030. An exploration of the regulatory adaptations on the part of the major emitters (“ME”) (2); the EU, US, China and within the evolving international climate change regime. Are we ready for an international agreement critical to avoiding 2°C? (3)

“Victory has a hundred fathers and defeat is an orphan” – President John F. Kennedy

Introduction – ineffective policies, rising emissions and need for urgent action

In April 2014 the United Nations’s (“UN”) scientific panel on climate mitigation (4), the Intergovernmental Panel on Climate Change (“IPCC”), produced their Fifth Assessment Report. These assessments are for the purpose of creating a better understanding of the action required to keep global warming below 2°C. This is the threshold beyond which the world’s most respected scientists (5) believe there is a much higher risk that dangerous and possibly catastrophic changes in the global environment will occur. (5a) The IPCC’s reports have become particularly important when considering the extreme uncertainties underlying causes and impacts of climate change. (6)

Included in their assessment (7) are the following four key findings;

- (i) Despite a growing number of climate change mitigation policies, Total man-made emissions from 2000 to 2010 were the highest in human history.
- (ii) Effective mitigation will not be achieved if individual agents advance their own interests independently.
- (iii) While deep cuts in greenhouse gas emissions (“GHG”) are needed to limit warming to 2°C compared to pre-industrial levels are possible, they will mean changes throughout the economy as well as challenging changes in technology, institutions and behavior. *Full decarbonisation of energy supply is needed in the long term.*
- (iv) Transportation has contributed to 22% to global anthropogenic CO₂ emissions in 2010 (8). Figures are projected to rise through 2100 (9,10). Total global CO₂ emissions from fossil fuel combustion rose 6.8 % between 2001-2010. (11) (Annex 2). Of global transportation total, approximately 61% of CO₂ emissions are related to passenger travel (mainly cars). Passenger travel shares were 70% in the US, while in China the passenger share of overall travel is around 40% but rapidly rising. (12)

Summing up the crisis, European Union’s (“EU”) Commissioner for Climate Action, Connie Hedegaard stated,

“The report is clear: there really is no plan B for climate change. There is only plan A: collective action to reduce emissions now. And since we need first movers to set a plan into motion, we in Europe will adopt an ambitious 2030 target later this year. Now the question is: when will YOU, the big emitters, do the same?”
(13)

Four months later, on September 23rd 2014 at the United Nations Framework Convention on Climate Change (“UNFCCC”) Summit in New York, Secretary General Ban Ki-moon’s newly appointed ‘Messenger of Peace’, Leonardo Di Caprio, gave the following carefully

scripted speech also calling for international cooperation leadership in the struggle to establish a new effective climate change regime. (14);

'I stand here today not as an expert but as a concerned citizen like the 400,000 others who joined me for The Peoples Climate March around the globe'.

"Every week, we're seeing new and undeniable climate events ... We are seeing extreme weather events, increased temperatures, and the West Antarctic and Greenland ice-sheets melting at unprecedented rates, decades ahead of scientific projections (15) (Annex 3)... The scientific community, industry and governments know it..."

Expressing the linkage of climate mitigation and energy security and the likely pathways ahead, Di Caprio continues:

"Even the military now consider climate change our single greatest security threat...this is not about just telling people to change their light bulbs or to buy an electric car. This disaster has grown beyond the choices that individuals make. This is now about our industries, and governments around the world taking decisive, large-scale action..."

We need to;

- (i) put a price tag on carbon emissions (ii) eliminate government subsidies for coal, gas, and oil companies.*
- (ii) end the free ride that industrial polluters have been given in the name of a free-market economy, they don't deserve our tax dollars, they deserve our scrutiny...*

New research shows that by 2050 clean, renewable energy could supply 100% of the world's energy needs using existing technologies, and it would create millions of jobs... Clean air and water, and a livable climate are inalienable human rights. And solving this crisis is not a question of politics. It is our moral obligation. This is the most urgent of times, and the most urgent of messages... The time to answer the greatest challenge of our existence on this planet ... is now." (16) (Annex 4)

This thesis explores regulatory reform of global GHG emissions as they relate to pure electric vehicles (PEVs) and its associated "clean" energy sources of supply.

For the purpose of this thesis there are four main types of vehicles that will be addressed; internal combustion engines (ICEV's), hybrids (HEV's), Alternative Fuel Vehicles (AFVs), Plug-in hybrids (PHEVs), Battery-electric vehicles (BEVs) and ZEV's/PEV's which cover zero-emissions or pure electric vehicles. The PEV paradigm is concerned with accelerating the latter to the exclusion of the others. i.e. BEVs and ZEVs. The reason for this is to not only to explore how this eco-innovation fits in with regulatory adaptation in a petroleum world but mainly because of its quality as the purest technological solution likely to aid aver 2C° currently on the market.

Under the UNFCCC's Kyoto Protocol ("KP"), the international climate regime's main instrument to date, primary focus has been given to limiting GHG emissions with production (as opposed to consumption) targets with "caps" on ME's worst CO₂ intensive industries.

In the EU, legislators seeking reform of the energy sector are making attempts to tackle *consumption* of fossil fuels *and* energy use with the setting of "mandatory" targets for Member States; to "an increased share of renewable energy sources in final energy consumption" (Annex 5).

Despite claims of 'leadership', behind the voluntary targets, incentives and initiatives flowing from The Climate and Energy Package ("CEP") there is little mandatory based 'hard law' being applied to the EU's energy or automotive industry. For the most part GHG emissions regulation is based on standard-setting which is meant to reflect technology

advancement in environmental (and now climate) protection law without hindering competition or trade.

This is against the backdrop of an emerging international climate mitigation regime based on a mixture of multilateral agreements and UNFCCC COP negotiated “pledges and reviews” and “timetables and targets” at the soft end, and environmental protection based principles, rights and obligations trickling through to national governments on the harder end. (Background on transnational environmental/climate law’s key legislative instruments in the EU, China and US can be found in Annex 6). One of the greatest barriers to a breakthrough for a PEV paradigm lies in the ME’s constitutional and competition caution over unsettling the energy establishment. A problem the ‘Clean Disrupter’s don’t suffer from. However, with the Rio Conference Report 2012 calling for ‘concrete steps to eliminate fossil fuels’ (see Annex 6 pg 3) in addition to a strengthening of measures towards increasing the share of renewable energy, hope is on the horizon.

These “cornerstone” strategic environmental law and energy principles and ‘rights and obligations’ are not only shaping these jurisdiction’s individual regimes but also lay the foundations for the EU, US and China to accelerate the PEV paradigm. The definition of this meaning the quest for worldwide EVs powered exclusively by renewable energy sources).

As they stand the EU and US regulatory regimes are fraught with contradictory strands of policy. For instance, reviewing the Clean/EEVs Directive 2009 the notion of ‘energy efficiency’ vehicles is so wide it even includes diesel cars and provides no definition of what a ‘clean’ vehicle actually is under “low carbon fuel standards”. Prima facie this legislative instrument appears to be a climate mitigation tool, however, its fudged policies fail to get results. So entrenched in the politics of the automotive and fuel supply industries and ICEVs regimes, this paper’s thesis is to suggest most of the so called low carbon fuel standards require radical overhaul. From a reduction of GHG emissions perspective, in the Commission’s Monitoring Report 2012 (17) there is a basic admission of ineffectiveness of the instrument. This is coupled by a recognition of slow Clean/EEV uptake in the market and a failure for Member States (“MS”) to transpose voluntary “measures” into national law. The recommendations (aimed mainly at public procurers) best efforts is to direct queries to “A Clean Vehicle Portal” which has been criticized by authorities as inadequate for the task. (17) Public Procurement is inextricably linked with the PEV paradigm as it is considered the one area where governments can directly impact accelerating EV uptake without having to wait for consumer catch-up.

Green Public Procurement (“GPP”) is a growing area of law which encompasses the private and public sector, environment, energy law, climate mitigation and administrative law. In the specific EV related area of “green” electricity it has a history of being particularly complex. This has unintentionally now been exacerbated by the introduction of “externalities” based mandatory Life Cycle Costing (“LCC/LCA”) requirements in the exclusive area of Clean/EEVs. As this author has previously written, the application of the 2009 “Green” series of Directives (18) coupled with historical ECJ energy (including “green” electricity eco-products, labels, services and PPMs) case law is “as straightforward as a spaghetti junction”. (19)

At the heart of the complexity is the suggestion that these directives are incompatible with TFEU rules on The Free Movement of Goods. Issues over where the line is to be drawn between national sovereignty and MS autonomy over energy security of supply on the one hand, and the IEM and other horizontal TFEU obligations on the other lies at the heart of the lack of legislative coherence in this area. While the environmentalists are pushing the CEP agenda, the EU federal expansionists are pushing the IEM and now Jacques Delors’s European Energy Community (20). In short, none of this spells good news for the climate. The decades long resistance to potential GDP reducing climate mitigation efforts in the US

such as the failure to pass The Clean Energy and Security Act of 2009 (ACES) through Congress (21) represent similar setbacks for the climate mitigation regime.

Another flaw at the heart of much of the legislation across all jurisdictions is the constant drive for “cost-effectiveness” over climate mitigation. With the exception of countries like Sweden (where they define what a “clean” vehicle in their LCA). Not surprisingly, these fragmentations, flaws and contradictions inherent in the existing “frameworks” are leading to poor results. This is not helped by the fact the vast majority of climate “measures” being transposed from international and supra-national levels carry a voluntary, as opposed to mandatory (or “binding”) legal weight.

Clearly to achieve the “deep cuts” the IPCC is calling for requires a total overhaul of the old regulatory regime. Until now, as Lutsey and Sperling have argued, regulations of vehicles around the world have ignored “upstream” emissions (exploration, extraction, refinement, production) and energy consumption, as well as emissions and energy use associated with manufacturing and materials embodied in the vehicles. (22)

To better understand where the game-changing reforms across the MEs need to take place, this thesis also provides an Annexed overview of showing how the US, EU and Chinese governments have approached EV development in the context of their own climate mitigation regimes (Annex 7).

While the wheels of regulatory reform have started to turn, especially in the arena of GPP to promote a host of different EVs, this paper’s core thesis is that the existing policy frameworks to date are, at best inadequate and slow, and at worst preventing the PEV paradigm from progressing to reach its climate protection potential.

However, where the public sector is lagging behind, light at the end of tunnel is being propelled from the private sector; the arrival of the clean disrupters and a ‘Silicon Valley car computer company’ called Tesla Motors, Inc (“Tesla”). Not only are these non-state actors vision of a PEV paradigm turning the climate crisis into an opportunity for ‘green growth’, (23) these revolutionaries are fast gaining traction towards “critical mass” and meaningful market penetration.

To conclude, despite major barriers to overcome within the existing regulatory frameworks of the MEs, the climate crisis is presenting an unprecedented catalyst for positive change; namely, towards a clean transportation a PEV paradigm by 2030.

The question is who is going to win the race and can a new international agreement help the world to get there.

The EU, China and US have all applied different legal frameworks to their climate mitigation regimes and PEV promotion. This inevitably causes fragmentation. Interestingly, because of the historical dominance of the automotive industry in the EU (Germany in particular) and the US, as MEs, they are proving less able to fast track to a PEV paradigm (with its implications for “deep cuts” in emissions) than China is proving to be.

The concept of a new international agreement is to create an ideal environment for PEVs in order to draw together under one coherent framework the most effective legal instruments and policy pathways to have emerged as from all the MEs. An outcome orientated approach needs to reconcile political sensitivities, dynamic competition, technology advancement, energy security with the primary goal of limiting GHG emissions. For the post Kyoto 2020 period, a phased sector-by-sector approach, starting with establishing a clear pathway towards a PEV paradigm for clean transportation, is the first crucial step for world leaders to take if the carbon war to avert 2C° is going to be won.

This thesis is structured as follows;

Section I: Clean Democratic Disrupters vs Plutocratic Polluters

Section II: What is the PEV Paradigm? Ignited by a 'Clean Disruption'

Section III: Regulatory Reform: Conflicts, Case-law and CO₂ Cons and Complexities

Section IV: A Descriptive Overview; EU, China, US; Barriers and Breakthroughs - Annex 7

Section V Regulatory Adaption; Moving from Petroleum to a PEV paradigm

Section VI: The Future is Now: China, Tesla Motors, Inc and ZEV regulation

Section VII: Conclusion: A New international agreement; Greenhouse Gas Emissions Management Act

Section I

Clean Democratic Disrupters vs Plutocratic Polluters – the paradigm within the context of the UNFCCC and an international climate mitigation regime

Di Caprio's no holds barred speech is significant because it marks a new level of aggression on the part of the most overarching of global governance institutions. This manifested itself most prominently in 1997 (in force 2005), with its first multilateral climate mitigation instrument; The Kyoto Protocol. This in turn has provided the transnational environmental framework under which any examination of a major climate mitigation regime and potential new paradigm must begin.

Despite repeated criticism for the COP conferences having not achieved more ⁽²⁴⁾ (Annex 6) to avert 2c°, the UNFCCC has achieved 195 parties under its name. This uniquely provides it with one of the highest levels of legitimacy of any other international organization.

From the perspective of reaching an ambitious new agreement (ideally at the Climate Summit in Paris in 2015), as a Permanent Secretariat, the UNFCCC provides the consistency and the level of expertise required. As Antto Vihma rightly emphasizes; 'legitimacy is crucial in achieving state compliance and thus effectiveness. But equally importantly, effectiveness is a component of legitimacy.' ⁽²⁵⁾

However, as the international community is already painfully aware, the greatest barrier to a climate regime breakthrough to date has been the absence of the world's worst two emitters, the US and China, from the negotiating table.

The extent to which these MEs frameworks are promoting or preventing clean transportation and its related roll out of pure electric vehicles is an important question.

As Daniel Bodansky rightly points out, the role of the international regime is not to define what each state must do, but rather to help generate political will by raising the profile of the climate change issue and to provide greater transparency (and ideally accountability) in the process. ⁽²⁶⁾

Non-State Actors, deformalization, legal pluralism; a multifaceted normative new world order

The UNFCCC Secretary General's choice of Di Caprio to deliver his 'urgent message,' is significant in two respects. First, it raises one of the key themes to emerge from this new body of [what is being coined as] international climate change law or climate mitigation law, namely, deformalization. As David Kennedy notes, 'most in the legal profession 'thought they knew how it all worked' and legal thinking tended to be organized in relatively unproblematic categories, such as private law and public, national law and international law (27).

Given this paper's focus on Tesla in Section VI with its associated relevance for the Zero Emissions Vehicles ("ZEV") Regulation in both The State of California ("CA") and China two distinct trends emerge; first, the role of 'bottom-up' non-state actors, along with the notions of soft law and 'governance' in a climate context are becoming increasingly relevant. Second, as CA's support for PEV producing Tesla also demonstrates, the support of the state, at national and sub-national levels, is also becoming an increasingly linked to success.

In line with the former trend deformalization, is the notion that governance takes place even without the state's involvement. According to Andonova and other scholars this trend is becoming known as transnational climate/environmental governance. In other words; "*a distinct form of global governance operating in a political sphere where public and private actors interact across national borders and political jurisdictions.*" (28)

While the formalistic scholars try to argue that deformalization does not create real law, according to Teubner, not only do these latter dynamics constitute 'fully fledged law' but they can be distinguished from the traditional law of nation states by their peculiar characteristics. Although lacking in institutional and political support, non-state actors, for instance tackling climate mitigation, is 'closely coupled with new world order globalized socio-economic processes' (29)

Another dynamic of legal theory that the role of those responsible for bringing about the PEV paradigm appear to be cultivating, is that of the non-state actor and legal pluralism. For Oren Perez, this represents a new kind of global economic system, "*governed by multiple systems of law...not based on a coherent set of normative or institutional hierarchies...[but] rather, a highly pluralistic mixture of legal regimes, with variable organizational and thematic structures.*" Relevant to this paper's Tesla analysis, Perez emphasizes the role of private legal systems that are not made of familiar sources of public international law, "*but rather, are the result of (private) norm-production by trade associations, professional/technical organizations, Multinational Enterprises, commercial arbitrators and other civic players*". (30)

Similarly, Rosen-Zvi sees this multifarious normative trend as creating a, '*world increasingly governed by an intricate web of norm-producers, which includes international organizations, transnational bodies, states in federative systems, regions, countries, cities, national and transnational associations of sub-national entities, as well as a host of private and quasi-private entities emerging as new types of actors on the global regulatory stage.*' (31)

Trying to broaden the scope of climate change mitigation as wide as possible so as to capture its efforts (of clean disrupters and their semi-public partners), Rosen-Zvi says the study of climate change regulation, '*should go beyond traditional or even transnational regulation to encompass hybrid regulatory forms which blur the distinction between the public and the private and destabilize boundaries between the global, the national and the sub-national.*' (32)

Di Caprio's speech fits squarely in this trend as it clearly demonstrates the fairly traditional UN Secretariat staking new confidence in the take-over potential of these entrepreneurial

clean disrupters (33), renewable revolutionaries and info-and-clean-tech giants (Google, Tesla, Uber, Apple, Microsoft, SolarCity, Sungevity, SunEdison).

Given their scientific and engineering backgrounds, this like-minded community recognize that to be successful in filling the energy gap left behind by their 21st century revolution, climate protection must be coupled with cost-effectiveness, cutting-edge technologies, critical mass, and market maturity. As Eric Schmidt, Chairman of Google and Jonathan Rosenberg have argued in *How Google Works* (34), a paradigm shift in society has occurred is speeding down a number of new decentralized, deformedalized and democratic pathways. And most significantly from the PEV perspective, the power base has shifted from the corporates to the consumer (citizen).

Putting this idea into a clean energy context, this concept of the empowered citizen was expressed by Ban Ki-Moon in his 'Sustainable Energy For All' ("SEFA 2012") Global Action Agenda. In this he spoke of how renewables, energy efficiency and sustainability would lift the world's poorest out of "energy poverty" in some of the worst emitting developing countries. (35)

As for clean transportation disruption, according to SEFA 2012, "Transportation accounts for more than 27% of final energy consumption worldwide (46 million barrels of oil per day). By 2030, global consumption is estimated to increase by 60% to 90% primarily due to increasing road freight traffic and passenger vehicles (with fuel efficiency even decreasing in developing countries without measures." Aiming to stem global fuel consumption SEFA 2012 went on to suggest an either biofuels or EV scenario. The latter this thesis will be seriously calling into question. On the issue of EVs it states; "*in relation to meeting targets in this area and drawing on renewable biofuels specifically; electric vehicles account for less than 0.1% of global transport, however, it is estimated that ... efficiency savings are achievable in this sector by 2030. Approximately one third of these gain can come from technological efficiencies and improvements to engines and vehicles design or the use of EVs.*" (36).

As Schmidt and Rosenberg explain, the PEV disruption will not be without its regulatory resistors:

In 2013 Tesla's stock quadrupled giving the company a market valuation of \$17 billion dollars. GM' CEO promptly asked his team of employees how it that Tesla can disrupt the \$4 trillion global automotive industry and we can't?"

