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How Can We Carry Out Green Incentives Most Efficiently?

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***Abstract*—**Green incentives are included in the "American Recovery and Reinvestment Act of 2009" (ARRA). It is, however, unclear how these government incentives can be carried out most effectively according to market-based principles and if they can serve as a catalyst for an accelerated green transformation and an ultimate solution to the current U.S. and global economic and financial crisis. The article will compare the existing U.S. green economic policies with those in Germany, identify problems, and suggest improvements to allow the green stimulus incentives to achieve the best results in the process of an accelerated green transformation. The author argues that the current U.S. green stimulus incentives can only be most successful if they are carried out as part of a visionary, comprehensive, long-term, and consistent strategy of the green economic transformation.

***Keywords*—**Green incentives, financial crisis, green economy, renewable energy sources, energy efficiency.

I. Introduction

ALTHOUGH the "American Recovery and Reinvestment Act of 2009" sets out the investment of fifteen billion dollars a year to develop technologies like wind power, solar power, advanced biofuels, clean coal, and more fuel-efficient cars and trucks [1], there is far from clear how this green investment can be less bureaucratic and more market-based and effective.

Doubts about the successful implementation of this green investment package include the following: What kind of role should the government play in such a transition and should it really play such a role? How can the green incentives be really market-oriented solutions? What are the most cost effective market incentives? This paper will explore changes needed to ensure the effective implementation of the green stimulus program by examining the recent German experience with a Government-sponsored transition to a greener energy and economic structure, which contributed to export and job growth in the German economy.

In regard to the government's role in this green transition, the author argues that it should function as a legislative and regulatory designer of the green transformation using more effective market incentives. To answer the question if the green transition is indeed a market-oriented solution, the author propose that using government funds as transformative market incentives for greener production and consumption is much more market oriented and effective than using these funds as mere bailouts for the ailing industries. In terms of the measurement for effectiveness of market incentives, the author argues that they must allow market competition for all businesses, small and large, and be most cost effective and least bureaucratic.

The remainder of this article will be organized as follows. Section II discusses the economic solutions in a global perspective. Here, the author suggests a green economic strategy and necessary changes to solve the structural problems of the U.S. economy. The author postulates that such a structural predicament can ultimately only be cured by a comprehensive visionary economic strategy of the U.S. Government. The author will support this claim by examining the recent German experience with a government-sponsored transition to a greener energy and economic structure, which contributed to export and job growth in the German economy. Section III explores green economic strategies and necessary changes to solve the structural problems of the U.S. economy. Here the author compares the U.S. green policies with those in the Germany to show that long-term and consistent market-based policies can achieve better results.

II. Managing Environmental and Climate Issues in a Global Perspective

In today's increasingly integrated world economy, pollution and environmental degradation in individual countries and regions are no longer merely issues with limited local and regional impacts. The worldwide economic integration is also globalizing its impact on the environment and sustainability of our planet.

It is therefore important to manage environmental and climate issues beyond a national perspective. For developed economies such as the U.S. and the EU, this means that it does not suffice to contain and reduce pollution and CO_2 within national borders. It also must prevent outsourcing pollution and CO_2 to developing economies. Greening out these problems to developing countries instead of greening up will further weaken the U.S. companies in international competition. In addition, it will proliferate environmental and climate problems worldwide, instead of solving them.

On the other hand, developed economies possess more economic, financial and human capital power than the developing economies to conduct the R&D of renewable energy technologies, they are more capable of tackling

pollution and sustainability issues by taking the lead in greening up by pioneering in a green economic revolution.

As matter of fact, taking the lead in the green economy is not just doing a favor to the developing nations, but rather benefits the developed economies as well. Greening up instead of dodging environmental and climate regulations by greening out is a rational strategy in line with the inevitable structural change. It will transform the U.S. economy and yield long-term positive economic results for the U.S. economy and the global economy.

III. "Green Economic Strategy": Changes Needed to Solve the Structural Problems of the U.S. Economy

A "green economic strategy" can revive and energize the U.S. economy and refocus it towards investments in clean renewable energy technologies, green and energy efficient products, and natural infrastructure such as forests and soils. It will therefore combat environmental degradation and climate change, and promote real economic growth and upgraded employment boom in the near future.

