Keynote presentation: Summary for JM Network Website (to be posted on JM Network website, pending speaker/author review)

R. Andreas Kraemer, **"From Two Hemispheres to One Basin: The Co-Transformation of Energy and Transport in the Wider Atlantic," The Atlantic Basin context for energy, transportation and climate change**

Mr. Kraemer began by positing three interrelated hypotheses:

(1) the 'pan-Atlantic' (or Atlantic Basin, or wider Atlantic) is a 'bio-physical reality, not just an abstraction of international relations';
(2) the 'pan-Atlantic' is a "meaningful space for diplomacy, cooperation, policy coordination and joint governance"; and
(3) the 'pan-Atlantic' is a "useful unit of analysis" both for the energy and transport transformations currently underway and with respect to their consequences for trade and security.

The Atlantic Basin should be seen as a reality distinct from the 'world ocean.' This is because of a number of distinguishing 'Atlantic' features. First, the Atlantic Basin is hydrologically 'semi-enclosed.' It is not as wide, or as open to the world seas, as are the other ocean basins (the Pacific, the Indian and the Southern Ocean), and it is characterized by a distinctive, letter-S-like shape and has a number of features in water quality, sediment etc. that set it apart from other seas. Furthermore, the main hydrological movements are 'intra-basin.' The Atlantic Meridional Overturning Circulation (AMOC) moves within the North Atlantic. There is also a strong, deep north-to-south cold water flow (with oxygenated water and deep Calcium compensation). Finally, there is the North Atlantic Oscillation (NAO) which circulates between the Azores and Iceland.

In addition, the Atlantic is a cultural and societal 'connector' of peoples and countries around its 'basin,' and has been at least for the last millennium but probably much earlier. For Kraemer, the pan-Atlantic is now bound together, as a distinctly identifiable socio-political space, by its common lifestyles and by the Atlantic Basin's unique climate change dynamics. This is because climate change is primarily caused by an 'Atlantic Lifestyle' --characterized by similar production and consumption patterns -- which has diffused across the basin, and even beyond. The world's "dominant and unbroken fossil energy systems" have their origins within the Atlantic Basin, along with their home bases. The Atlantic is also highly interconnected through significant 'intra-basin trade' in energy, technology and carriers.

On the other hand, the "Atlantic Nations" are also leaders in climate policy and renewable energy (although this leadership is now being contested in Asia). Nevertheless, the Atlantic is home to both the "worst (climate) offenders" (in the North) and the "most vulnerable victims" of climate change (on Africa). Climate change could negatively impact the unique hydrological circulations and oscillations of the Atlantic Basin. For example, the Atlantic 'gulfstream' warms Northern Europe, but a large ice mass on Greenland is now melting, potentially threatening the uniquely Atlantic, climate-moderating effect of this gulf stream upon northern Europe. Sea level rise also threatens the Atlantic's highly productive coastal and delta ecosystems (Chesapeake Bay being perhaps the world's most productive). In addition, the wider Atlantic is characterized by significant 'intra-basin migrations' of a number of species of whales, fish, sea mammals, turtles, etc., which would be compromised by such warming-induced

ecological impacts. The Atlantic Ocean may also become more open to Arctic as the sea levels rise and terrestrial features are effaced by water under the impacts of coastal flooding and rivers backing up.

The energy transformation in the Atlantic Basin

The costs for renewable energy are now at or below 'parity' with fossil and nuclear energies. Indeed, across a widening space within the Atlantic Basin, REs are now competing – and increasingly without subsidies – with heavily *subsidized* and *privileged* fossil and nuclear energy. The costs of REs, together with those of storage and smart energy systems, continue to decline. The energy transformation now underway is "self-sustaining, self-accelerating and self-replicating." As a result, it is unstoppable – coal, oil and methane gas are on their way out, in that order.

A residual energy share for nuclear power might survive (with economic 'ring-fencing'), thereby helping to sustain a military technological base that is devoid of energy-economic justification and will need to be sheltered from markets forces, liability and other economic realities. Overall, however, the temporary fossil and nuclear energies that characterized the age of industrialization will yield to the new, green energy systems using traditional energy sources like water and wind. These new energy systems will also be 'Atlantic' in character. As a consequence, by 2050, international fossil energy commodity trade will likely have ceased, thus lifting the 'resource curse' out of its one-time structural central dynamic role in global political economy. On the other hand, the new energy systems will increasingly harvest ubiquitous and free environmental flows, and will do so with increasingly low-cost technologies that lend themselves to small-scale investment in micro-grid and off the grid. Rural electrification in grid-less Africa, and 'grid defection' in the industrialized countries of the North are different phenomena of the same underlying technological and economic trends.

While those underlying trends apply throughout the Atlantic Basin, the energy status, regional development trends and outlook is somewhat different on the four continents around the basin, as is shown in this table:

An Energy Overview of the Atlantic Basin

Overview of Energy Status, Trends and Outlook around the Atlantic Space

North America	**Europe**
Status: Very high energy consumption; Largely grid-supplied (110V, 60Hz), weak interconnections, many distribution lines over-ground and vulnerable; Mid-level supply security; High levels of renewable energy (including wood for heating); An innovator and technology supplier with the power (by business but also government) to direct technology development and make informed technology choices. **Trend:** Nuclear down, coal out, oil declining, fossil methane gas holding up (for a while); Renewables up, especially solar and onshore wind, driven by states and municipalities;	**Status:** High energy consumption; Largely grid-supplied (220V, 50Hz), strong interconnections, most distribution lines underground and safe; High supply security; High and rising levels of renewables, with variations; The region is an innovator and technology supplier with largely governmental power to direct technology development and make informed technology choices; **Trend:** Nuclear down and out everywhere except France, Russia and UK; Coal out, oil and fossil methane gas declining (except in Russia);