"Governments also have important decisions to make. They can stand side by side with incumbent businesses, expending their energy to try to stave off the forces of change. This is the natural path of politicians, since incumbents tend to have a lot more money than disrupters (37) are quite expert in using it to bend the political will of any democratic government. New challengers usually fail to understand the extent of the legal and regulatory tools that incumbents have in their arsenal. But, just like businesses, governments have the option to encourage disruption and create environments where smart creatives can thrive. They can choose to have a bias toward innovation. Regulations get created in anticipation of problems, but if you build a system that anticipates everything, there's no room to innovate. Furthermore, incumbents have a big influence on the creation of regulations, and there is often a lot of movement between the public and private sectors, so the people who are making and enforcing innovation-killing regulations today become the executives in the private sector who benefit tomorrow. There always needs to be space in regulatory environment for a new company to enter. For example, in the US automotive industry new entrant, Tesla (38) is running into regulatory roadblocks in several states that are preventing it from selling directly to consumers (39). The regulations protect autodealers and reduce consumer choice in those states." (40)

In addition to the public sector, this thesis focuses on the important role being played by the non-state actors especially those playing a critical role in the struggle to find solutions

to solve dangerous climate change. (41) Not only will they be the ones to provide the vast majority of future financial flows to address climate change, but they also provide a pace and ingenuity that the public sector cannot match. Given the severity of the task that lies ahead, it is now commonly understood that if humanity is going to have any chance of staving off 2°C, a new age of convergence, collaboration, coherency and cooperation needs to take place. On the road to achieving an ideal environment for a PEV paradigm, with more public-private partnerships and join and match funding schemes than ever before non-state actors are now as influential as governments. However, as they become involved more with traditionally owned state structures, such as roads for recharging points, smart grid mixes, data services and modern power networks, the voluntary and self-regulating nature of their activities (including around climate change) will come under increasing scrutiny.

This section now concludes by taking Rosen Zvi's broad (theoretical) interpretation of 'transnational regulation' and applying it to real-life GHG emissions related examples.

The old regulatory regime is no longer valid - Relating the climate change regime to fuel consumption & inadequate GHG emissions methodologies

When considering the contribution of transportation in the rise of GHG emissions and its associated regulatory frameworks, in respect of vehicles in particular, it is important to consider two main distinctions. First, between fuel consumption (also called fuel economy) which can come under the broader term of 'energy' consumption (or use). And second, the "upstream" (refineries, pipelines etc) GHG emissions generated by the vehicle itself (both in case of its manufacturing and production but also during its use "downstream" on roads. Within the latter category regarding emissions, as opposed to energy/fuel consumption, these emissions can be generated (i) during the initial natural resources "upstream" process (extraction, exploration, transportation, refinement)(42) (ii) "mid-stream" emissions during the production and manufacturing of the vehicles (iii) "downstream" emissions from the consumers use of the internal combustion engine vehicles ("ICEVs"), hybrid or PEV.

From regulatory perspective, the key observation to make is that traditionally the ICEVs have completely dominated the market and, as Lutsey and Sperling explain; *"until now, vehicle regulations across the world have ignored energy consumption and emissions upstream of the vehicle largely because of the convenient fact that upstream emissions and energy use are nearly uniform across petroleum-fueled vehicles and play a relatively minor role in total lifecycle (43) emissions...including upstream impacts would greatly complicate the regulation."*

Highlighting EV producers influencing role, the scholars continue, *"but because the vast majority of emissions and energy consumption for EVs are upstream, the old regulatory design is no longer valid. The pressing regulatory question is whether to assign upstream GHG emissions to electric vehicles."* They conclude, *"we find that assigning zero upstream emissions – as a way of incentivizing the production and sale of PEVs – would eventually lead to an erosion of 20% of the GHG emission benefits from new vehicles, assuming fixed (i.e. existing) vehicle standards. We suggest alternative policy mechanisms and strategies to account for upstream emissions and energy use."* (44). An alternative view will also shared below by John DeCicco from University of Michigan, who not only punches holes in the Life Cycle Analysis approach to calculating GHG emissions for procurement and EV "low-carbon" standards but also bursts the biofuels bubble. (45)

Avoiding the tendency for “overt descriptiveness” – Is this even law?

Before discussion on PEV regulatory adaptation in the EU, China and US, it is important from a climate mitigation regime and law perspective, to retain a normative focus and not fall into the trap of “overt descriptiveness”. Hence why Section IV is annexed.

The ease of falling into such a trap is clear when faced with the complex interplay of characteristics, disciplines and the portfolio of policy instruments having expression within any individual national regime. The three paragraphs below provide some the dynamics;

- ◆ The complex landscape of climate law characterized by multiple layers, overlapping sources of legal authority, deformalization and recurrent interactions between legal systems regimes and actors (state and non-state).
- ◆ Regulatory complexity which houses a variety of legal disciplines including global legal pluralism, global administrative law, fragmentation and constitutionalization of international law and so on (46)

The plural mix identified by the IPCC’s AR4 as the nine most promising climate mitigation policies are;

- (i) Regulations and standards specifying mandatory requirements/abatement technologies or minimum requirements for pollution output; which provide “some certainty about emission levels” and may be preferable to other instruments” (including Life cycle costing (“LCC”) analysis in public procurement/and higher than harmonized standards
- (ii) Taxes and charges imposed on undesirable activity by a source (“which set a price for carbon “but cannot guarantee a particular level of emissions”)
- (iii) Tradable permit schemes establishing a limit on aggregate emissions by specified sources and allowing trade among them (“which will establish a price for carbon”)
- (iv) Financial incentives such as subsidies and tax credits (involve a higher economic cost but are “often critical to overcome barriers”)
- (v) Voluntary agreements between a government authority and one or more private parties with the aim of achieving emissions reductions beyond compliance regulated obligations (the majority of which “has not achieved significant emissions reductions beyond business as usual”)
- (vi) Informational instruments requiring public disclosure such as sector calculations for impact on GHG emissions, labeling programs and rating and certification systems (however, their impacts on emissions has not been measured yet)
- (vii) R&D measures involving direct government funding and investment for innovative approaches to mitigation or the infrastructure of emissions reductions. (“to stimulate technological advances”)
- (viii) Planning and impact assessments
- (ix) Voluntary actions by corporations, local and regional authorities, NGOs (which alone have limited impact (47)

- ◆ Portfolio of policy instruments, including pricing controls and quantity rationing, performance standards, subsidies, agreements and informational instruments such as sector calculations for impact on GHG emissions (49)

What ‘descriptiveness’ means, according to Kati Kulovesi, is “a project aiming to paint a comprehensive image of the complex and colourful climate governance structures involving non-state actors [where] the risk of descriptiveness becomes the main objective.”

(51) Or as Koskenniemi puts more profoundly, “the problem with legal pluralism is the way it ceases to pose demands on the world. Theorists of globalization are so enchanted by the complex interplay of the technical regimes and a positivist search for a vocabulary that would encompass all of them that they lose the critical point of their exercise. This is visible, for instance, in the habit of collapsing the distinction between law and regulation... ‘legalization’ as a policy-choice sometimes dictated by strategic interest (52).

Hard law/Soft Law, ‘the legalization continuum’

Outside the scope of this paper but useful to touch on is the distinctions between hard law (binding) and soft law (non-binding), as Koskenniemi emphasizes, it is still important to distinguish between what is policy and purely promotional, incentive driven, even disincentivizing and what is legitimately law in a binding mandatory requirement sense. (53) The great umbrella term of the climate mitigation regime, ‘measures’, can be either.

According to Antto Vihma, hard law refers to ‘precise and legally binding treaties that oblige a behavioural change with delegated enforcement bodies. Soft law, on the other hand, refers to ‘vague, aspirational goals and no delegation or institutional follow-up’ (54) The theorist goes on to explain, ‘rather than frame the understanding of the two legal trends (hard law/soft law) within the simplistic, ‘bottom up’, ‘top-down’ or ‘pledge-and-review’ vs ‘targets-and-timetables’, the more insightful starting point for analyzing international agreements (KP, CEP, Clean/EEVs, RES Directive from derived) is through ‘the legalization continuum’. (55). The simplistic approach, argues Vihma, ‘runs a notable risk of being misleading. Giving two reasons; first in the policy discourse of the UN climate regime, ‘pledge-and review’ is usually used to imply a very soft architecture and second because, in defense of the management role of the UNFCCC, ‘*reviewing policies, pledges, targets or obligations is actually an ambitious task for international law.*’

The role of international negotiations is to provide a framework of reference for the domestic politics of emissions reductions. A common misunderstanding, argues Vihma is that countries such as the US and China, ‘*are extremely sensitive about allowing such measures to be taken...’top-down’ architecture, on the other hand, risks sounding idealistic and lacking credibility. It suggests that the international community have to agree on the needed aggregate amount of emissions reductions and then divide the pie up to different parties via negotiations.*’ Vihma explains, ‘*this picture is far from the reality of policy-making, where countries emissions targets are adopted ‘bottom up’, agreed upon by the domestic constituencies, and then communicated to the international arenas.*’ (55)

The significance of raising this is to highlight the differences between the notions of “government” and “governance”, as well as the difference between “legislation” and “regulation” as they both raise important questions concerning legitimacy and effectiveness. (56) Put more simply, as the world heads ever closer to the 2C°, whether the approach for an agreement is top-down or bottom-up, is achieved through “soft law” or binding mandatory instruments, the only thing that really matters is if it actually works.

This thesis is concerned with finding the shortest pathways possible to “deep cuts” in global GHG emissions on how the PEV paradigm compliments the existing UNFCCC’s core principles and rules in customary international law and acts as ameliorating force in the intersection between environmental protection and fuel supply systems (Annex 6).

A new international agreement? Greenhouse Gas Emissions Management Act – sector-by-sector - Transport – Solar/EV

‘Countries choose to live in the energy dark ages not because the sun fails to shine but because they refuse to see it’ - Tony Seba

In line with the proposal made by Erkki J. Hollo et al (57), it is this author’s submission that ahead of the next UNFCCC Summit in Paris in 2015, a new uniform and coordinated ‘management scheme’ for an ideal pure electric environment be introduced as the first sector-by-sector area to undergo radical regulatory reform i.e cleaning up transportation and its fuel systems base with A Greenhouse Emissions Management Act. Taking a sector-by-sector approach, starting with all vehicles and their energy sources is far more likely to achieve consensus across MEs and by state and non-state actors because of its prima facie ring-fenced scope.

While such a regulatory adaptation must build on the existing frameworks of the ME with a cost-effective, energy security and competition orientated approach, in line with UNFCCC’s ultimate objective (Article 2), the goal of such a new multilateral mechanism would be based on its efficacy for “deep cuts” (58) in global GHG emissions.

As Rudolf Steinberg argued, clear objectives and parameters have proven essential for effective governance of environmental challenges in the past. (59) Similarly, Michael Mehling has observed, “*not only is specification of a common purpose a prerequisite for the determination of substantive principles and regulatory instruments, but its very existence may also have a unifying effect on the subsequent implementation process.*” (60)

To accelerate towards a PEV paradigm within the context of clean transportation, it is necessary to focus on both GHG emissions and the broader aspects of energy, electricity (including “green”), fuel consumption, automotive industry regulation including all vehicles (light and heavy duty). For this paper although freight would be included in such a Greenhouse Gas Emissions Management Act (GHGEMA) the focus in this paper is on passenger vehicles (and fuels/electricity charging energy sources) including delivery vehicles and their fleets emissions management.

The question is the speed with which such “proactive” steps can realistically take place. Establishing a mechanism that carries with it a high level of legitimacy is of crucial importance. This is especially the case where in jurisdictions such as the EU the extent to which MS can favour ‘new and renewable forms of energy’ (TFEU (energy chapter) Article 194 (1) (c)) or Clean/EEVs in a manner compatible with the Treaty competition rules (Internal Markets FMG rules) is subject to some uncertainty. (61)

According to the The Lisbon Treaty (“TFEU”/Lisbon Treaty 2009) at Article 191 ‘promoting measures to combat climate change’ are permissible. However, due to the constitutional need for recognition of self-determination on sovereign choices between “different energy sources and the general structure of its energy supply” (Article 192(2)) European Council unanimity is required on the adoption of specific measures concerning the latter. At Article 4 (2) (g) (h) (i), (TFEU) MS shared competence is recognized for transport, energy and trans European networks. Similarly, at Article 194 (1) (c) TFEU specific measures to promote energy efficiency, energy saving, new and renewable forms of energy is now permitted.

These Treaty rules that effect energy policy are further complicated by The Energy Charter Treaty Article 18 (Sovereignty over Energy Resources) and Article 19 (Environmental Aspects) and the crucial provision in respect of fuel supply systems and vehicles; Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects. And Article 7 Promotion of Energy Efficient Technology (ECT) (62)

Similarly, Directive 2009/33/EC on the promotion of clean and energy efficient road transport vehicles (“Clean EEVs Directive 2009) restricts legislative preference for ‘cleaner, smarter, safer, energy-efficient vehicles” to “public procurement and awareness-raising”. The EU’s transposition under the KP’s GHG emissions target-based framework is covered in Section III. With the IEM and CEP working to different agendas an international level multilateral agreement such as GHGEMA is essential.

Despite the need for effectiveness and accountability at the UNFCCC level and the current “market-pull in favour of the consumer, it is this author’s submission that creating a petition or a referendum from the ME’s leading municipalities could act as accelerating and legitimizing force to achieve the PEV paradigm. The idea of voting has recently been floated by several scholars (64) This would chime with the suggestion of ‘enhanced decision-making’ in the UNFCCC (63) just as much as with the 400,000 citizens who participated with Di Caprio in the Peoples Climate March.

This approach is supported by Kulovesi who argues, ‘*the main motivation behind the bottom up approach is arguably political, but this can be turned from being a cause of conflict to an opportunity for constitutional coherence and creation of the highest level of legitimacy.*’ (64). In other words, the ‘bottom up approach’ is a necessary part of the constitutional requirements to achieving 2C° particularly as it takes into consideration national political sensitivities and complexities around climate change and energy security. Contrary to popular belief, the reality (for now atleast) of international law pledges is that they arise out of and reflect domestic policies rather than top down impositions against citizens will.

As explored below, in the US such a petition on road transport vehicles and their polluting impacts had a transformative effect on regulatory requirements following the Supreme Court’s 2007 decision in *Massachusetts v EPA* (65).

If a petition can effect pro-active climate change mitigation measures in one jurisdiction it is only logical that such a remedy cannot be adapted as a part of transnational environmental ‘legalization continuum” or rather a ‘bottom up’ legitimization tool for a GHGEMA.

As suggested by Bausch and Mehling, such an international agreement could be arrived at through a combination of negotiations made through the UNFCCC summit but also for by the MEs who prefer alternative venues for climate cooperation. A suitable venues proposed include the G20, The Cartagena Dialogue or President Obama’s Major Economies Forum (MEF). The latter extends to 17 economies and represents 80% of global GHG emissions. The climate change authors even suggested a Group of Two (“G2”) where only the US and China participate (66). Extending this to “Group of Three” has its merits.

To be successful GHGEMA needs of create a level playing field. Its success will turn on whether it has the flexibility and ability to regularly adapt and keep pace with clean technologies solutions to the ever more severe climate crisis, all whilst operating in a fiercely competitive market place.

Ironically, the greatest barrier to GHGEMA, is Mehling’s insistence that ‘a central condition for the success of GHG mitigation...[is that] such a strategy must be deployed in conformity with the *existing* regulatory framework.’ (67) However, as previously explained, it is precisely ‘this existing regulatory framework’ which urgently requires reforming.

Specifically, GHGEMA would provide an overarching international framework for the management of GHG emissions in respect of Clean/EEVs and PEVs. This would include an alignment of the WTO’s trade law objectives (especially in respect of the dispute settlement mechanism) with the UNFCCC’s Art 2 ‘ultimate objective’. To be done in a manner that strikes a balance between reducing GHG emissions on the one hand, with

ensuring a level playing field and ensuring dynamic competition for clean-technologies on the other.

One of the most identifiable trends to arise in this field, and most aggressively in China, is the public sector's increasing willingness to impose mandatory requirements to aid the acceleration of clean transportation starting with incentivizing Clean/EE/EVs in the passenger vehicle and car fleets market and imposing limits on their emission through complicated "low carbon fuel standards" on ICEVs (including hybrids).

One challenge for climate mitigation lawyers is ironing out the conflict of priorities arising in the WTO dispute settlement mechanism (DSM) due to clashes between the MEs over international clean-tech-innovation trade. This is against the backdrop of an increasingly interventionist (less market driven) international climate mitigation regime which since the KP has been encouraging national support measures to reduce global GHG emissions. It is this author's submission, in line with Kati Kulovesi's arguments on 'the intersection of the two international legal regimes', the WTO urgently needs to be brought into alignment with the higher-priority of the UNFCCC's "ultimate objective" to averting 2°C. Addressing this crucial issue is key to the success to clearing a pathway to a PEV paradigm and clean transportation.

This author has "Eight Starting Points" for COP negotiations in Paris 2015. (68)

Other policies to be included in the Clean Transport/PEV GGMA to pave the way for a

Cooperation

PEV paradigm by 2030 should include;

- ♦ phasing out of fossil fuel subsidies in favour of non GHG emitting RES (see Annex 6 pg3 UN Rio Conference Report 2012 has already voiced commitment to this effect)
- ♦ restricting biofuels to ICEVs on non-sustainability grounds
- ♦ phasing out production of new ICEVs by 2020 by reforming all petroleum-powered and energy efficiency vehicle regulation under the so-called 'low carbon fuel standard' banner
- ♦ regulatory adaption of longstanding and entrenched regulations that fail to account for upstream emissions and environmental impact
- ♦ phasing out production of hybrids (with any ICE element) by 2025
- ♦ continue to incentivize the automarket to produce PEVs' with an appropriate mix of purchase incentives, state R&D and demonstration project support, target-based initiatives between states and increasingly ICE intolerant standards alongside encouragement, support and guidance on adopting Zero Emissions Vehicles (ZEV) regulations
- ♦ reassess ZEV regulations to phase out 'energy efficient' vehicles that do not pass 'what is a clean car' test (Sweden has an established clean car criteria)
- ♦ Seek to incentivize the new PEV market through targeted consumer niches that attach value to the climate and GHG emissions benefits

As this paper goes on to argue, this new cog in the wheel of the international climate mitigation regime would align the pace of the public sector with the speed of change of the private sector.

Complications

As Mehling rightly identifies one of the greatest challenges for a GHGEMA is 'that emission reduction policies should be aligned with energy market rule to avoid tensions between the pursuit of a more sustainable energy supply and further market liberalization'. (69)

By way of guiding both the national legislator responsible for implementation of a future GHGEMA, Mehling provides "eight signposts" for policy-makers and legislators (70)

For greater clarity the climate lawyer's own conclusion requires repetition; *“By necessity, a management scheme will have to address central aspects of the energy sector...conditional on a **gradual transition** to sustainability through improved efficiency in the exploitation of energy resources as well in generation, conversion, distribution, and end use of energy, but also a shift in the structure of energy sources towards increased use of renewable energy”*.

In contrast to the Mehling's suggestion for a management scheme to “allow sufficient time for adaptation”, Tony's Seba thesis (below) provides a rapidly paced vision of a PEV paradigm by 2030. In 2014 the conventional energy and automotive sectors are now being outpaced by the current Solar/PEV players already well under way in Australia, The State of California, China, Japan and in parts of Northern Europe.

Section II – What is the PEV paradigm? Ignited by a ‘clean disruption’

‘If the rate of change on the outside is greater than the rate of change on the inside, the end is near’ - Jack Welch, former CEO General Electric

The Context: The Future is Solar/EV – Turning the climate crisis into an opportunity

In *‘Clean Disruption on Energy and Transportation ‘How Silicon Valley Will Make Oil, Nuclear, Natural Gas, Coal, Electric Utilities and Conventional Cars Obsolete by 2030’*. (71) there is almost no view expressed by Stanford's clean-tech economics professor to which this author does not equally subscribe.

With the complex energy, economic and environmental pressures facing global governance in an unprecedented way, steers a remarkably clear pathway across the US, Europe and China to arriving at understanding of what an ideal environment for the PEV paradigm “will” look like. i.e. For the purpose of this thesis Seba provides the context.

Explaining how the industrial era of energy and transportation is giving way to an information technology and knowledge-based energy and transportation era, the disruption, says Seba, will be a clean one and will have the following five characteristics;

1. Flipping the architecture of energy – Off Grid Infrastructure Alternatives
As the Internet and cell phone turned the architecture of information upside-down, the clean disruption will create an energy architecture that is distributed, mobile, intelligent and participatory. The conventional energy model is based on big banks and big energy and big plants where energy flows one way and cash flows the opposite way. Participatory energy (72), on the other hand, is when individuals and communities as consumers participate in the generation, transmission and storage of their own energy. The new energy architecture is based a structure which is smaller, distributed and more consumer-financed.
2. Technology-based disruption.
Dirty energy is expensive, pollutes cities, erodes natural resources and exacerbates climate change while clean energy as a source is free. The future will bring about the electrification of transport where clean energy is derived from the sun and wind. This will be led by three main technology-based products; (i) Solar (ii) electric vehicles (iii) Autonomous (self-driving) cars. Clean disruption is also about software (73) and revolutionary business model innovation. EVs represent connected, mobile, info-tech platforms and products. For instance, The Tesla

Model S already offers over-the-air software downloads not dissimilar to a smartphone or tablet computer.

3. Abundant, cheap and participatory energy. Silicon valley is all about abundance, business model innovation, participatory culture and democratizing power. The age of centralized, command-and-control, extraction-resource-based energy sources will not end because we run out of petroleum, natural gas, coal or uranium. It will end because these energy sources, the business models they employ, and the products that sustain them will be disrupted by superior technologies.
4. Clean disruption is inevitable. Brought about by the exponential cost improvement of disrupting technologies, creation of new business models, the democratization of generation, finance and access, and exponential market growth. The utility business model is soon to be obsolete.
5. Clean disruption will be swift. It will be over by 2030. Maybe before.

Providing the full picture Seba continues, “The first wave of energy disruption has already begun with distributed solar and wind generation...Transportation is a \$4 trillion industry globally.

The transportation industry is inextricably linked with energy...the internal combustion engine automobile will soon be disrupted, sending shock waves through the oil industry...The first wave of disruption of the century-old automotive industry is well underway with electric vehicles.”

Solar’s spike – EVs potential power providers

Solar is on its way to disrupting all forms of conventional energy. Solar is already cheaper than nuclear. It’s already cheaper than retail electricity in many markets around the world. In some markets solar has already pushed wholesale electricity prices down by as much as 40 percent. According to John Schaeffer, Solar Living Institute, particularly key for EV charging demand challenges are new solar power plants to generate (and store) electricity around the clock.

Wholesale and distributed solar generation are disrupting the conventional energy companies century-old business model. Both commercial and the residential users are now generating their own solar energy. Rather than be dependent on utilities the consumer is entering a new era of renewables based self-reliance.

Silicon Valley’s most innovative business models for solar are coming from new entrants into the power business including SunEdison, Solarcity and SunRun, Sungevity. All of which are successfully bringing the concept of solar-as-a-service to the market. With the increasing EV market penetration of firms like Tesla, this now represents EV/solar-as-a-service. Under the SolarLease plan or Solar Power Purchase Agreements (PPAs), instead of buying the equipment (now including the EV), customers can lease it. As ownership is increasingly considered too onerous, car-sharing schemes with small sized PEVs such as Car2GO are transforming the urban environments in California and Holland.

The world’s largest solar panel vendor, First solar, said its global strategy is to build solar in markets without government subsidies. (73) While unsubsidized solar is already cheaper than subsidized fossil fuels and nuclear power in hundreds of markets around the world.

US GPP-RES-E

City and regional authorities are also demonstrating record levels of renewable energy uptake in their public procurement as well as entering the market as energy providers

themselves by investing in electricity infrastructure, solar power plants and installing rooftop-solar on their buildings and facilities.

New community based and private sector companies are all exploring new collective ways to self-finance and provide distributed, participatory energy. These new methods, such as Revolv's crowd funding based on the Danish model are also disrupting the conventional power base of the big power utilities that depend on all their "consumers" being on grid.

The US Department of Energy's 'Sunshot' Vision program foresees \$1.5/Watt by 2020. The DOE hopes the US will take six years to catch up with today's cheap solar prices in Australia. US's new solar capacity has grown from 435 MW in 2009 to 4,751 MW in 2013. Solar represented 29% of all new generation capacity in 2013, up from 10 % in 2012 and 4% in 2010. (74)

Below are a list of examples of the municipalities Seba highlights as leaders in the US, particularly in The State of California;

- (i) Public Sector Solar Support Programs –Energy Management on a large scale Sonoma's County Energy Independence Program is the US leader in providing financial services support for solar uptake (75). The centerpiece its clean energy program is PACE (property assessed clean energy) program, a variant of the 'no money down solar' one of the "20 World Changing Ideas". It provides an accessible, low-interest rate financing mechanism that makes EV/Solar affordable for at all levels of the community. Its goal is to improve 'performance in 80% of Sonoma County homes and commercial spaces to the highest cost-effective efficiency levels. By 2011, Sonoma County had 500 Watts per resident and 4.5 solar installations per 100 residents. SCEIP was not funded with taxpayer money but with bonds raised from private investors. However, as a municipal government program it relies on legislation at the State level to remain active. If the entire US achieved the same as Sonoma County is today, it would have 159 GW of solar and 14 million solar installations. This is equivalent to 159 nuclear power plants; "a truly disruptive scenario". (76)
- (ii) City of Lancaster has introduced changes in zoning laws mandating every new home must be built with solar panels. The authority has enabled 155,00 residents to build 23 MW of solar and has approved an additional 100 MW. Assuming all permits are granted this will give Lancaster 60 percent more than Sonoma County, the state leader. Lancaster also expects to be a net-zero city within three years and are building a solar pipeline of 700 MW to accomplish this goal.
- (iii) Sacramento, CA providing a commercial financing program.
- (iv) El Paso Electric, Nevada Solar Reserve, New Mexico (77) agreed to purchase power from First Solar's 50 MW Macho Springs project for 5.79c/kWh. This represents less than half the 12.8 c/kWh from typical new coal plants.
- (v) Miami Dade County, Florida also adopted a PACE program and established \$550 million investment into commercial solar in the county to be led by Ygrene Energy, a Santa Rosa (Sonoma based financial services company).
- (vi) City of Palo Alto has a 100% green/clean energy mandate using their green public procurement program and charges half the minimum price a main utility usually charges proving its residents with cheaper solar than the utilities. Palo Alto's agreement is for 52 MWh of solar per year, which in its case will come from a 20 MW solar power plant.
- (vii) Long Island (New York) Power Authority has incentivized large-scale distributed local solar generation.
- (viii) Utah's Rocky Mountain Power (RMP) recently asked its public utility commission to a minimum monthly bill of \$15 as a customer service fee, a

customer service fee of \$8 per month and a monthly solar fee of \$4.25 for monthly solar. Fees like this make on-site storage more financially viable. By 2025 it will cost about 12.30 per month to have 20 kWh of onsite storage. Fifty or sixty million American homeowners will essentially be able to generate all their energy using solar to store what they don't use at the moment of generation for the rest of the day and night. (79)

- (ix) **Denmark** wind generated over 100 per cent of their power demand in 2013, breaking a world record. (80) They became the world's largest wind installed base without investments by or the participation of the country's large power utilities. It has achieved it through communities investing in their own wind generation assets. To encourage communities to adopt wind energy, the Danish government created incentives for locally based cooperatives to invest in community in wind farms.

Private Sector 'Heavyweights' turn to Solar Investments

- Warren Buffet's company, Mid-American Energy Holdings, invested 2.4 billion to acquire the Topaz solar development project. Mid-American is a regional \$3 billion a year energy company which has invested nearly \$5 billion in solar and is poised to retire seven coal-burning power plants. Buffet explains his investment, 'I want to know what a business will look like ten years from now. If I can't see it has a strong future I don't buy them'. (81)
- (PV) companies have decreased their costs by a factor of 154%. Sungevity is one of the fastest growing solar installers for residential rooftops in Silicon Valley.
- Apple, the world's largest company by market capitalization, has a goal of being a net-zero company, 100 percent powered by clean energy.
- Prologis manages 46 billion announced partnership with NRG Solar and Bank of America to build 753 MW of solar on the company's rooftops.
- Other Silicon Valley based solar players of significance are Sunrun, Vivint, Clean Power Finance, Verengo.

We have learned that renewables are not a side salad on the greasy fossil fuels burger plate. They are the main course - John White on the threat of AB 177 in CA not pushing beyond 33% RES (83)

Big Box Stores turn to solar self-sufficiency

- Wal-Mart, has installed 89.4 MW in 215 stores while Costco has installed 47.1 MW in 78 stores and Kohl 44.7 in 147 stores. Wal Mart plans to install solar in a thousand of its 4,522 stores by the year 2020. It is expected they will cover 218 square miles in 2015 'How Big Box Stores like Wal-Mart Affect the Environment and Communities', Sierra Club (84)
- IKEA want to become a net-zero organization and to operate all its energy needs using solar and wind by 2020. Currently has 874 kW per installation in all its US stores.

Transition to the Solar/Electric Vehicle Paradigm – a triple sector technology convergence

The EV is already better, faster and safer than the internal combustion engine (ICE). Demonstrated by the launch of FIA's Formula Electric Championship in ten of the major emitter cities all aspiring to join the net zero-emissions era. (85)

While EVs are currently expensive to purchase upfront, the increased investments in electricity storage technologies in the automotive industry keep driving down their main cost; the Lithium-Ion (Li-on) battery, spelling the end for ICE's in less than two decades. Significantly, Tesla's car batteries use Li-on. (86).

Never has investment in electricity storage been so high. Three multi-trillion dollar industries are now investing billions to come up with better batteries; electronics, automotive and energy. Apple, Samsung and Google are now as interested in batteries as

Tesla, Solarcity and General Motors. Tesla has recently announced a \$5 billion next-generation battery factory (“gigafactory”) in the US. These batteries allow solar customers to store solar power as well as purchase grid electricity when it is cheap and use the electricity when it’s expensive. Even Tesla’s factory will get 100 % of its energy from solar and wind from local resources. (86)

Due to this “battery boom”, the lines between the auto, energy and electronics industries are blurring and soon will be non-existent. “Convergence” is the new terminology.

Solar and EVs started out as different sets of products and markets, however, it is their symbiosis that will complement and accelerate their adoption in the marketplace.

This virtuous cycle of increasing demand, increasing investment, and increasing innovation will dramatically lower costs; it will exponentially improve the quality benefits to both the clean energy and clean transportation industries; it will lead to advances in which batteries can be used for transportation and for grid storage. EVs can be charged at work and become a source as well as a user of energy for the home. The result will be a swift transition from liquid-energy transportation to electric transportation. (87)

In his chapter ‘The Electric Vehicle Disruption’ (88), Seba highlights the rapid disruption caused by the arrival on the global automotive stage, in just ten years (2003), of pure EV producer Tesla Motors, Inc.

Having outsold its competitors Mercedes Benz, BMW and Audi, Seba explains the companies significance; ‘Tesla fashions itself a Silicon Valley computer company, closer in spirit and thinking to Apple and Google than to its Detroit forebears’

From a technological perspective, Seba goes on to list his ‘Nine reasons why the electric vehicle is disruptive (overtaking the gasoline car industry (and with it the oil industry) swiftly and permanently’. It will be through market disruption the whole business model of the automotive industry, built on for a century, will be obliterated.

- (i) The electric motor is five times more energy efficient
- (ii) The electric vehicle is ten times cheaper to charge
- (iii) The electric vehicle is ten times cheaper to maintain
- (iv) The electric vehicle will disrupt the gasoline car aftermarket
- (v) The revolution of wireless charging aided by cutting edge satellite companies such as Qualcomm (89)
- (vi) The EV has a modular design architecture
- (vii) Big data and fast product development
- (viii) Electric vehicles can contribute to grid storage and other services
- (ix) Solar and electric vehicles are four-hundred times more land efficient

The race to drive down costs

With Tesla bringing out an SUV with superior performance and quality (and a similar price point) to its GM and European rivals, EVs costs are dropping fast. As Seba continues, “As is the cost of solar panels. Solar panels have a 22% learning curve. That is, PV costs have historically dropped by about 22% with every doubling of industry capacity. By the time (before 2030) the EV matches the capital cost of the gasoline car (just as the business model of the ICE did over century before against the horse carriage), the disruption of the gasoline car industry will be pretty much over.”

Tesla and free electric charging

Another disruptive business model is the Tesla Supercharger Network being installed across North America and Europe so that Model S owners can drive long distances – and crucially drive for free. (90) From a feasible business model perspective, EV vendors could offer free electricity for five years as a purchase incentive. As Seba rightly asks, ‘what is worse ‘range anxiety’ or financial insecurity brought about by high gasoline prices? (91)

EVs and Solar and The End To Oil (92)

'An age is called Dark not because the light fails to shine, but because people refuse to see it'

- James Michener

In the context of Seba's chapter entitled, 'The End to Oil' the Stanford expert, illuminates the pathway to 'When Solar and the EV Converge'.

Simplifying his thesis, Seba explains, "solar will disrupt oil in two ways. The first is by displacing diesel and kerosene, which still provide expensive polluting energy to billions of people around the world. The second is by disrupting the rest of the power industry while the EV disrupts the gasoline internal combustion engine.

Testing his thesis, Seba asks himself the question of how much solar surface area, as compared with oil and gas land and water surface use, would be needed to power all EVs in the US?

His answer is illuminating. *'To power just one third of the gasoline car-miles in America, oil uses 143 times the surface area than solar would need to power all electric car-miles. Put another way, the combination of solar and electric vehicles used land 400 times more efficiently for energy production than the combination of oil production and gasoline vehicle usage...when a technological convergence (solar and EVs) is 400 times more resource-efficient than incumbent technologies, its time to pay attention'.* (93)

Conventional utilities are using their best weapon to fight competition; the regulatory system. But disruption can't be stopped, only postponed a bit. - Tony Seba

Barriers to Breakthrough in US legislation

It is helpful to conclude this section by highlighting a few of "legal structure" barriers preventing clean disruption from enjoying a level-playing field in US commercial law that Seba identified (which can be relatively easily fixed but for the strong political resistance of the old energy and automotive players) notably;

- (i) Regulatory capture on behalf of the old energy and automotive sector
- (ii) Costs attached to permits and regulations (92)
- (iii) Restricted financing of solar with Real Estate Investment Trusts (REIT's)
- (iv) Not extending Master Limited Partnerships to clean energy

Generally speaking, the current energy mix in the US, with the exception of The State of California's low-carbon example (currently under threat with AB177 (93)), according to Seba is environmentally and economically damaging due to the continuation of fossil fuel based (oil, gas, biofuels, coal, nuclear) government protection and subsidies. He explains, despite major energy companies such abandoning the technology due to its unsustainable cost structure, *"The Obama Administration has tripled its nuclear subsidies and refers to nuclear as 'clean' energy..."*(94). He continues, *"In economics, we call this 'regulatory capture'...which refers to what happens when a state's regulatory agency, that was created to act in the public interest, works instead to advance the commercial or special interests in the industry it is supposed to regulate.* (95). In other words, echoing Di Caprio's UNFCCC speech at the start, Seba concludes, *Regulatory capture encourages companies to pollute, cut health and safety corners, and take financial and technical risks safe in the knowledge that citizens will bear the costs.'*

Unlocking clean-tech's potential

Financing solar with Real Estate Investment Trusts (REITs) Making clean energy assets REIT-able

An anomaly in US investment law the IRS rules are preventing real estate investment trusts (REITs) (96) with a market valuation of 630 billion to spend from solely on clean energy investments. However, a new precedent has been set by a “private letter ruling” given to Hannon Armstrong Infrastructure Capital, Inc (to provide sustainable infrastructure capital) resulting in record ROIs for the fund and a boost for clean energy projects. As Seba explains, *“Should the tax code be expanded beyond this single capital fund, clean-energy REIT’ would have access to hundreds of billions of private investor dollars instantly lowering the capital costs.”* According to a letter that 35 members of Congress sent to President Obama in 2012, *‘small tweaks to the tax code could attract billions of dollars in private sector investment to renewable energy deployment, reduce the cost of renewable electricity by up to one third, and dramatically broaden the base of eligible investors’.* It actually doesn’t take an act of congress to make solar and wind REIT-able, explains Dr. Reicher, all it takes is an administrative ‘revenue ruling’ by the IRS.

Extending Master Limited Partnerships to clean energy to ALSO pay no corporate tax

Since 1990’s MLP’ have raised more than \$400 billion for building oil and gas pipelines, drilling, mining, transporting energy and processing oil, gas and coal. According to Seba, *“as a business structure, the Master Limited Partnership has the tax advantages of a limited partnership, but its stock can be traded like corporate stock. Giving them a big advantage. Unlike typical ‘C’ corporations, which have to pay corporate taxes, MLP’s pay no corporate tax.”*

Dan Reicher, former Assistant Secretary of Energy, has proposed to President Obama using MLPs for clean energy projects because he believes they can substantially increase the number of investors (decrease the cost of capital) for clean energy projects. (97). The Master Limited Partnership Act has been introduced in Congress by Senators Chris Coons and Jerry Moran. In 2013 it was amended to broaden the scope of energy projects that it covers i.e. to create a Master Limited Partnership Parity Act for clean energy. Seba explains, *“The Act would cost taxpayers 1.3 billion over ten years compared with forecasted costs of 6.7 billion over the same period for existing fossil-fuel MLPs.* By adopting this regulatory reform Act, Reicher says, *“it would give solar and wind companies the opportunity to directly access millions of investors through public capital markets.....if the oil and gas industry had access to the limited number of investors the government allows solar and wind to access, the fossil-fuel industry could never have developed its millions of wells and thousands of pipelines”.*

Seba observes, “The US wants to build a clean energy economy – a ‘sun shot’ to match JFK’s ‘moon shot’. With State authorities like Sonoma County’s achievements through PACE, will the federal government now take the lead? Answering his own question SCEIP’s (88) spokesperson, Diane Lesko emphasized what is required; “Political will...you need leadership coming together to achieve our common goals’. (99)

As Seba says, “the race for solar primacy is on.” In the US, solar wattage has nearly doubled every year over the past three years. Solar installations in China tripled in 2013. (100) China’s the world’s largest manufacturer of solar PV panels, and has now quickly turning into the world’s largest consumer of solar, EV, battery products. China set a goal of installing 14 GW in 2014. i.e. same amount in one year as in the whole of US history.