Grid defection in some areas; Growth of smart-energy applications and business models. **Outlook:** Accelerating green power shift, with rear-guard action by powerful coal lobby and nuclear military-industrial complex; Disruption by technical, material and business model innovation in political environments ranging from conservative-to-reactionary (in the US) to fossil-friendly liberal (in Canada).	Renewables up, especially onshore but also off-shore wind and solar; Even more interconnections, including with North Africa; Growth of renewable technologies. **Outlook:** Continuing green power shift, spreading to the East and South-East; rear-guard action by retrograde regimes in some countries (e.g. Poland, potentially Germany), disruption is partly policy induced.
South America **Status:** Mid-level energy consumption (with great variation); Mix of grid-supplied areas and off-grid or micro-grids weak interconnections, many distributions lines over-ground and vulnerable; Mid- to low levels of supply security; Partly caught up in unreformed corporatism (and collateral corruption, e.g. Brazil, Mexico); Venezuela as first petro-state in full collapse; The region has a weak innovation system (with Brazil being a possible exception) and is generally a technology follower with the power to chose. **Trend:** No entry or growth for nuclear; Persistence of fossil structures in corporatist utilities, but autonomous electrification in unserved or underserved areas based on renewables (mainly solar); Persistence of sugar-cane-to-alcohol in car engines in Brazil. **Outlook:** Falling cost of renewables will shift private investment their way, including LVDC systems; Potential for conflict with incumbent utilities (and the unions or other political factions behind them); Utility-scale renewables may accelerate in some areas.	**Africa** **Status:** Low energy consumption; Large areas unserved, weak or non-existent interconnections, mostly no distribution lines; No supply security; The region can innovate in business models but is a technology taker without the power to choose in all other respects; Political power (and corruption) often trumps economic sense. **Trend:** Patchy growth of utility-scale renewable energy in some countries (e.g. Morocco) but futile focus on coal in others (e.g. South Africa); Some interest in nuclear, driven by corruption (e.g. South Africa). **Outlook:** No entry or growth of nuclear; Stagnation in areas already served by grids, due to political and economic power of incumbent utilities and associated interests; First access to modern energy accelerating in areas not served by a grid, based on increasingly inexpensive, smart low-voltage direct-current energy systems; Potential conflict over energy supply visions (e.g. Tanzania, where kerosene lobby fights solar power).

Source: own elaboration.

The transportation transformation in the Atlantic

The automobile industry is on the cusp of a radical transformation which will be based on electrification, with pure electric vehicles dominating the passenger transportation matrix, along with some hybrid vehicles. Self-charging at home will increasingly become a structurally dominant behavior mode, starting in the Northern Atlantic, alongside of an expanding platform and sharing economy. This will produce more miles per car, with fewer cars needed for each unit of transport demand. Autonomous Driving and other cross-functionalities with internet and cyberspace will increasingly favor electric cars. As a result,

future vehicles will be simpler and much cheaper to build (with no after-sales). Indeed, total cost of ownership of a Tesla Model S is now already below that of rivals.

Public and commercial freight transport is on similar trajectory. New fuels and drive/propulsion technologies are also increasingly available for railroads, ships and aircraft. This all started in the Atlantic (well, California), but such leadership may be lost to Asia-Pacific (mainly China, but also Japan, South Korea and Taiwan). Nevertheless, most innovation is undertaken by 'new entrants,' while the disruption of the incumbents is also an Atlantic trait.

Finally, new materials will be required by new transportation modes and technologies. New resource trade routes will be born with a reduction in overall trade a distinct possibility (see below).

Common intersections of the energy and transportation transformations in the Atlantic

Economics Is on the side of these parallel transformations, but fossil subsidies (although declining in recent years) continue to be arrayed against them. Both transformations have strong environmental and social value propositions, although new policy is required to make such propositions reality.

The learning curve in technology is steep; new raw materials will be demanded of new areas. Demand for oil, steel and welding is weakening, but demand for carbon fibers and plastics (including adhesives) are up. Furthermore, such a curve is self-accelerating and disruptive to incumbents. In addition, a focus is now emerging on cheap and efficient low-voltage direct current (LVDC) systems that help integrate the mobility sector with the power sector and home energy management.

The energy and transportation transformations are mutually reinforcing. More EVs connected to the grid for charging also means more storage capacity on balance, allowing the grid to incorporate high levels RE electricity more readily and reliably. On the other hand, a higher penetration rate of REs in the generation mix will lead to a smaller carbon footprint from 'mobility.'

Given that new systems will provide a range of services far beyond that possible under the old fossil energy system, this co-transformation will extend to buildings (including the use of solar roof tiles).

Broad economic, trade and security implications

The energy and transportation co-transformation will lead to shifts in trade flows and volumes. Trade in energy (for consumption) will be displaced by trade in equipment (for the 'harvesting' of ubiquitous, free environmental flows). Current patterns of mining and metals trade will give way to a wider range of elements: demand for non-ferrous metals, metalloids and rare earth elements will continue to rise; demand for trade in ferrous metals, on the other hand, will remain flat or even decline.

Overall, this co-transformation will be accompanied by a decline in the trade of fossil energy commodities, in both value and volume. At the same time, the revenues of petro-states will collapse (see Venezuela), as new business opportunities will not compensate for this. On the other hand, the total cost and capital needs for energy and transportation will fall, while the services provided expand and the related environmental and social values will rise. Still such transformations, along with their co-benefits, will not appear as positive as they actually are when viewed and misinterpreted through the prism of fossil-generated economic growth, and the outdated statistics of GDP and trade.

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