Concluding he says, ‘when the cost of solar hits the point of no return, the impediments to building 10 million, 40 million, or 100 million solar rooftops in less than a decade will certainly not be technical. The impediments will be legal, political and regulatory (they will likely be placed there by the incumbent energy companies) (100)

Section III

Regulatory Reform: Conflicts, Case-law and CO₂ Emission Cons and Complexities

The starting point to understand the multiplicity of transitions and tensions taking place between promoting the new clean energy disruption, on the one hand, and maintaining conventional energy stability and political interests on the other, is to analyze each level of governance in descending order.

The International Level – conflicts for clean-technologies companies WTO vs UNFCCC-bringing the climate and trade regimes onto the same page

To be victorious in averting 2C° all jurisdictions need to agree on how to make a fair and swift transition to clean energy consumption and production as well as transportation.

One of the key issues stalling governments from providing greater support to the PEV disruption is concern of litigation at the WTO. As Kulovesi (101) calls it, 'the intersection of two international legal regimes'; notably that of climate mitigation law and trade law. Put simply the WTO and UNFCCC are working from two different hymn sheets and need to be brought onto the same page. As Kulovesi explains these two international organizations operate in parallel are fragmented and 'operate largely in isolation from each other.'(101)

The only provider of a 'decider of last resort' to deal with commercial trade disputes between the UNFCCC and The WTO, is the latter's Dispute Settlement Mechanism (DSM). Post GATT, under new rules of the WTO, a strong DSM has been established with the adoption of "reports" which can only be *prevented* by consensus (as opposed to before which required an all parties consensus). While compulsory and exclusive jurisdiction over international trade was established to ensure the favorable "free-trade" outcomes other legal weaponry included a permanent Appellate Body and trade sanctions are now at the WTO's disposal. To defend the principles of climate mitigation law, the UNFCCC on the other hand provides no such mechanism. Given that the US' history of favorable WTO decisions, the recurring linkages and clashes between the trade and climate regimes warrants fresh analysis and radical reform.

In order for 2C° is to be averted climate cooperation (Art 3,5 UNFCCC (103), as opposed to fierce competition, requires a new common vision between the two regimes to be established, even if that is one a sector-by-sector basis starting with The Proposed GHGEMA.

The main area of legal tension regards the General Agreement on trade in Services (GATS), Agreement on Technical Barriers to Trade (TBT Agreement and the Agreement on Subsidies and Countervailing Measures (SCM). The latter is turning out to be of particular significance

Given the level of subsidies being directed the renewable and clean-tech industries TBT in proving a barrier in particular.

The key climate policies conflict areas include:

- ♦ Trade bans or punitive tariffs on certain products or on products originating from countries that are not participating in climate change mitigation
- ♦ Product standards and regulations, including energy efficiency and other sustainability requirements (such as Sino-German standard charging equipment agreement 2014 (104)

- ◆ Border tax adjustments, including taxing imported products based on their carbon content and other similar requirements on imported products or their importers, such as requirement to purchase emission allowances
- ◆ Various climate change related subsidies
- ◆ Compulsory licensing and other measures to relax IP rights for climate-friendly technologies

Kulovesi predicts that, *“it is possible to imagine a WTO dispute involving such climate policies or measures that have not been clearly prescribed under the UNFCCC regime but that are closely related to the implementation of its ultimate objective in Article 2 (105) of the Convention to avoid dangerous anthropogenic climate change....this scenario looks, in fact, fairly plausible.”*

Highlighting the need for greater precision but warning against too much national discretion in the regime the scholar argues, *“there is a tendency under the UNFCCC regime to avoid prescribing climate policies and measures. This trend is reflected in the KP, otherwise based on ‘top down’ legally binding emission reduction targets for developed countries. The recent shift under the UNFCCC towards informal, ‘bottom up’ mitigation pledges means even less clarity in terms of mitigation commitments.”* (106)

Despite the efforts being made, for instance, with UNFCCC’s Article 4.2(e) of the KP and Article 2.4 KP (107) the greatest barrier to coherent global governance on climate change is a political one.

Summarizing the weaknesses of the current UNFCCC and how to overcome the legal obstacles Kulovesi analysis is that *“the vagueness of the UNFCCC and Kyoto’s regimes in terms of policies and measures is not an accident...countries have been firm in international climate negotiations on the need to minimize external constraints on domestic policy choices, particularly in such sensitive sectors as energy, transport and industry (107/108)...however...the last sentence of Article 3.5 UNFCCC echoes GATT’s own language in Article XX (and KP Article 2,3 Annex I), namely, ‘parties shall strive to implement their policies and measures’ in such a way to minimize adverse effects, including adverse effects of climate change, on international trade, and social, environmental and economic impacts in the parties’ especially in developing countries i.e international trade has been listed in KP”* (108)

Kulovesi concludes, *“Following Durban it seems reasonable to expect that trade measures will be among the issues considered under the new initiative. This means a new process under the UNFCCC where the relationship between trade and climate change could be considered focusing on the negative and the positive impacts being taken to mitigate climate change”* (109)

Given the export nature of the automotive industry and the fuel supply system, ensuring the TBT, DSM is brought into alignment with the UNFCCC’s objectives is clearly one of urgency especially to reflect the paradigm shift towards the primacy of transnational climate mitigation law.

Caselaw

National Support for Clean Energy: Pending Disputes at the WTO between Major Emitters

As the electricity, automotive, info and green-tech industries continue to converge, so do their respective legal regimes. These new linkages, often conflicting are manifesting themselves in a rise of clean energy disputes between ME’s being brought to the DSM. While an EV case has yet to surface with any significance, renewable energy cases are now fairly common.

The following two cases highlight the complications national support schemes are causing within the GATT rules (echoing in the EU’s Internal Market FMG/Art 29/Art 29 rules)

• In *Canada-Certain Measures Affecting the Renewable Energy Generation Sector* (110) Japan (KP party) called in to question Canada's "green" electricity feed-in tariffs, commonly used national support scheme,⁽¹¹¹⁾ accusing them of discriminatory measures. This regarded the rule that to receive Canadian support 60% of the goods or services must be sourced locally. Japan contended this breached national treatment provisions of the GATT and Agreement on Trade Related Investment Measures. The plaintiffs also claimed the local content requirement amounted to a "prohibited subsidy" under the SCM.

Held; The Committee sympathized with Japan's grievances and also reprimanded Canada for hindering trade from the EU worth 300-600 million. Canada however appears resolute in its protectionist measures and its withdrawal from KY in 2013 is a further setback. (111) A setback for the regime, Canada announced its withdrawal from the Kyoto Protocol in December 2013.

♦ In *China-Measures concerning Wind Farm Equipment* (100). US and China were brought head to head in 2011. The disputed measure related to funds, grants or awards (worth several hundred million dollars), the US accused China of not complying with WTO transparency rules on state aid. The grants ranged from \$6-22.5 million to Chinese enterprises for manufacturing wind power equipment.

From the US perspective (101), it was a clear breach of Article 3 of SCM creating an unfair advantage in the market place favoring domestic over imported goods. Reluctant to go further down the transparency pathway, China chose to end its subsidy scheme also due to the threat of economic sanctions. China attempted to defend its measures on the basis of energy savings and environmental protection (112/113).

According to Wilke,^(114/115) this case highlights two key legal questions;

- (i) whether the environmental (including air pollution and GHG control) exceptions under Article XX of the GATT extend to SCM Agreement, and if so;
- (ii) could the local content requirement be defended under Article XX."

For the US this withdrawal by the Chinese was considered a great victory (113), as the third successful WTO challenge the US has brought against Chinese government subsidies" and citing "China's inadequate transparency" in line with Article 25 of the Agreement on Subsidies and Countervailing Measures (SCM) Agreement.

As Kulolesi observes, 'the pending WTO cases and US-China solar panel controversy illustrate that a new era may be dawning in the relationship between trade and climate change as the transition towards a low-carbon economy takes off...' (116) Seba warns that by 'turning up the heat on the multi-billion dollar Chinese state aid support for their solar industry' (117) and given the exponential growth in China, the US is leaving the nation open to Chinese retaliation.

One of the key legal challenges that governments design their support schemes in such a way that aids the domestic industries to gain an edge in green technologies without breaching the WTO national treatment and non-discrimination rules. While the pending disputes leave national governments heavily invested in their clean energy projects open to criticism and potential litigation, from a climate policy perspective, the continuation of national support schemes and state aid is not only a necessity but under GPA a deliberate world-wide for the implementation of the international climate regime.

Highlighting the uncertainty that exists between whether climate or environmental and sustainable development principles can win out over accusations of favouring domestic producers and hindrance of trade Kulolesi concludes with the following stark reminders of the precarious position of EP within the international trade and commercial law regime;

Reviewing at the case history, it is clear is that the WTO DSM has broad discretionary powers when it comes to considering Multilateral Environmental Agreements (MEAs).

- In *Shrimp-Turtle* Appellate Report (109) while some advances were made between trade and environment much was left unanswered - most critically it did not explain the legal relevance of the various environmental instruments to which the WTO Appellate Body referred in its decision.
- In *Biotech* Rather than repeatedly act as an obstacle, the WTO has the competency under international law to invoke their VCLT-based (111) interpretative practice to positively promote climate coherence across the international legal system. (120/121/122) Kulovesi concludes, “*The Situation is far from satisfactory; the legal relevance of the KP or its successor in the WTO dispute settlement proceedings remains unclear with options ranging from direct application to complete ignorance. Such legal and institutional discrepancies are hardly conducive to fruitful cooperation between trade and climate change regimes.*” (123)

The answer to this conflict can be established in a new international agreement for 2015 proposing a realignment of the ultimate objectives of both regimes. As Recital 17 In The EU’s New Public Procurement clearly sets out; “*Council Decision 94/800/EC approved in particular the World Trade Organization Agreement of Government Procurement (“The GPA”). The aim of the GPA is to establish a multilateral framework of balanced rights and obligations relating to public contracts with a view to achieving the liberalization and expansion of world trade...contracting authorities should fulfill the obligations under those agreements by applying this Directive to economic operators of third countries that are signatories to the agreements.*” (126)

This provision goes some way to reinforce Kati Kulovesi’s point that a lack of integration of climate policy is currently in place among the legal regimes of the Major Emitters. This next section reveals and even greater diversity of goals.

Conflicts at the heart of the EU - Clean/EEVs uptake and rising GHG emissions

From a purely legal perspective stretching as far back to energy-based cases such as *Campus Oil* (127a), (allowing energy security to justify barriers to trade), *Dundalk* [1987] (127/128), *Outokumpu Oy* [1998] (128), the competing interests melting pot of competitive trade, energy security, and environmental policy has revealed constant sources of tension. (see case-law in footnotes). Manifesting itself in a constant struggle between IEM and CEP regimes agenda; cost-effectiveness and energy security vs high level of environmental protection. Established ECJ caselaw (now incorporated into Directives) has done much to progress “green” energy (including electricity especially with the mandatory requirement of GOO and other forms of verification for sources of energy. In addition to the recent case of *Dutch Coffee*, within a public procurement context now permits in EU law for local authorities to choose “what-to-buy” on the basis on higher than harmonized environmental or climate performance based value choices. However, the policy areas of transport and fuel supply systems is proving harder to attain reform.

In 2014 The New Public Procurement Directive brought out a Factsheet summarizing the keys reforms to enable further GPP uptake. (Annex 8).

The New PP Directive introduces significant legal reforms for mandatory LCC specifically in regard to Clean EEVs and removes the barrier on characteristics of PPMs which was hindering “green” electricity uptake due to its complex and uncertain procedural procurement rules. In particular the most important new inclusions are that in regard to the production process today;
“Public purchasers can consider all factors of the production process, provision or trading, even where such factors do not form part of the material substance of the product.

For example (i) when technically describing the products or services they want to purchase, they may require that they do not involve toxic chemicals or pollutants (noxious gases – As was held in *Concordia Bus Finland* in regard to public purchase of bus fleets for the public health of the community vs “lowest cost” conventional rule) and are provided using energy-efficient technologies. (ii) public purchasers may also decide that the contract be awarded to the enterprise offering products/services which meet these conditions in the best possible way, or they may favour the product which is of fair origin or a recognized International or Euro Standard/Euro Norm Eco-label (*Dutch Coffee case* incorporation). (iii) public purchasers can assess value for money on the best-quality ratio basis (replacing Most Economically Advantageous Tender MEAT) on the basis of environmental or climate performance levels/aspects. Under the new LCC Public Procurement Directive 2014 this significantly for PEV’s/RES-E includes ‘consumption of energy and other resources.’

The extent of its impact is yet to be felt. Judging from the Clean/EEVs Directive’s success to date contracting authorities are likely to remain reluctant.

This has especially been true in the case of Europe’s renewable energy growth in the electricity sector. By virtue of The Green Power Directive 2001/77/EC and the accompanying cases; *Preussen v Elektra* [2001] (2001), *EVN-Wienstrom* [2003] (130) Guarantees of Origin (“GOOs”). Article 15 RES Directive 2009) (120) have dealt with the ‘invisibility fallacy’ of not being able to distinguish between conventional fossil based supplied electricity from that supplied using renewable energy sources. Mandatorily requiring energy producer, operators and providers to produce verifiable GOOs for both consumers and procurers alike has significantly helped to increase RES-E (renewable energy supplied electricity) uptake. *EVN-Wienstrom* was instrumental in establishing the permission (within the TFEU Internal Market Free Movement of Goods Regime) for contracting authorities to purchase 50-100% electricity supply from renewable energy sources in accordance with new rules and standards such as verification through the use of Guarantees of Origin (GOO) that guarantee source of energy. (see the EU results in Annex 9 ‘Best Performers’)

As this paper is focus is on electric vehicles and an ideal PEV paradigm, this section will now attempt to highlight the key areas in EU legislation that are impacting on in its progress.

Contemporary context:

- ◆ In 2014’s Carbon Budget, emissions in the EU, put them third place in the league table of worst emitters (China 28%, US 14% and EU 10%). While they fell 1.8% on the back of sustained recession and deindustrialization, attempts to make “deep cuts” in emissions by some countries are offset by others due to the return to coal led by Poland, Germany and Finland. While national emissions are falling in line with the KP targets, especially by increasing renewables uptake in final energy consumption, Europe exports about one third of its emissions, largely to the emerging economies. Due to these ‘consumption’ emissions, EU’s reduction of emissions can only be said to have only “stabilized”. (132)
- ◆ Professor Jim Skea vice chair of IPCC, says the EU plan to cut CO₂ emissions by 40% by 2030 is too weak. He says the Commission’s current stance means that future leaders will need to make a three-fold cut in just 20 years which is not credible.
- ◆ The political difficulty of getting EU to make “deep cuts” in their emissions they claim to be doing lies in economically based fears that EU’s competitors; the US and China, in particular, will not ‘play their part’ in reducing emissions, leaving EU firms and consumers with ever-increasing energy prices and without a competitive edge. (133)
- ◆ In Annex 10 ‘electric car use by country’ The Netherlands (5.37% PEV market share of total new car sales in 2013 with 28,673 units), France (0.65% 28,560 units), Norway (5.60% 20,486) (in descending order, the latter is a non-EU MS) have made it into the ‘Top Six

PEV's stock, market penetration per capita and EV sales market share by PEV stock (December 2103). This is behind the leaders (US, China and Japan).

♦ As **Annex** shows (123) in terms of 'total passenger vehicle market' for BEVs alongside the part-ICE based vehicles, EU is far from realizing its potential. (135) While its share of the market is 58% its realization of the HEV & BEV market currently stands at just 11%. The survey revealed one of the primary reasons for poor BEV, HEV and PHEV sales is 'because of a more established EU diesel market that offers competitive fuel economy with petrol-HEV's but at a comparatively lower purchase price.' These figures need to be read against the US which accounts for 50% of the global HEV & BEV market as well as China which currently only represents 1% but is projected to exponentially grow to be a market leader even ahead of Japan, which accounts for 39% of the HEV & BEV market currently. (124)

Renewable Energy Directive 2009

In line with KP commitments, The Renewable Energy Road Map (2007) proposed 'a new legislative framework to enhance the promotion and use of renewable energy. Best known as '20-20-20' target namely; that by 2020 EU Member States meet (binding) mandatory national overall targets and measures for the use of energy from renewable sources of 20%. Additionally, a separate target of 'at least 10% from all forms of transport in 2020 is at least 10% of the final consumption of energy in transport in each Member State.' These were set out in Article 3 (1) (2) and (4) Directive 2009/28/EC (119).

From a PEV perspective the following provisions of Article 3 are noteworthy; Article 3(2) states;

'MS shall introduce measures... (3) in order to reach targets... and may apply the following measures; (a) support measures (b) measures of cooperation between different MS and with third countries for achieving their national overall targets'. In particular, it is significant at Article 3(4)'s 'transport' calculations provision at Article 3 (4) (c) it states for the calculation of the contribution from electricity produced from RES and consumed in all types of electric vehicles... MS may choose to use either the average share of electricity from RES in the Community or the share of electricity from RES in their own country as measured two years before... for the calculation of the electricity from RES consumed by electric road vehicles, that consumption shall be considered to be 2.5 times the energy content of the input of electricity from RES. By Dec 2011, Commission shall present a proposal of the whole amount of the electricity originating from RES used to power all types of EV to be considered.'

In addition, The RES Directive 2009 highlighted the importance of electric vehicles for their potential to reduce GHG emissions for the public transport sector. While at Recital 28 it emphasizes the role of EVs stating, 'The Community and MS should strive to reduce total consumption of energy in transport and increase energy efficiency in transport. The principal means of reducing consumption of energy in transport include transport planning, support for public transport increasing the share of electric cars in production and producing cars which are more energy efficient and smaller both in size and in engine capacity.'

The Resource Efficient Europe – Flagship Initiative under the Europe 2020 Strategy

The key policy paper's informing Europe's trajectory and focus on GPP-Transport and Clean/EEVs in particular is the Europe 2020 Strategy (as included in Recital 2 of The New Public Procurement Directive (communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and The Committee of the Regions (COM 2011)21) Brussels 26.1.2011) and The Resource Efficient Europe – A Flagship Policy For Europe. (120). Contained within the latter is the following significant (and honest) project to transport policy in the EU, given on a variant scenario basis; 'Annex 2: Key EU modeling assumptions and possible parameter variations'

♦ At Annex 2 'Smart Grids'; 'they will provide a framework for implementing smart grids

in MS to increase energy efficiency, support the uptake of renewable energy and build infrastructure for electric vehicles. Judging from the 2014 Proposed Alternative Fuels Infrastructure while infrastructure and a multiplicity of ‘recharging and refueling points’ are being installed in an unprecedented way for public access across the EU, the 2011 emphasis on renewable energy has been replaced by an extension of a fossil fuel “mix” thus exacerbating EU emissions even further. This is addition to new coal-fired plants in Poland, Germany and parts of Eastern Europe.

Transport Parameter:

‘continuation of current trends where freight demand grows in line with GDP and passenger transport slightly lower than growth in GDP, mainly continued use of currently available car technologies.’

Reference Scenario (current trends and policies ‘low end variation’):

Reference scenario trends combined with significant delays and limits in technical progress and cost reductions of low carbon technologies such as electric vehicles, lack of favourable policy framework.

Reference Scenario (high-end variation’):

Successful transformation towards demand management, ‘getting prices right’ and accelerated technological innovation, enabling widespread electrification’

There is also useful insights regards Energy Efficiency and Air Quality. (see Annex X)

A Resource-Efficient Europe-Flagship initiative under Europe 2020 Strategy - Communication from the Commission to the European Parliament, The Council, (COM 2011)21) Brussels 26.1.2011)

Legislative development and key provisions assisting in EV and RES-E uptake in the context driving force of Green Public Procurement “GPP”

These following directives have not only incorporated the main ECJ caselaw decisions but also the main policy strategies (usually summarized in ‘recitals’). They are also responsible for guiding public procurers through the highly complex procedural rules of the tendering process in order to purchase RES and EVs without breaching Internal Market “treaty rules”. The pitfalls of which will be explained below. Under the current legal framework these combined ‘new energy’ technologies and forms of “eco-innovation” are sometimes referred to as EU GPP-Transport-RES-E/EV (i.e. electricity used for EVs and generated from renewable energy sources).

Since 2001 GPP-Transport-RES-E/EV has received a push through a series of directives from The Commission including;

- These Directives are 2001/77/EC “The Green Power Directive”
 - Directive 2009/33/EC “The Clean/EE Vehicles Directive”
- The key provisions EU aimed to achieve were;

Environmental protection, climate mitigation and energy security – cooperation & legal principles; principle of subsidiarity (Article 5) and principle of proportionality.

- (i) Recital 7 Strategy to reduce CO₂ emissions from 120g/km objectives from new passenger cars by 2012. A legislative framework for vehicle technology improvements and measures to promote fuel-efficient vehicles (as opposed to PEVs - added by author).
- (ii) Recital 8 (i) promoting market introduction of Clean/EEVs through GPP. (ii) internalization of external costs LCC for energy consumption, CO₂ emissions and pollution emissions. Give preference to Euro Standards; Recital 15 states PP for vehicles of public transport services can make a significant impact on the market if harmonized criteria applied at EU level; Article 3; taking into account the operational lifetime energy and

- environmental impacts (i) energy consumption (ii) emissions of CO₂ (iii) emissions of NO_x, NMHC and particulate matter; (iv) Methodology for calculation of operational lifetime costs Article 6 – based on the fuel consumption per kilometre of a vehicle, the operational lifetime cost for the CO₂ emissions, the lifetime cost of pollutant emissions and fuel consumption as well as CO₂ emissions and pollutant.
- (iii) Recital 9 & 10 CARS 21 High Level Group industry cooperation focus on competitiveness, energy and environmental for public and private procurement should take account of LCC with emphasis on energy efficiency. PP guidance to move beyond 'lowest price' criteria in transport, energy and postal sectors; Recital 16 states, 'biggest impact on the market, together with the best cost/benefit, is obtained through mandatory inclusion of lifetime costs for energy consumption, CO₂ emissions and pollutant emissions
 - (iv) Recital 11; the environmental benefits of Clean EEVs
 - (v) Recital 14 Support MS adoption through exchange of knowledge

Additional headings were given to; (i) Crossing the public/private divide and the positive impacts of high-than-harmonized standards purchased by contracting authorities AND contracting entities. (Recital 17); Setting technical specifications for 'higher level of energy and environmental performance. (ii) Public support for infrastructure – state aid (Article 87/88 of TFEU) for environmental protection and cities (Recital 31); Article 5 – Purchase of Clean/EEVs road transport vehicles

• Directive 2009/28/EC “The Renewable Energy Directive” (see Annex X ‘Best Performers’/Legislative highlights on RES-E/EVs provisions and incentives)

The main point to make here is that the EU appears to have taken a very regressive step away from renewable energy and towards ‘Alternative Fuel (Mix) Infrastructure’ as evidenced below. The lack of emphasis on genuinely “green” electricity to power EVs flies in the face of the caselaw and legislative efforts to date; to integrate (Article 11 TFEU integration principle) climate and environmental policy into the IEM. Article 11 TFEU (integration principle), (124b)Article 191 (combating climate change), Article 194 (promoting EE and development of new and renewable forms of energy). Looking at Article 194 ‘s energy chapter in the round, however, it is hoped that The Commission has not lessened its enthusiasm for renewables but rather is implementing the necessary steps in Article 194 (d) promotion of interconnection of energy networks: first, in order that public purchasers and consumers alike can have the adequate charging infrastructure for EVs (as well as their potential supply from RES-E) and to the necessary build up confidence in the technology. As it has been expressed in a number of studies this is one of the main barriers to greater EV uptake.

• Directive 2014/24/EU “The New Public Procurement Directive”

This was created as Recital 2 states because “*there is also a need to clarify basic notions and concepts to ensure legal certainty and to incorporate certain aspects of related well-established case-law of the Court of Justice of the European Union*” (Directive 2014/24/EU Recital 2).

Although they do not specifically address electric vehicles or modes of the automotive sector, also relevant is:

• Directive 2008/50/EC “The Air Quality Directive”; dealing with tailpipe Co₂ emission limits; and ambient air quality and cleaner air for Europe. These are complemented by “Air Quality Framework Directive” and so the co-called First/Second/Third Daughter Directives. A milestone case in the UK Supreme Court has held DEFRA, a UK government agency accountable for breaching air quality standards in 2013. Punitive measures are being sought from The European Court of Justice (brought by the Commission) The innovative aspect of this case is recognizes ‘*individual citizens have the right under the air quality directive (96/62/EC to require national authorities to draw up action plans to comply with their air quality limits.*’ (125)

Additionally, soon to be in force will be:

• The Proposed ‘Clean Power Strategy for Transport: A European Alternative Fuels Strategy 2014 “The Alternative Fuels Infrastructure Directive”; rather than climate mitigation policy the emphasis in this new directive is on “oil independence and ‘low-CO₂

alternatives for decarbonisation of transport. The Commission states is to create a coherent and stable regulatory framework its is 'extending' the Europe 2020 strategy 'towards a target of 60% reduction of CO₂ emissions from transport by 2050 as set out in *Roadmap to a Single European Transport Area – Towards a Competitive and Resource Efficient Transport System* (2011) (126). Rather than cut out fossil fuel dependency it seeks 'a comprehensive mix of alternative fuels' as 'there is no single fuel solution'. The mix is heavily fossil fuel dependent and carbon-intensive. (126)

This directive is essence is placing a policy framework around sufficient number of recharging points being made available for the public, future interface technologies such as wireless or battery swapping, non-discriminatory access options for recharging and refueling points, car-sharing schemes, intelligent metering systems, standardization of multistandard (127) recharging (but on European lines) and best practice and coordinated data.

Fossil fuel dependent 'alternative fuel mix' with biofuels to compliment EVs but no mention of renewable energy

The clear emphasis for The Commission is on the short term to get the infrastructure of recharging points rolled out and EV uptake established. As they say at "the current stage, the main alternative fuels [also called "dual-fuel technology" have a potential for long-term oil substitution". Judging from this statement and the fuel mix approved, the idea of phasing out fossil fuels in the near or even mid-term is clearly not on the EU's "current" agenda. The provision stating that, "*fragmentation of the internal market through uncoordinated market introduction of alternative fuels should be avoided... (128) in order to serve the dual purpose of minimizing oil dependency and mitigating the environmental impact of transport.*" would be more believable if any emphasis in this directive on RES-E had been included.

Of significance to this paper's section entitled 'bursting the biofuels bubble' it is important to add, from a climate mitigation perspective, the latest setback as expressed in this new directive. In the preface it states, "*biofuels are currently the most important type of alternative fuels, accounting for 4.7% in EU transport in 2011. They can also contribute to a substantial reduction in overall CO₂ emissions, if they are produced sustainably. They could provide clean power to all forms of transport.*" Unfortunately, this is a statement which neither Tony Seba, Kulovesi nor John DeCicco cited below would agree. As Kulovesi argues, "although biofuels are becoming increasingly popular several concerns have been identified in relation to their production. Depending on where and how they are produced, biofuels can have a limited impact on GHG emissions. With some scholars arguing with zero effect and great cost to biodiversity and agricultural needs. These concerns should invoke the dual application of Article 3 (5) and Article 191 (2) TFEU (high level of environmental protection and human health), Article 11 TFEU, additionally in the energy chapter Article 194 TFEU states, "in the context of the establishment and functioning of the internal market and with regard for the need to preserve and improve the environment,". This broad principle is echoed in Article XX (B) of the GATT, where WTO members can justify measures 'necessary' to protect human, animal or plant life in the TFEU. For UNFCCC environmental principles see Annex 6. Although there has been a marked shift in EU policy in 2014 it should be noted that in The Renewables Energy Directive (Directive 2009/28/EC the bar for biofuels was set high; it forced producers of biofuels to comply with strict "sustainability criteria" before they could be included in the 10% transport emissions target. (The Renewables Energy requires GHG emissions savings from biofuels must be at least 35% until 2017, and 50% from 2017 onwards (Article 17 (2) 2009/28/EC. Unsurprisingly the 2009 Directive acted to dis-incentivize investors in the sector. In this sense biofuels are effectively being 'caught' by the new rule for mandatory life-cycle analysis 'common methodologies' in the Clean/EEVs Directive (2009). Clearly the battle between the environmental and the energy pundits has yet to be played out.

Key provisions to consider include; Art 4

- Article 4 is the key provision which covers all the details for the infrastructure for electric vehicles and in particular addressing all aspects of recharging points; Art 4(1) mandatorily requires national policy frameworks to ensure ‘an appropriate number of recharging points[for electric vehicles] accessible to the public by 31 Dec 2020. As would be expected the rest of the provisions contain; compliance requirements for technical specifications; rules on ensuring fair accessibility for the public using EVs; prices to be charged to be ‘reasonable and clearly comparable, transparent and non-discriminatory’, requirements for recharging points to the public for EVs ‘if technically and economically feasible.’ (129 for the full text)

- The Article 4 provisions (129) that stand out are; (i) the ones that seem to impose greater EU supremacy on national authorities discretion (ii) establishing a Euro as opposed to a international standard, (iii) place emphasis on addressing access to services and fair prices that envision a scenario where individuals taking more rather than less control over their electricity supply; See Article 9, Article 10 in particular (129). In addition to;

- *Art 10A requires The Union shall pursue the development by the standardization organizations of European Standards containing detailed technical specifications for wireless charging and exchange of batteries for motor vehicles, and for re-charging points for L-category motor vehicles and electric buses.*

- *Article 11; The Commission shall be empowered to adopt delegated acts in accordance with Article 8...in order to require compliance, by infrastructure to be deployed or renewed, with the technical specifications for wireless charging, exchange of batteries, recharging points for L-category motor vehicles and recharging points for electric buses contained in the European Standards...where the relevant ESO have recommended only one technical solution with technical specifications as described in a relevant European Standard.*

While the provisions speak for themselves, aside from the clearly carbon intensive nature of the ‘alternative fuel mix’ contained here, is the crucially important Article 10 which appears to be asserting European supremacy for Community wide energy security over the usual recognition of independent states energy-choice sovereignty. This would be more palatable if the alternative fuel mix element has a plan to be phased out and a clear pathway to a PEV/RES scenario was part of the plan. Seemingly, this is far from the EU’s latest intentions.

Green Public Procurement – Highlights of the EU’ promotion of failure to deliver greater EV uptake

Since the EU Sustainable Development Strategy (SDS), Renewed SDS, Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan (141) contracting authorities have been required to meet a 50% GPP targets by 2010. The aim was to get MS to ‘develop a structured process to share best practice and expertise to take into account the potential GPP can contribute to reducing emissions and to promote selected major product groups’ (130). Transport is one such ‘product group’. However, five years on EU GPP Transport’s MS feedback report (taken through National Renewable Action Plans and local authorities surveys) reveal uptake has been slow at best and at worst barely measurable. This is evidenced by the fact The Commission has failed to meet the report deadline of Dec 2011 on how much RES-E is being used to power Clean/EEVs. In addition the GPP Uptake EU27 Report co-produced with The Commission two years ago failed to even have Clean/EEVs as a ‘product group’ category. (131)

Voluntary targets for GPP (The EU GPP goal of 50% GPP uptake (142)) are based on the uptake of the “core” (and “comprehensive”) elements of those criteria (see Annex on ‘Best Performers’); In short, products with specific environmental characteristics which define them as ‘green’ follow a twin criteria that they are linked to either; 1. The impacts of a product and divided into ‘core’ criteria (addressing the most significant environmental impacts and/or easy to verify) 2. ‘Comprehensive’ (best environmental products which may require more efforts to procure in terms of verification). This is the current formula being applied to EU GPP-Transport and procurement of Clean/EEVs (including bus and car fleets).

As part of EU GPP monitoring of progress, through NREAP's (National Renewable Action Plans) MS do sector specific feed reports back to The Commission to update of GPP uptake progress. Currently this covers the RES-E, RES H/C and RES-Transport 2020 target public sector related product groups. Alignment is sketchy due to prolonged recession and the voluntary/optional nature of the GPP regime (exception of EU GPP-Transport which has seen "significant increase" as a consequence of mandatory measures in place seen 2009 Clean/EE Directive/RES Directive/Old PP Directive) The GPP Uptake Report 2012 proved in Section II by the low uptake and feedback from authorities claiming difficulty in including 'green' requirements in award criteria).

The Commission has been forced to postpone its deadline of December 2014 on the monitoring of progress of Clean/EEVs uptake in public procurement, due to sketchy and poor feedback and low uptake across Member States in relation to EU GPP-Transport. This was reported direct to the author in an interview with Kemal Onel (August 2014) in DG Clean Transport and Sustainable Urban Mobility, European Commission, Brussels. In the meantime, in accordance with The 2011 Clean/Energy Vehicles Monitoring Report all public procurers are directed to The Clean Vehicle Portal. This has already received criticism for not satisfying the detailed inquiries required to assist with The Clean/EE vehicles 2009/New Public Procurement mandatory requirements for 'common methodologies' towards LCA/LCC.

Despite the poor record of achievement to date, the priority The Commission still places on GPP, especially for "clean" transport is evident in Recital 95 of The New Public Procurement Directive February 2014, *"it is of utmost importance to fully exploit the potential of public procurement to achieve the objectives of the Europe 2020 strategy for smart, sustainable and inclusive growth. In this context, it should be recalled that public procurement is crucial to driving innovation, which is of great importance for future growth in Europe."*

Highlighting the socio-economic sensitivities at stake as well as the significance of the Clean/EEVs Directive 2009 being singled out as a GPP-Transport-starter-sector, Recital 95 continues, *"in view of the important differences between individual sectors and markets, it would, however, not be appropriate to give general mandatory requirements for environmental, social and innovation procurement."*

The New Public Procurements 2014 – Three Key Provisions for climate mitigation's regime

As Harro Van Asselt has argued, GPP has the potential to be the most important tool for "environmental improvement". While the effects of efforts in Europe are yet to be realized, nevertheless government procurement accounts for an average of about 20% of the OECD countries GDP and 14.5% of non-OECD countries (China, for instance) ^(144a) In Europe, alone 18-19% of GDP is spent on supplies, works and services (estimated in 2004 at 1.5 billion ^(144b)). As evidenced in Annex 10 'Electric Car Use by Country' this figure is rapidly rising from governments investing in clean transportation, electric vehicles and its associated charging infrastructure. In addition to the 2014 GPP "factsheet" for PP reform (see Annex 8) here are three key provisions which may render results in a following five years.

1. Article 68(3) Annex XIII states that all MS must ensure as a new mandatory requirement that contracting authorities apply life cycle costing and 'common' methodologies' in the sector of Clean EEVs. This the first and only sector to have this 'hard law' non-market-driven interventionist instrument applied to it.

2. Addressing LCC Article 68 also specifically now permits coverage of "parts of or all the following costs over the life cycle of a product, service or works; (b) costs of use, such as consumption of energy and other resources, end of life costs, such as collection and recycling.

This is clearly helpful for RES-E uptake related to EVs.

3. Marking progress for the PEV paradigm, this EU decision to include externalities in GPP (green public procurement) has received a significant boost as a result of its 'strategy for smart, sustainable and inclusive growth' (124 Europe 2020 Strategy (Recital 95) directive 2014/24/EU) in the latest Directive 2014/24/EU (125) as part of GPP reform package. This directive marks a significant departure for the EU in its public procurement policy as it finally puts to bed a long standing obstacle in the way of GPP-Transport which would affect Clean/EEVs uptake, namely PPMs and "factors that do not form part of their material substance." As of February 2014 by virtue of this new directive public purchasers are, crucially, now permitted to consider all factors (including environmental, pollution and climate related) of the production process, provision or trading [of a product works/or service], "even where such factors do not form part of the material substance of the product." The inclusion of these last words in the new PP directive are very significant as they clarify decades of uncertainty over the characteristics of PPMs (processes production and methods) which has acted as a particular prevention in the past for purchasing of "green" electricity the past due to a so-called "invisibility fallacy" (126) but this has now be resolved due to a series of cases (127) that have established as a matter of EU law strict verification procedures (including GOOs and eco-labels) for contracting authorities to follow to clearly distinguish electricity produced from renewable energy sources from that of conventional fossil fuels.

Life Cycle Costing – setting a new procurement standard for EVs - best price-quality ratio

Setting the stage for the introduction of the "externalities" (120) based mandatory requirement of Life Cycle Costing/Analysis in the "green" public procurement sector of governance, the RES Road Map also stated, *'the cost of renewable energy has been falling steadily for the last 20 years, but remains higher than that of conventional energy sources. This is above all because the external costs of fossil fuels have not been internalized'*

Building on the *Concordia Bus Finland* (144) the breadth of considerations that can now be included under "cost" during the MEAT (Most Economically Advantageous Tender) stage of award criteria during of the tendering process has been stretched to include 'innovation-led' and 'climate performance' levels considerations during the life cycle costing analysis (LCA). Consistent with the EU's new GPP reforms, to avoid confusion and reversion to the old "lowest cost" or test the term MEAT to be applied to public contracts has now been changed to 'best price-quality ratio'. Directive 2014/24EU The New Public Procurement Directive Article 68 on Life Cycle Costing (149) At Recital 49 the Directive explains its inclusion. It states, "promoting innovative products and services to create market-pull" using the new 'best price-quality ratio'. This shall be assessed on the basis of the criteria, including qualitative, environmental and/or social aspects, linked to the subject-matter of the public contract (128). The latter is a key concept in public procurement law.

The concept of "externalities" has now received even bigger boost in the regard of the notion of higher-than-harmonized standards (consideration of which is needed for the purchase of Clean/EEVs). At Article 67 (2) it provides that life cycle costing may now include best price-quality ratio...including qualitative, environmental and/or social aspects, linked to the subject matter of the public contract (the latter being a key concept in EU PP law) (134)

Similarly Article 67 crucially provides public procurers wishing to purchase Clean/EEVs to take into account; Life-Cycle Costing Article 68 (1) (b); *environmental externalities...such costs may include the cost of emissions of GHG and other pollutant emissions and other climate change mitigation costs.*"

Alignment of new climate mitigation and eco-innovation policies, such as Clean EEVs, are working with the EU's core economic policies, casting public procurement in the role of the key market-based instrument of the Union approach to GPP. This has the effect of changing the legal framework and providing important tools (such as Clean Vehicle Portal or GPP Training Toolkit, 'common methodologies') for those contracting authorities that wish to exercise their purchasing discretion to advance environmental, air quality or climate mitigation values. At the same time, as the EU adopts more mandatory environmental procurement standards on a sector-by-sector basis, it *promises to reduce the scope of contracting authority discretion* (i.e. impose EU supremacy over national sovereignty) by requiring an alignment of public procurement demand around such standards. At present the Union's ambitions are not being achieved for GPP-Transport uptake. Feedback from MS are currently non-existent and demonstration projects are only a very small scale. This is with the exception of Sweden, The Netherlands and Norway (see Annex x).

These new EU GPP regulatory reforms are important incorporations for the climate mitigation struggle against pure economic and energy security concerns. This is particularly the case when contracting authorities wish to favor 'green' electricity supply and Clean EEVs (when tendering out their contracts) but are fearful of the Internal Market's Article 28-Article 30 Free Movement of Goods rules FMG rules.

These two rules providing a stumbling block for the PEV paradigm are Article 28 "Quantitative restrictions on imports and all measures having equivalent effect shall be prohibited between Member States." And Article 29 "Quantitative restrictions on exports, and all measures having equivalent effect, shall be prohibited between Member States.

Tensions in the transition towards a PEV Paradigm in the EU The Treaty Rules vs The Renewables Energy Directive 2009

It is out of the scope of this paper to discuss this very complex topic in any depth, however, it should be noted these Treaty rules are aimed at ensuring the removal of all barriers to trade and discriminatory or anti-competitive behavior within the Single Market. It has been suggested by energy law scholars that The Renewable Energy Directive 2009; The Clean/EEV Directive 2009 and possibly even the New Public Procurement Directive 2014 (with its clear GPP reform package incorporations) is in fact incompatible with the Internal Market's Treaty rules (as above) (147). Prompting scholars like Dr Kim Tallus to suggest the Directives have been adopted 'on the wrong legal basis' (136) The core question being asked here is to what extent can a national authority or government exercise policies, using their own discretion, when wanting to purchase either "green" electricity or "green" vehicles? The answer appears to be that if done following the principles of precision, transparent, 'open access' and non-discrimination and following the correct new (and relaxed) EU GPP guidelines for executing the tendering procedure, this should be permissible and therefore lawful. If on the other hand, a national entity applies 'measures', as explicitly set out at Article 3 (3) (a) of The Renewables Directive) to provide national support schemes to meet national emission targets, and then favors their own "homegrown" early stage industries they are likely to be caught by Treaty rules or WTO rules. However, as Tony Seba and Kati Kulovesi have only too often pointed out, when it comes down to it the issue is a political one.

Conclusion on EU GPP Transport today

Alignment of new eco-innovation policies, such as Clean EEVs, is working with the EU's core economic policies, utilizing PP as driver for change as a key market-based instrument. This is adapting the legal framework by using guidance (vast majority voluntary) tools (Clean Vehicle Portal, GPP Training Toolkit, 'common methodologies') to guide public purchasers wanting to use their discretion to advance environmental, air quality or climate protection values. As the EU attempts to manage "demand" it is adopting more mandatory environmental procurement standards on a sector-by-sector basis, with Clean EEVs

representing the first. This is having the highly controversial constitutional effect of *reducing the scope of contracting authority discretion* (i.e. imposing EU supremacy over national sovereignty (contrary to ECT's Article 18 see Annex 6)

As for Clean/EEVs today, the EU's regime is failing to achieve any meaningful uptake, whilst the "fudge" of the latest Alternative Fuels Infrastructure Directive is sure to increase, not reduce, emissions yet further. In addition to the contradictory policy frameworks, the prospect of a PEV paradigm shift in transport continues to be impeded by MS resistance to implementing and transposing the RES, PP and Clean/EEVs directives into domestic law. One reason for delay is that NREAPs (Article 4 Renewable Energy Action Plans The Renewables Energy Directive 2009) have yet to be aligned with GPP-Transport for RES-E-EV; an explanation why feedback from MS as part of 'pledge-and-review' is currently non-existent, uptake minimal and demonstration projects on a small scale. This is with the exception of Sweden, The Netherlands, Germany, Norway (see Annex 'Electric Car Use By Country' and 'Best Performers'). Therefore, the shift towards 'an alternative fuel mix' alongside the non-inclusion of renewables (137) in the latest directive aimed at promoting EVs represents a major setback for EU's climate mitigation regime. Whether a longer term plan to revert back to TFEU's Article 194 (1) (c) (renewable energy) and Article 191 (combating climate change) remains to be seen.

Section III continued: Regulatory Reform: CO₂ Emission Cons

"We are shaping the world faster than we can change ourselves, and we re applying to the present the habits of the past' Winston Churchill

Redefining Basic Assumptions – Bursting the Low Carbon Fuel Standard and biofuels bubble

In his 2013 discussion on climate change and the law in the US, Michael Mehling's proposition that, "*the climate regime in California provides a useful model for the rest of the country*", ⁽¹⁾ begs to be disagreed with. While it is true the cap-and-trade regime now in place in CA is progressing the cause of PEVs (especially in the case of Tesla Motors (CA based), as explored below) the old regulatory design is still failing to achieve the "deep cuts" in emissions the IPCC says is required to avert 2C°.

The visionary critique by John DeCicco on alternative pathways ways to reduce automotive GHG emissions and net GHG impacts in the energy sector is certainly to be preferred. Particularly selected because it represents the "best data available" and by DeCicco's admission, "it deliberately analyzes the transport sector only from a GHG emissions perspective, rather than from the (common) perspective of reducing oil dependence and energy security." ⁽²⁾

Propping up the polluters – Major Emitters (ME's) from a climatic-scientific perspective

A 7 point summary with diagrams of DeCicco's critique on LCFS and biofuels is as follows;

1. The US remains the world's largest source of auto-related GHG emissions ⁽³⁾ and figures are only expected to rise.
2. A low-carbon lock-in epitomizes the challenges faced if MEs sticks to this paradigm. Exacerbated by an unconventional fossil renaissance, if transportation and personal mobility continue to rely on the use of carbon-based fuels without carbon mitigation CO₂ emissions will rise along with it.

3. Despite R&D in alternative fuels to lower GHG emissions, no trend of substantial “decarbonization” for *any* fuel is apparent.
4. The proper policy focus to achieve “clean” transport should be on the *sectors* that supply fuel rather than the *choice* of fuels in the auto sector. (4)
5. The current legislative framework in US, China (and EU (5) is based on three common approaches; (i) reducing travel demand (ii) improving vehicle efficiency (iii) using alternatively (non-petroleum) fueled vehicles (AFVs). i.e. carbon intensity is a modeled representation of complex energy supply and use systems rather than a measurable property of fuels themselves.
6. Current policies in this sector are therefore more aimed at commercializing and perpetuating ICEV’s and AFVs, their infrastructures and after-sales services than “*climate protection at present.*”
7. Given the auto-sector’s reliance on petroleum, GHG emissions have hardly varied;

Where the emissions really coming from?

The great majority (91%) of emissions relate to fuel use and are largely proportional to the quantity of fuel consumed. John DeCicco

- The largest portion of CO₂ is from “end-use” fuel combustion (i.e. downstream) ‘due to incomplete combustion and trace gases (6)
- The other portion is “upstream” emissions during fuel production, including extracting, shipping and reefing crude oil and distributing fuel products. (See Annex X ‘Fig 4 (Figure 4 GHG Emissions breakdown for a typical US light duty vehicle’ 2011 pg 387 DeCicco Energy Policy 59 (2013) 59) Annex ‘Figure 4’ breaks down lifecycle GHG emissions for a typical US gasoline car. (7)
- Emissions during vehicle materials production and manufacturing account for about 9% of the total prorated over a vehicle lifetime. (8). This highlights the futility of the EU’s emphasis in A Resource Efficient focus on “green” vehicles carbon footprint as with compared with emissions from fossil fuel consumption. (9) Conversely, using natural gas as a transitional energy strategy is supported by Annex is ‘Fig 5 (10) showing trends in direct GHG emissions from gasoline combustion and electricity generation. It shows a modest declining trend for electricity, reflecting greater use of natural gas and some renewables rather than coal, in contrast to the constancy of direct CO₂ intensity for gasoline. However, US EPA has greatly increased estimates of methane emissions from the US oil and gas sector. (11)

Bursting The Biofuels Bubble – A scientific analysis from a climate protection perspective

The situation, argues DeCicco, “*is even more murky for biofuels*”. For the following reasons;

- Replacing gasoline with ethanol has *little appreciable effect* on direct (tailpipe) Co₂ emissions because ethanol’s chemical carbon content differs little from that of gasoline per unit of energy.
- Upstream impacts of any biofuels now produced at commercial scale are too uncertain to meaningfully quantify. Traditional lifecycle and government biofuels advocates claim significant GHG emissions reduction benefits (12). However, *profound uncertainties* and ongoing scientific debates surround the extent of net Co₂ uptake (13) given the magnitude of associated N₂O emissions (14)

Suitability of lifecycle analysis for LCFS fuels policy – Are mandatory LCA requirements unreliable?

- The complications surrounding fuel system GHG impacts have moved from the arena of academia to the realm of regulatory policy as seen in the LCA GHG emission thresholds of a low-carbon fuel standard (LCFS) or a renewable fuel standard (RFS). Problems identified in particular by recent studies in this field are concluding that quantification of key impacts through LCA is overwhelmed by uncertainties. (15)

- These concerns should remind analysts of the ISO “impacts” report where it concluded; “there is no scientific basis for reducing LCA results to a single overall score or number, since weighting requires value choices” (16)
- LCA is a tool for analyzing *product systems* and so LCA-based policies such as an LCFS are product-focused. In contrast, a source is simply a specific entity from which GHGs are emitted, and so a source-based approach focuses on the location where emissions occur. (i.e. a need to address both the production and consumption source of CO₂ emissions). A preferable approach is Searchinger’s recommendation of counting all CO₂ emissions where they occur regardless of the origin of the energy product. (17)
- Deluchhi has suggested that “calculating the climate impact of biofuels is so complex, and our understanding so incomplete, that we make only general qualitative statements.” He also argues that while GHG impact of biofuels have traditionally been assumed beneficial relative to fossil fuels, a more prudent view is that *it is scientifically indeterminate*. There is no consensus even on methodology and it is an issue that confronts the limits of LCA and other methodologies for addressing GHG emissions and associated climate impacts (17)

Why Renewables are more efficient than biofuel – according to Stanford’s Tony Seba

Echoing this view Tony Seba adds, “Next-generation biofuels” seems to have borrowed a strategy from the coal lobby’s “clean coal” campaign...meant to keep the financial subsidies and political protection flowing and the scientific evidence at bay...the ethanol market is a government-created support mechanism for the agricultural biofuels lobby.” (18)

Although a more realistic viewpoint is to extend his sole focus on solar/EV to a renewables/EV generally, Seba rightly points out the following three reasons why the latter is a superior energy choice to biofuels;

1. Solar-to-ethanol conversion rate is rate 0.13 %, this compared to an average solar panel of 16%. CPV (19) about 40% of sunshine into electricity, making it three hundred times more efficient than sugarcane. (19)
2. PV is 123 to 550 times more efficient than biofuels and will do it without valuable land or water, let alone fertilizers or toxic pesticides.
3. As an industry insider admits, ‘The whole market for biofuels is a 100% political’. (20)

Seba concludes, ‘*many government subsidy programs continue decades past the expiration dates of the products they help prop up. Agricultural biofuels is a well-meaning experiment gone awry. They are obsolete. The only thing that’s renewable about them is the special-interest lobby groups in Washington, Brazilia and Brussels.*’

Why PEV’s are a superior technology to ICEVs

According to DeCicco there are 4 reasons why PEV’s should be preferred by policy-makers; (23)

1. When an EV draws power from the grid it is inherently more efficient than an ICEV because major energy conversion losses occur at the power plant (upstream) rather than the car engine. EVs have about one-third the energy intensity of current non-hybrid, non-efficiency-optimized vehicles (21)
2. Electrification of some portion of the fleet is a pathway to automobile energy intensity levels one-third of today’s. Even greater reductions might be seen if autonomous (self-driving) vehicles and “podcars” emerge from the MITs and Google’s projects. (22)
3. As the US energy sectors do not currently face sufficient constraints to reveal if one sector could progress the PEV more than another. However, with the auto-industry’s fast stock turnover regulatory adaption results will show more rapidly in the auto than energy sectors.
4. Efforts to deeply reduce auto-related GHG emissions need not be held hostage to AFV strategies and their associated transition barriers such as infrastructure needs, cost hurdles and customer acceptance challenges.

Section V Regulatory Adaption; Moving from petroleum to a PEV paradigm

Regulatory adaptation: moving on from the petroleum to the new PEV paradigm – making the grid mix and upstream emissions accountable

As Lutsey and Sperling rightly ask, ‘what is the best way to adjust increasingly anachronistic vehicle performance standards to commodate plug-in electric vehicles PEVs?’

Highlighting the “convergence” paradigm occurring, the scholars categorize PEVs as “an energy option”. A summary of their conclusion is as follows;

As petroleum is replaced with fuels having high upstream emissions, a shift to lifecycle emission accounting will be necessary. Currently, the US and EU GHG regulations analyze the impact of assigning O g/mile to EVs and PHEVs operating on electricity. They found that adopting this method results in an erosion of up to 20% of the GHG benefits from new vehicles (assuming a 10% PEV market share and fixed vehicle standards in the 2020-2025 timeframe). The greater the PEV fleet grows the worse this scenario becomes. Therefore they propose 3 new policy approaches for addressing upstream emissions;

1. O g/mile crediting for all PEVs;
2. O g/mile crediting that requires automakers to purchase offsetting carbon or renewable electricity credits
3. Establish lifecycle upstream factors that are based on *the grid mix* and *emission factors* where the PEV’s are charged (“Option 3”)

Aimed at establishing the case for Option 3 “is inevitable and scientifically correct. It assures that the full emission impacts are considered by industry and consumers and market forces are harnessed. It also ensures governments “can’t pick winners” (also known as technology neutrality claimed to be adhered by the EU for instance (23). Today the US EPA now requires some upstream emissions to be taken into account in the national biofuels mandate (Renewable Fuel Standard RFS (24) and the CARB requires full lifecycle accounting in their Low Carbon Fuel Standard (LCFS). The EU also does in their “analogous” Fuel Quality Directive. (25)

Approaches by EU and US to biofuels demonstrating climate mitigation advances:

- EPA and CARB (US) do account for upstream indirect land use effects in their RFS and LCFS regulations; including car air conditioners (2016 rules)
- These new regulations are being acutely resisted by automakers who argue they can’t influence the upstream emissions and pollution caused by electricity utilities.
- Automakers are encouraged to (i) think climatically about their own manufacturing carbon footprint and select strategies accordingly (26) (ii) direct PEV sales to areas with lower electricity grid GHG emission intensity. (27)
- This is a transition phase and compromises need to be made. (28). However, it is essential that AFVs are evaluated on their environmental (as opposed to energy efficiency) performance. Taxes and fees could be applied to ensure GHG and energy externalities are taken into account.
- O g/mile regulatory accounting procedures should not become entrenched. Its role should be a mere first step in the transition to *full* lifecycle accounting. A (scientifically correct) process needs to be put in place that creates a definitive timeline for this to happen. (29)

Focusing on energy efficiency as opposed to ‘environmental efficiency’ would do much to shine the spotlight in the correct place. As the former terminology, entrenched in policy strategies for over two decades and in particularly the ECT Treaty, is proving to have the reverse affect of what it says of the label. i.e. doing it well appears to be having the reverse impact of what environmentally-minded intended; i.e. rather than decreasing demand it is increasing it due to the economies of scale attached to driving down prices.

Section IV: A Descriptive overview EU, CHINA, US; barriers and breakthroughs
Annex 7

Section VI: The Future is Now: China, Tesla Motors, Inc and ZEV regulation

“China is now the main decider on the future global temperature and climate of the world”
- *Financial Times (China) Cover Story*

China and EVs

On July 2014 at the 10th International Pure Electric Vehicles and Charging Station Exhibition in Beijing it was reported (2) that China is in a transitional phase before ‘an electric car surge’. Noting that EV producers still have much consumer’s reluctance to overcome. Always at the center of any PEVs debate, it was also reported that, “US premium electric-car maker Tesla has drawn a great deal of attention in China becoming a popular toy for the country’s growing number of rich people. But a recent picture featuring a Tesla with a dead battery being pushed along the street has been widely circulated on China’s social media.” (3) The delay in roll-out blamed on the lack of charging facilities, as opposed to immature battery technology which is said by industry experts to be EV’s the biggest hurdle yet to overcome. The report concludes, “The Tesla case shows that China is still not ready for a pure electric era.”

However, according to one of China’s leading PEV experts, Maya Ben Dror (4), this is just a populist assumption. The Chinese central government and its research institutes and universities are more prepared for the PEV revolution than most people think.

Annex X’s ‘Top Six’ by ‘Electric Car Use By Country’ demonstrates the how the Major Emitters are increasingly embracing the PEV paradigm. This is being done by a combination of state aid, national support schemes, taxes and incentives and GPP to accelerate their countries in the 21st century’s clean-tech race.

While GPP-Transport-EV is being technologically driven by the clean disrupters and the automakers, and especially by companies based in California such as Tesla, the push to date to achieve cost-effective critical mass for the consumer is being pushed by government support. This is the case for some countries in an unprecedented way, most notably Tesla Motors, Inc.

In Dec 2013 the auto-tech company had a market valuation of \$17 billion dollars (5). However, this success has mainly been achieved as a result of substantial capital generated by The State of California’s ZEV regulation credits scheme.

One of the main barriers to a breakthrough for the PEV paradigm (to reiterate this includes BEVs and PEVs but not PHEVs or any ICEV hybrids) for “clean” transportation is the conflict that exists between the free-trade agenda of the WTO’s trade and the UNFCCC’s climate mitigation agendas. For companies like Tesla, however international Cooperation with countries like China is what will give them the global competitive dominance they want while saving the planet in the process.

Contrary to most people’s understanding of China, understandable given it is both the World’s Worst air polluter (6) and is the largest emitter of CO₂ (10 billion tonnes in 2013) (7), the Chinese Central government is in fact turning out to be the world’s largest clean-tech investor.

As shown in Annex X the global GPP figures are strengthening as both the private and the public sector are latching onto the new race to net zero-emission cities and clean transportation. Public-Private Partnerships are also a key feature of the new PEV paradigm.

To make this transition to maturity, the EV industry still depends on a mixture of regulatory pressure (on the incumbents) and governments measures to motivate firms (8) Socio Technical Inertia: understanding the barriers to EV, Simone Steinhilber et al 60 (2013 531-539 pg 537] and increase consumer sales. In the process procurement is being targeted as one of the main pathways (subsidies, tax credits and other incentives) on the road to a zero-emission environment.

The most surprising and starkest example of this GPP-EV uptake phenomenon is China. Perhaps not so surprising given its already highly centralized and command-and-control structure. An example of the complex 'system-scale and interactions' (including smart grids) for a PEV paradigm at a local and urban level are shown in Annex /Annex As most of the utilities, power stations road networks and other relevant assets are state-owned in China the scale of their development is incomparable with the US and Europe. From the Chinese perspective, as they missed out on the last ICE automotive revolution, and due to their acute public health issues, President Xi Jinping has repeatedly expressed his intention for China to become the largest EV player in the world. Two examples of his personal efforts are the recent Sino-German cooperation on charging equipment standards and his personal endorsement of a \$3.5 billion investment to build a car battery plant in East China's Jiangsu Province. (9)

China is also now an advanced industrial nation having become in 2009 the largest automotive market in the world with 13.6 million vehicle sales (10) Although only 1% market share of the global BEV and HEV sales market to date in passenger vehicle fleet, according to technical forecasters; "This is expected to rapidly change as Chinese purchasing power increases over the next few decades." (see piechart Annex II for EU, US, China comparisons)

In 2013 other projections involving GPP growth in China reported that 'According to the 'China New Energy Vehicle Development Project' (July 2011), the Ministry of Finance will grant a total of RMB 100 billion to support the development of the NEV industry from 2011-2020. (12)

China has set the target of having more than 500,000 battery-electric vehicles (BEVs) and plug-in hybrids (PHEV) on the road by 2015 and 5 million by 2020 (SCC, 2012) (13) Additionally the central government aims to establish one or two auto-manufacturers with the production capability of more than 1 million NEVs per year (14)

In January 2009, the Chinese central government launched 'Ten Cities, Thousand Vehicle Program' to stimulate the adoption (demonstration and promotion) of NEVs. (15) In 2010 the pilot cities were increased to 30; and the program was further expanded from focusing on government fleet applications to including private consumers. For each city/province, the Chinese central government are paying a subsidy between 40,000-60,000 yuan with BEVs getting more than PHEVs.

To accomplish the program, rapid construction of infrastructure facilities has been initiated by governments. (16)

"Beijing is one of the leading cities in the world to promote electric cars and we would like to take this opportunity to showcase this to the world. The City of Beijing plans to have 50,000 electric cars on the streets by 2015, while across China the government has set a target of producing and selling 500,000 energy-efficient and alternative energy vehicles per year by 2015, and five million vehicles by 2020."

Vice Mayor of Beijing, Ms Cheng Hong – Host of the launch of the Formula Electric Championship September 2014

For example, in Beijing, the local government provides subsidies of 30% of the construction costs of charging facilities for NEV companies, 36,000 slower, lower power charging points, 100 rapid charging stations, one battery swap station and two battery recycle stations will be deployed around the city by the 2015. In addition to this are extensive and "generous" incentive policies for NEVs aimed at substantially reducing the cost of purchasing a NEV. (17)

Even China suffers from GPP-EV-slow-uptake

As Zhang et al report, “*despite the government policy of intensive support their efficacy in actually promoting the adoption of NEV’s is limited, and enthusiasm for the private purchase of NEV’s seems very low in China.*” (18)

This is supported by Tran et al’s statistical translations on AFV from 2012 (Alternative Fuel Vehicles) sales were struggling; “*while in 2009 China became the largest automotive market in the world reaching 13.6 million total vehicle sales, surpassing the 10.4 million sold in the US...only 1900 were sold, less than 0.1% of the passenger vehicle market. What the statistics also show is that despite China having the single largest automotive market in the world, its passenger vehicle fleet is a fraction of the total at 1%.*” (19)

Zhang et al continue, “*the disparity between strong incentive policies and unsatisfied NEV sales indicates that NEVs as new products are facing skepticism...Government policies, particularly demand-side incentives for NEV’s can be a helpful means of stimulating NEV adoption by potential customers only when the government has adequate information related to the preferences and the determinants of demand of these consumers*” (Roche et al, 2010; (20)

It should be noted these sales figures are subject to rapid change as the 2014 sales figures show; PEV stock, market penetration per capita in China has propelled them to third largest in the world with 38,592 PEV units. This is in contrast to the US in first place with 172,000 PEV units and Japan with 74,124 PEV units. (21)

While an analysis of how government policies affect sales and consumer preferences is outside the scope of this paper two paragraphs are awarded to scholars proposal for curing GPP-EV slow-uptake.

‘Next steps’ to Niche Markets

In response to the almost universal failure of governments (with exception of The Netherlands, Sweden, Norway, France and Japan) failure of governments incentives, in ratio investment terms, translating into increased EV sales, Steinhilber observes that, “a key concept in the evolutionary approach is that of the niche, wherein a technology may be nurtured or managed (Hoogma et al 2002). These scholars, ‘claim that in such environments new technologies can be far more effectively adopted by user groups willing to pay a significant premium for the superior characteristics...thereby initiative a process of regime transition” (22)

Putting it into a policy context and offering a ‘*critique of the shortest paths approach to low carbon transport*’, he continues, “*the intermixed character of low carbon transport systems with many other policy fields makes integrated strategies necessary but also more problematic (Wells 2012). Intervention has been premised on strategies intended to enable an early adoption of low carbon vehicles with an intelligent and adaptive transport system.*”

Along similar lines, *The King Review* on Low Emissions Vehicles, marks out the PEV paradigm in particular as it, “*sees different roles for different fuels, but in the long run, only truly zero-emission technologies should prevail.*” (23)

These last remarks do highlight not only the struggle of introducing a non-fossil fuel based product into the market but also the reason why, from a climate mitigation perspective, such reliance is now being placed on GPP to stimulate the uptake required.

The UN China EV Report - 2011

Evidence of PEV potential’s in China is documented in the 2011 UNDESA report (24) published in May 2011 entitled, “*Electric Vehicles in the Context of Sustainable Development in China*”

Mainly technical in nature a summary of its findings; is as follows;

- The UN report provides a useful breakdown of China’s ‘policy support for electrification of transport’ instruments for EV/battery technology (with lithium/rare earth as commodities) roll-out and industrial support; (* see Annex 14 ‘Box 1 Electric Vehicle Policy Support in China: A Timeline and ‘Box 2 The “Ten Cities, Thousand Vehicles” New Energy Vehicles Demonstration Project’) including the Ministry of Science and Technology’s ‘863 Program’, (25). This was started in 2001 from the 11th Five Year Plan and focuses on policies, standards and finance.

Although the ‘863 Electric-Drive Fuel Cell Vehicle Project received an initial investment of RMB800 million, the key funding mechanism in recent years has been supporting the development of EVs.

- Emphasis is on exchange of knowledge and exploration of synergies between industry leaders and in particular ‘bilateral cooperation in EV development’. The latter covers a comprehensive range of clean transport modes; passenger vehicles, electric buses and municipal vehicles, e-bikes, low speed rural e-vehicles HPEV.

- The thrust of China’s ‘bilateral cooperation’ is to ‘ensure the development of a vehicle market that both meets and sets global standards.’ The US and Europe are singled out as China’s ‘two major bilateral partners for cooperation in the area of EVs.

- Unlike more recent policies, the 2011 UN report does not single out the benefits of BEVs as opposed to PHEVs, in particular. Conversely, the Report argues that BEV’s should only be a ‘transitional’ solution, “as we believe PHEVs will become mainstream for decades to come.” Seeking to prove the “on-grid” PHEV is a superior choice, they state; “we believe that PHEVs have potential to be a mainstream technology for decades to come... on basis of higher efficiency and lower overall life-cycle GHG emissions”.

The key institutions and reasons for these cooperation based partnerships are provided in Annex ‘Bilateral cooperation in EV Development’ in the US and Europe’. Descriptions of the main actors in these US-China-EU collaborations are also given. (26). Most notably, the UN Report mentions;

- The US - as a key developer of technology and world leader in technical modeling in vehicles, vehicle use and other key technologies.
- The US and China have created the US-China Clean Energy Research Center (CERC) focusing on three areas; clean coal, “green” buildings and clean vehicles. California has been a test bed for a number of Chinese EVs including cars and buses. The goal of the center the UN states, “is to identify collaborative development opportunities between the US and China and build a long-term relationship in these fields.” A key automotive power... CATARC is deepening ties with Germany with projects including “Mini e” for EV Market in China with Volkswagen and supporting energy consumption standard development (27)

“EVs are only an energy conversion technology rather than a clean energy technology...it is essential that the energy supply for EVs be cleaned up...charging schedules and linking to renewable energies are key to this strategy” – The UN Report on EVs in China

Attention also given to ‘life-cycle raw material assessment, energy use and GHG emissions for electric vehicles.

(i) Impact of EV development on raw materials’ in particular lithium and rare earth. (28)

(ii) ‘GHG emissions’. The UN looks at the potential lifecycle GHG emissions changes due to the replacement of conventional ICE vehicles by PHEVs and pure BEVs.

Annex provides graph summaries of potential GHG emissions reductions focusing on 3 specific sectors;

- (i) Fuel consumption
- (ii) Comparing alternative fuel vehicles with BEVs and PHEVs
- (iii) The energy mix of China’s major regional electricity production grids;

- Figure 2's *Tank-to-wheel fuel consumption* of vehicle technologies in 2035 is compared to present technology'
- Figure 3's *Well-to-wheel GHG emissions per km* from vehicles drive technologies in 2035 compared to present gasoline ICE technology'.
- Table 2's '*Electricity production from major Chinese regional grids*'. The latter, unsurprisingly reveals that while RES accounts for 1% of carbon GHG emissions, coal, on the other hand, is responsible for **97.5%** of GHG emissions.

Against the backdrop of the heavily carbon intensive GHG emissions figures, The UN report (29)) emphasizes the need for China '*to take into account Lifecycle GHG emissions; i.e. need to take action GHG emission from each stage of the energy production and use cycle, including Primary Energy Fuel Extraction and Transport, Electricity production, Electricity Transmission and Distribution, Charging Efficiency, and Battery-wheel efficiency*'.

UN team also raise the 'emission reduction potential of EVs in China; "it is essential to compare the energy consumption of EVs with the energy consumption of ICE on a fair basis, that is, *on a full fuel lifecycle emission assessment basis*."

2011 Cleaning up China's energy supply sources for PHEV vs BEV

In their conclusions they (30) focus on '*enhancing sustainability of EVs*', the report highlights, the dangers of assuming electrification of transport in itself is environmentally friendly (in terms of GHG emissions), and in particular BEVs, without also fully taking into account "the source of electricity which power them." (31).

Emphasizing the depletion of natural resources they state;

"Because of their range of impact on the environment BEVs in themselves are not necessarily a "green" technology. Rather, it is an enabler of green technologies, such as clean coal, renewable energies and lightweight materials and design. Given this context, our recommendations do not focus on electric vehicles or batteries themselves, but rather on the sources of the corresponding power generation and the "cleaning up" of the power sector."

Put even more simply, EVs, they say "*are only an energy conversion technology rather than a clean energy technology, the UN team argues for cuts in emissions, "it is essential that the energy supply for EV be cleaned up...charging schedules and linking to renewable energies are key to this strategy."*

As G. Zhou (2013) (Annex) highlights two years later, "not all provincial grids can deliver the environmental benefits that EV technology can enable." (32) Avoidance of the cities where, due to the energy mix, BEVS would increase emissions is recommended. (33). They re-emphasize, "*renewable energies are key to cleaning grids across China. In order to make electric transportation truly environmentally friendly, renewable energy should be increased in areas where EVs can take advantage of it."* (34) As the UN highlights, different regions and locations will require different solutions whether that is to tackle practicalities or climate protection.

The report ends by (i) addressing controlled charging modes for load times on the issue of how to manage spikes in electricity demand (ii) emphasizing the need to expand fuel economy standards in include EVs. (35)

Email Exchange from Leading Expert in Beijing – 14th October 2014

Writing direct from Beijing on October 14th 2014 iCET's Maya Ben Dror (36) provided the following insights on her country's latest developments on its pathway to a PEV paradigm;

"pushing industry to move quicker towards zero-emissions vehicles"

“Past policy efforts have concentrated on high figures targets and resulted in empty announcements that expressed mainly a will to do rather than concrete solutions to commercialization impediments. Today, however, vehicle electrification in China seems to be gaining more “real commercialization” momentum than ever before, shifting from “top-down” pilot programs.

Now there seems to be more hands-on industry efforts, finally going beyond big-auto players to a more diverse spectrum of players, which may really be able to one day (say after 2025) serve commercial consumers to the full extent (vehicle services, battery warranties, diverse charging solutions, diverse vehicle options, connected vehicle platform and consumer benefits). For example, China Unicom signing with Tesla on charging infra deployment collaboration, Daimler and BYD collaboration on the Danze, plans of Renault to shift their Fluence ZE production to China (possibly to the hands of their JV partners), Wangxiang's moves (e.g. AI23 acquisition), small (low-speed) EVs manufacturing boom by local independent manufacturers etc.

Policy-makers are also more creative than before, e.g. putting an end to local protectionism (favoring local auto brands), giving vehicle registration plates for low/no fee and no waiting lists/bidding required, providing funds for innovative projects and programs that go beyond auto prototype production etc.

*One program we are working on with Shenzhen municipality is evaluating the California ZEV-program for the case of Chinese cities and recommending adjustments in design for Shenzhen city. This program has arguably supported Tesla in its early years via a market-based mechanism. By shifting from government funds to government mandate with industry payments and trading system, some issues of insufficient allocation of funding could be resolved, **while pushing industry to move quicker towards zero-emissions vehicles.***

There are still some major issues, like complex and “independent” organizational structure at the government and industry levels (meant to show there is an effort rather than providing for the success of such efforts) which are not allowing for real programs to evolve and reach the market, for instance; unclear consumer preferences, parking (and charging) mass, S4 (dealerships) with no understanding/motivation to sell electric etc.

Attaching iCET's latest “brief” the following three radical new policy barrier busters to assist China's EV revolution are as follows;

Socio-Political Barriers to NEV Demand Progress: Protectionism vs Commercialization: Pushing ‘Open door’ Policy at home and abroad

Challenge: Target to sell 5 million NEVs by 2020.

Difficulty: Slow uptake in 2013 NEV sales reached only 20,000 vehicles and in the first 8 months of 2014 sales *only reached* 22.8k.

China's Central Government Solution: China has exempted NEVs from import and purchase tax as of September 2014, incentivizing purchases of well-recognized global brands by potential early adopters. The Tesla and China Unicom partnership is an example of one of these agreements.

(<http://www.reuters.com>)

Challenge: Commercialization barrier

Difficulty: Serving local brands

Solution: MIIT abolishing protectionist local NEV approval lists paving the way for the national market growth

New Infrastructure

Challenge: Consumer reluctance and triggering demand for NEVs

Solution: Deployment of new EV infrastructure and recharging points across China's cities

Phased Reduction Pathways for reducing CO₂ Emissions in China's Cities

Challenge: the need to expand fuel economy standards and make “deep cuts” in GHG emissions for Urban China

Solution (i) : An innovative market approach the Chinese government is considering is the inclusion of NEVs into China's Corporate Average Fuel Consumption (CAFC) calculations. As the "brief" reports, "This will lead to significant reductions in GHG emissions along the lines of the pre-calculated schedules 'Phased Reduction Pathways' to reducing fuel consumption and guiding China to a low-carbon automotive economy. Annex 'China 2014 Annual Corporate Average Fuel Consumption Report's China passenger Vehicle Fuel Limit and Target by Standard Phase' CAFC graph showing ICE vehicles fuel consumption reduction towards Phase IV CAFC target, should NEV production targets be met." (37)

Solution (ii): another innovative market creation method being considered by the central government and local governments is the incorporation of trading programs in regulatory requirements. As the National Energy Standardization Committee deputy has stated, "incentives and penalties should be integrated with fuel consumption management meanwhile, the CAFC credit exchange can be designed along with carbon trade mechanisms".

Maya Ben Dror's iCET is currently working with the government of Shenzhen, leading region for EV development, on suitability of California's ZEV credits scheme being adopted in Chinese cities.

Section VI cont: The Future is Now: China, Tesla Motors, Inc and ZEV regulation

"I mean, the market is like a manic depressive" - Elon Musk

As this thesis is aimed at drawing together various divergent strategic policy strands involved in the struggle to establish a PEV paradigm the case study on Tesla below has been chosen as a leading example of regulatory effectiveness in action. Lessons from which can be imported into UNFCCC 2015' Paris Summit and 'Group of Two' (three including the EU) negotiations for a new Greenhouse Gas Emissions (Management) Act "GHGEMA". By way of introduction to the international community through a sector-by-sector approach to limiting GHG emissions starting with the objective of "clean "or rather zero-emissions transportation.

Drawing on best lessons from the Californian or European Commission 20-20-20 (20% overall/10% for transport) approach to increasing the share of renewables in final energy consumption, the Proposed GHGEMA's legal framework's core objective would be (instead) to *increase the share of EV's against ICE vehicles final fuel (and energy) consumption* within which specific PEV production targets to be met. The details of the specific calculation and methodology for such an ambitious task of regulatory adaptation is out of the scope of this thesis, however, the following four notions would certainly need to be addressed;

1. Defining precisely what a 'clean' is (along tried-and-tested Swedish lines) through scientific and engineering expertise established by an independent international agency, best placed under the Permanent Secretariat of the UNFCCC. Currently, for instance, the EU so-called 'Clean/EEVs Directive' has failed to this preferring to use less interventionist 'energy efficiency' terminology. The latter has been established in The Energy Charter Treaty and remains the policy choice as they push ahead with their new vision for a new European Energy Community (EEC Part 2).
 - As the paper's of Zhou et al (38) and the UN report suggest, it appears China is in a struggle over whether to opt for a "on-grid" PHEV paradigm or BEV see Annex). Stanford's Tony Seba says the clean-disrupter's in California are pushing for more of a distributed Solar/EV paradigm. The reality is a phased approach to wean the Major Emitters off their habit of fossil-fuel dependency *and* energy use will be required. Given the special circumstances of each city and country in regard to their 'grid mix', energy security and economic priorities, as the UN Report recommends; "different regions and locations will require different solutions whether that is to tackle practicalities or climate protection."

2. A comprehensive Fuel Consumption Management Scheme should, as China is rightly pursuing, follow similar lines to China's CAFC Phased Reduction Pathways (see Annex X 'China Passenger Vehicle Fuel Limit and Target by Standard Phase).
3. Within this sub-framework of the GHGEMA, should be a ZEV emissions credits scheme along the lines explored below and now established under California's Environmental Protection Agency (Air Resources Board ("ARB") ZEV regulation mandate. In October 2013 the latter has brought 8 other US states into their ZEV 'Bold Initiative' with the goal 'to put 3.3 million zero-emissions vehicles on the roads by 2025'. The Californian's are implementing from their 2013 ZEV Action Plan spearheaded by Governor Edmund Brown (39). Needless to say, the influence of and familiarity to ZEV regulation and the concept of aspiring to zero-net emissions cities is growing fast. The City of Lancaster in CA appears likely to be first to achieve this goal. (40)
4. As explored in more detail below, the PEV paradigm's greatest protagonist's in the private sector are working closely with state-level governments to ensure economies of scale for PEVs for reasons of competition *and* climate protection. A central focus of any GHGEMA needs to be establishing the international implementation (starting with the three Major Emitters) ZEV of a GHG Emissions credits scheme which gives preferential treatment and priority to ZEV vehicles. Given the EU Internal Market FMG Treaty Rules (41) in addition to the WTO's "free-trade" rules this will be no easy legislative task. However, as set out in Annex X the principles and commitments for climate mitigation already made under international environmental (and energy) law, through UNFCCC's COP negotiations and other various multilateral agreements should suffice to establish international legal legitimacy. As highlighted by Leonardo Di Caprio and Google's Eric Schmidt at the start, citizens and consumers (with the help of NGOs and other non-state actors) could do much to speed up this process with a similar Major Emitters petition or referendum (as this is transnational climate mitigation) which proved so effective in the 2007 *Massachusetts v EPA* (42) to change US law. The latter triggered the US Supreme Court's to mandate that the EPA impose new standards and regulations by recognizing that passenger vehicles cause GHG emissions and air-pollution harm to the public health of citizens. Alongside this public interest platform, the additional, (albeit slightly less immediate risk) harm currently being caused to humanity and the environment by rising GHG emissions now needs to be included.

In addition to the need for greater 'political will' to bring a GHGEMA into force, as Tesla's CEO Elon Musk's quote highlights above, the market is proving to be the greatest battleground.

Given that Tesla is widely considered the leading pioneer of the PEV paradigm an examination of the ideal legislative environment within which its success and full potential is now being realized is therefore required.

Bringing together the two world ME's this paper draws to a close by drawing on an example of private sector transnational cooperation in action. Which cuts through conventional cynicism to demonstrate that the dual-objective of climate change protection and dynamic competition can be mutually compatible. As iCET explains, "Tesla's story, exemplified in its transparent financial reports, showcases the dependency of a new clean transportation technological manufacturer in the ZEV scheme at its early stages."

"You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete" – Buckminster Fuller

A Case Study of China-Tesla-California Expertise Exchange

A summary of Beijing's iCET's current California-China ZEV "expertise exchange" evaluation of 'California's Zero-Emissions Vehicle (ZEV) credits and trading mechanisms and its Potential Suitability for China – Credits Introduction and Tesla Case Study' 2014 report, is therefore provided as follows: (43)

The State of California (“CA”) – Implementation of its ZEV regulatory framework

One of the most polluted States with over 26 million cars and accounting for about 40% of its GHG emissions. CARB is constantly innovating legislation directed at improving the CA’s air quality. “Stringent” and “Complementary” programs include zero and low-emission vehicles development and market commercialization.

Twofold target is to (i) advancing sales of ‘non and nearly non-polluting vehicles (PHEV, EV and Hydrogen) (ii) increase vehicle fuel economy by 2025 (44)

CA’s ‘Global and Local’ Goals: new vehicles to emit 34% fewer GHGs and 75% fewer smog-forming emissions; environmentally superior cars across full range of models; consumer savings on fuel costs (45)

Legislative/Regulatory background and how the ZEV works

Low Emission Vehicle Program (“LEVP” created by CARB in 1990); aimed to achieve 80% reduction in GHG emissions from 1990 levels by 2050. Adopted as part of the latter, ZEV regulation; at its core is aims at the ‘*utilization of industry players*’ resources for advancing market development and integration of low and zero emission vehicles (PHEV and hydrogen fuel cell cars).

The ZEV regulation is a credit scheme (See Annex X ‘Figure 2.3 ‘ZEV credits program illustration’.

Section 177 Federal Clean Air Act (46) involved agreements signed between CA and other States following the pathway of the ZEV credits program; credits can be transferred or sold within a geographical area with no premium if done within the West Region Pool or the East Region Pool. (47) A credit scheme mandates that a portion of automakers vehicles sold in a state during each model year to be ZE vehicles only. Allowing automakers to earn credits, referred to as ZEV credits, if it produces and delivers for sale ZE vehicles, (48) that produce zero exhaust emissions of any criteria pollutant (or precursor pollutant) under any or all possible operational modes and conditions under the Zero Emissions Standards (49) An automaker with a surplus of credits may sell its excess credits to other automakers who can then apply these credits in order to comply with the regulatory requirements, including making up for deficits.

Advanced Clean Cars Program (2012) has 4 part pathway for these goals. (i) GHG standards for cars and light trucks, (ii) Clean Fuels Outlet; (iii) Reducing Smog-Forming emissions; (iv) Zero Emissions Vehicle (ZEV) Regulation. Latter two unique to CA but ZEV has been successfully adopted in 10 other US States (50) representing about 30% of the US vehicle market. (51)

The success of ZEV is evident in last few years through the number of clean vehicles adopted and the financial stability of innovative clean technology companies such as Tesla Motors Inc.

The ZEV regulation builds on the LEVP and is *designed to accelerate ZEV production* “to early commercial volumes, establishing sustainable and growing market for advanced technology vehicles.” ZEV contains II major steps including size determination and rules on credit use and penalties for non-compliance (52). ZEV credits regulation does *not* require all “VMs” (vehicles manufacturers) to comply. ZEV credits regulation does *not* require all “VMs” (vehicles manufacturers) to comply. (53). However, those vehicles are required are divided as “ZEV-credit categories”. (see Annex) (54). To obtain a ZEV category credit (“Gold”, pure electric vehicle), there are specified minimum sales figures for each ZEV category type. (55)

General rules governing ZEV credits program are as follows; (i) all credits produced in excess of a VMs requirements may be “banked” for future use; (ii) credits are earned from all types of vehicles (iii) credits may be traded or sold to any other party (while the price per credit is not reported); (iv) traded credits can be used the same way credits are earned from vehicles placed; there is a cap for PZEVs. These rules include transparency and disclosure rules from companies to the public on ZEV credits earned per vehicle in each year. (56)

Advanced demonstration vehicles (placed for 2 years, where 50% of time in CA) may *earn credits, and vehicles with innovative transportation systems*, such as shared-use (i.e. “car sharing schemes like Daimler’s rapidly expanding “Car2Go”) and intelligent technologies, and technologies linked to transit. (57)

Started in 2003 Tesla is one of very few global PEV companies on course to reaching market maturity and financial sufficiency. According to Elon Musk, founder and CEO, its “quest” is to accelerate the shift to a ‘PEV paradigm’ (58) by designing, manufacturing and selling innovative high-performance fully EVs and advanced vehicle powertrain components. The first company to be commercially certified to sell EVs in the US, Tesla is considered the market leader with several heavyweight automakers as investors. It started to expand outside the US in 2010. (59) As a public company it provides full transparency on all its operations (60). Its success in market penetration has followed a number of strategies including upstream production improvements (i.e. batteries).

Tesla also utilized the unique business strategy of targeting premium car consumers in the first phase followed the introduction of mass market models. (61) Focus on high-quality production has enabled them to leverage off company credibility to an ever strengthening market positioning. (See Annex X “Figure 3.2 Tesla major developments timeline (2003-2012)



The Tesla Model S, released in the Dutch market in September 2013, is the country’s top selling all-electric car.

Tesla – Clean Disrupter; Should governments decide on a standardized system to be developed around EVs and powertrain components, Tesla’s economies of scale to date is seen as both a market leading stabilizer and accelerator of market demand for further electrification of the auto market. It is also an increasing source of envy amongst its peers. (62) The key to Tesla’s business development success has been the revenue it has generated from the ZEV credits scheme. (63)

The Secrets of Tesla’ Success: the Innovative ZEV Credits Scheme Business Model

The advantage of California’s ZEV approach lies in its integrated methodology for addressing both criteria pollution and GHG emissions, while allowing ZEV credits trading in a pre-defined market place. *Through credits trading early stage zero and near-zero emission vehicle companies are funded* and all automakers are provided with an added incentive to develop ever-cleaner vehicles and related technologies.

Tesla Motors has earned revenue from the sale of ZEV credits of about \$245M over 5.5 years (accounting for 27% of its profits to date), enabling it to reach market maturity in the cash-strapped new energy vehicle industry that have typically diminished PEV players elsewhere (e.g. Coda, Better Place etc). (64)

ww In order to allow for its initial and increasingly expensive design, development, procurement, and sales Tesla relied on receiving pre-announced ZEV credits, sales of its electric power-train components, the financial market (since 2008) as well as pre-orders and down payments. The impact of changes in sales of regulatory credits were recognized as one of importance at its development stages.

The revenue from credits in 2008 has enabled the company to engage in powertrain deliveries to mature and leading auto manufacturers, starting off from Daimler with actual shipments of batteries and chargers commencing early 2010, furthering to its ongoing commitments to other manufacturers and contributing to its global expansion capacity.

ZEV credits impact on Tesla's gross margin is significant, enabling the company to reach a whopping margin of 25% in the last quarter of 2013, overtaking Ford's 15.5% and General Motor's 12% gross profit margin. The ZEV credits accounted for up to 125% of the company's gross revenue over the past five years. As gross margin is often used by analysts from the financial market, the ZEV-credits arguably made important contribution to the company's stock valuation and subsequently influenced its liquidity. (64)

Answering The ZEV Critics:

There has been controversy over Tesla's high market valuation and its dependency on government credits (ZEV, GHG, CAFÉ). (65) One clear shortfall of the ZEV program's scope lies in its neglect of low-emissions infrastructure and components players.

CARB claims California's ZEV regulation has contributed to California's emission reduction goals by spurring significant commercial integration of mainly near-zero emission vehicles. Today, nearly 2 million Californians are driving partial zero and advanced technology partial zero vehicles (PZEV and ATPZEV) with near-zero tailpipe emissions and some 80% cleaner exhausts than average 2002 model car year. All VM's are currently in compliance with the program. (66)

While automakers can enjoy the fruit of the program during their seed period, other complementary players that have a significant influence on market demand and uptake are excluded from this scheme. (67) Lack of support in the complete zero-emissions car ecosystem may result in delays in mass-market integration of zero-emissions vehicles.

Study Outcomes – Assessment of the Credits Scheme Suitability for China

- Tesla's story showcases the amount of fees that should have been injected into such a business entity either privately or through government in the absence of such a mechanism.
- Central advantage of CA's ZEV approach lies in its integrated methodology for addressing both criteria pollution (and GHG emissions), while allowing ZEV credits trading in a pre-defined market place. Additionally, its potential empowering of China's own clean disrupters especially those non-state-owned strongly funded actors who struggle to receive capital flow. (68)
- ZEV credits program. ZEV credits program is a well-demonstrated regulatory framework capable of accelerating innovations primarily through market sources. However, these impressive results may be result of CA's unique characteristics (innovation hub, comprehensive regulatory framework, amount of early adopters) (69). A multi-stakeholder collaboration between China's pilot cities is needed to enable in-depth understanding of how a China-tailored program could come to fruition.

Disadvantages

- Central disadvantage of CA' ZEV approach lies in its neglect of low-emissions infrastructure and component players.

- Lack of support in the *complete* zero-emissions car ecosystem may result in delays of mass-market integration of zero-emission vehicles

Lessons for China – Climate Mitigation

- China government's has shown extensive support for climate mitigation efforts to date (70) including ambitious energy consumption reduction policies and large-scale funding of New Energy Vehicles and related infrastructure There are 25 pilot cities for NEV incorporation in city planning and a trajectory has been set for further energy saving and new energy vehicles institutional/infrastructure frameworks development. To implement ZEV credit schemes in China's cities need to be carefully selected for their readiness, institutional feasibility, government proactive collaboration and potential linkage to broader areas and sectors. (71)
- Accelerated action is required. 50% of city center air pollution and over 25% of GHG emissions, comes from China's petroleum-based transportation system, its global production and sales is growing rapidly. This is against the global goal of reducing petroleum consumption by 50-80% by 2050, however, China's vehicle fuel consumption is steeply increasing. Air pollution in China's major cities is deteriorating fast causing hazardous public health and social unrest.
- Realizing the important role market-based mechanism play in transition to a low-carbon economy, from 2013-2014 China's major cities; Beijing, Shenzhen and Shanghai have launched carbon emission trading schemes to replicate the success in California. These pilot schemes are to test innovative trading approaches and multi-disciplinary participation aimed at carbon efficiency and improved air quality.
- More aggressive, comprehensive and innovative approaches are needed including (i) multi-stakeholder working together (non government dependent) to mitigate chronic city-based air pollution (i) incentivizing consumption through end user subsidies. (72)

Section VII: Conclusion: A New international agreement; Greenhouse Gas Emissions Act

For a timely transition to low-carbon, sustainable transportation, other complimentary policies for new forms of energy and new vehicles are needed, coupled with innovative business models and coordinated investment actions. Overcoming the many start-up barriers, market failures, and market conditions inhibiting innovations and investments is one of the grand challenges facing our generation.

- Sonia Yeh, Daniel Sperling - University of California, Davis CA

The complex, comprehensive and multidisciplinary nature of climate mitigation law as an approach to address the challenge of averting 2C° cannot be overstated. Nor can the small matter of the existence of humanity itself.

As DeCicco says, "climate policies depend on domestic and international political considerations as well the mitigation needs implied by climate science." To meet the challenge he offers the following three suggestions from an energy and scientific perspective:

1. The importance of limiting the net GHG emissions of the fuel supply system should be considered in two ways. First, "concentrating on the use of alternative fuels does not limit GHG emissions from their supply systems". Second, "addressing fuel system GHG impacts does not necessitate alternative fuels i.e. different end-use energy carriers for vehicles". i.e. what really matters is the GHG impacts not only of the emissions from the vehicles themselves but also all the "upstream" energy sources supplying them. This applies equally to PEVs as it does to ICEVs. He continues, "the true urgent need is to start controlling emissions in energy sectors". Success in this endeavor is prerequisite for any AFV (including PEVs) to have significant climate benefits. It is also consistent with the need to focus on locations of actual GHG sources and sinks."
2. The need to address the 'overwhelming uncertainties' and adapt LCA from a mere 'value choice' to being on a solid scientific basis. Adding, "efforts to deeply reduce auto-related GHG

emissions need not be held hostage to AFV strategies and their associated transition barriers such as infrastructure needs, cost hurdles and customer acceptance challenges.”

3. Given the overwhelming dominance of liquid hydrocarbons (oil and gas), the most timely steps will entail GHG management for the petroleum sector. The development of robust GHG tracking protocols for managing and offsetting the large flows of carbon through this system is imperative.

Meanwhile providing a climate mitigation and law critique, Mehling and Frenkil highlight the barriers for “green” energy uptake associated with the US’ Renewable Portfolio Standards. “Although over half the US State governments have adopted some form of RPS (73), in contrast, the US Federal Government has not been able to establish a similar policy, despite repeated attempts to do so (see Annex Section IV: A Descriptive overview EU, China, US; barriers and breakthroughs). Inconsistencies in REC programs (74) leave the system open to fraud an error. Additionally, the non-standardization of RPS obligations, rules and regulations in the utilities industry leaves the system open to discrimination and a non-level playing field environment. Echoing Tony Seba, they conclude, “*The US needs to provide equal opportunities in the energy sector for distributed renewable energy producers alongside traditional utility sector players. The utility industry is resistant to being accountable to a Federal-wide RPS Program. The power of the utility lobby is only increasing as they continue to consolidate...heightening cost, CO emissions and consumer dependency*”. (75)

To clear the pathway to clean transportation and an ideal PEV paradigm, therefore, comes down to multiplicity of actions that need to take place. As The King Review rightly concludes only zero emissions technologies and vehicles should prevail. Given the variety of stakeholders involved, ranging from ICT, renewable energy, conventional industries, automakers and financiers, rather than a single innovation dominating, the paradigm shift will emerge due to a critical mass of clean disrupters and “innovation clusters” (76) converging and combining their efforts. At Steinhilber says, the electrification of road transport will not emerge from one lead market, if one country leads in high-performance batteries, another could lead in smart load management or integrated mobility concepts. (77) .

This author identifies three ways to progress the Zero-Emissions environment.

1. Advancing PEV technology in all ways described in this paper in addition to pushing out all new ICEVs by 2020 with a phased plan to recycle and waste management all the world’s obsolete fleet. With all hybrids still relying on any fuel being redefined as an ICEV.
2. Enable an ideal regulatory environment for innovative business models to breakthrough and become mainstream i.e. provide them with a level playing field across the automotive and energy sectors.
3. Create radically transformative regulatory regimes to accelerate the “deep cuts” in GHG emissions required. This involves three major phased pathways ; (i) phase out fossil fuel based subsidies from the automotive and energy sector within by 2025 and create a total level paying field for the renewable energy sector with immediate effect. (ii) exclude alternative fuels from the definition of “clean” technologies unless generated by renewable energy sources or electricity sourced from RES; excluding them from all electricity generation supply by 2030, by which time according to Seba their business models will have become obsolete in any event.

Next Steps

As for a new international agreement the recommendation of a Greenhouse Gas Emissions Management Act has been made. According to Mehling there are six secrets to its success; (i) all major current and future emitters are participants (ii) it is able to ensure transparency procedurally and regard emissions (iii) it can facilitate agreement on mitigation (from commitments, pledges to compliance) (iv) it has sufficient resources, time and expertise to navigate the complexity (v) it form political will to act swiftly to achieve 2C° goal (vi) it reaches a common vision on how this should be achieved. Added to this should be the vision should contain the highest level of legitimacy and effectiveness possible. As time is not a luxury the

world can afford, taking the shortest possible pathway to Mehling's idea of an agreement, 'relying on an even more limited group of countries...highly influential...could have the necessary political spillover effects. For example, if cooperation between China and the US were to solidify...any agreement by these two powerful nations to meet the mitigation challenge might be able to trigger a landslide within the broader international community." The one inescapable barrier is the incumbent and powerful old energy and automotive players and the perpetuation of "propping up the polluters". A wall of resistance which has to be brought down.

China is ahead of the game and totally focused on turning their current crisis into an opportunity for dynamic competition. The centralized nature of their political system and sheer scale of their investments in infrastructure and EVs in their latest Five Year Plan suggests they will get closer to the PEV targets faster than their US or EU counterparts. They are also less likely to get distracted by policy ambitions like the EEC or IEM with its carbon-intensive 'Alternative Fuels Infrastructure' policy. As for the US, the EPA and the NHTSA currently have 2025 earmarked as the first year "upstream" fuel emissions will be taken into account. Given the pace the Chinese are going, the US legislative may have no choice other than to drastically bring their timetable forward. After decades of resistance, the time has come for the US to embrace a leadership role and to take concrete action on climate action and enforcement not only for the sake of its citizens but also for the planet. As Abraham Lincoln famously stated in his Gettysburg address; "The government of the people, by the people, for the people, shall not perish from the Earth."

This is dedicated to my children and their future generations and all the creatures of our planet.
Totus Tuus