Needless to point out, the current U.S. and world financial crisis has brought about significant difficulties for the transition to a greener economy. Not only have the suddenly evaporating financial markets an adverse impact on the R&D of RES, the drastic reduction in the oil price as a result of the financial crisis and the subsequent economic contraction has also reduced the comparative cost advantage of the emerging green energy sector and therefore caused its slowdown [2][3]. This situation has forced investors and entrepreneurs to reassess funding this sector, for fear of another false start similar to the setback in the early 1980s.

Moreover, in the current economic downturn, it is easy for the U.S. Government to make the mistake to merely focus on short-term remedies to rescue troubled companies and to get out of the immediate economic and financial crisis without acting on a fundamentally different long-term economic strategy for a green economy. Such a short-sighted economic policy plus the reduced oil price might well help the existing carbon-based U.S. economy and the global economy survive the current financial crisis and return to business as usual. However, this will prevent the U.S. economy from a strategic transition from further deteriorating competitiveness and vitality to a greener economic future.

The UNEP initiative, which focuses on a greener economy, includes promotion of clean energy and technologies; renewable rural energy; sustainable agriculture; ecosystem infrastructure; sustainable cities and initiatives to reduce emissions from deforestation [4], has mapped out what the U.S. Government has to do in its economic stimulus project.

The green economy based on such an economic strategy can mobilize the historical transition from a carbon-based economy to a green, clean, and efficient economy. Such an economic strategy will not only help solve the current financial and economic downfall, but also ensure sustained, real economic growth. This is because it will help create much needed products, sustainability, and green jobs for consumers, and real market opportunities and healthy returns for companies. To accomplish this, the U.S. must take following more significant legislative and reform steps.

First, the U.S. lawmakers must review the nation's "inconsistent, incremental, and inadequate" energy policy [5] and work out consistent, transformative, and strategic energy policies with mandatory federal targets for renewable energy production to replace fossil fuels. In contrast to at least 66 countries, including 27 EU countries (see Fig. 1), that have some type of renewable energy policy targets, the U.S. does not have a national target although 29 states in the U.S. have similar targets [6].

Similar targets and mandates include land-use policies, building codes, and energy-efficiency standards (for appliances, vehicles, etc.). Setting such targets and mandates can significantly improve the international image of the U.S. Government as the leader of the world's number one economy in the transition to a greener economy. It can also create real economic and ecological benefits for the U.S. economy. These regulatory tools can facilitate in conjunction with related market incentives an accelerated transition to greener energy structure, technologies, products, and services, and thus expand sustainable green job markets.

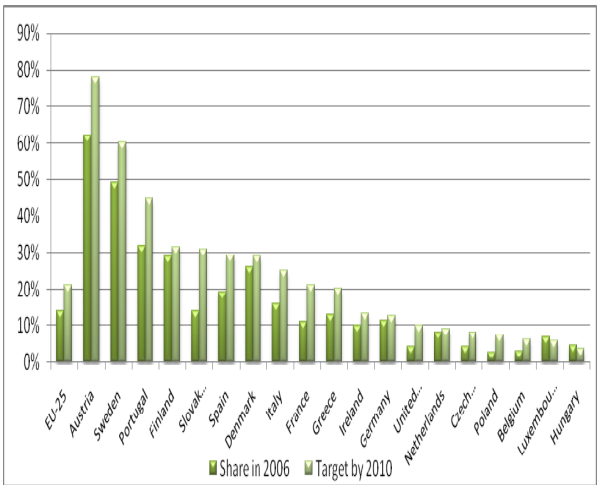

Fig. 1 Renewable Targets in Selected EU Countries [6][7]

Second, the U.S. needs to pass tax reform and green energy bills similar to Germany's econ tax reform and "Renewable Energy Act" to provide market incentives for RES. President Obama's green economic package includes $15 billion annual funding for R&D of renewable and clean energy sources and creating green jobs by such green energy investment and high fuel efficient cars, as well as implementing an economy-wide cap-and-trade program to reduce greenhouse gas emissions [3]. Such a green plan signals an important move towards a green transformation. However, a more comprehensive and more coordinated legal and financial mechanism of subsidizing the R&D of renewable energy sector by eco-taxes on fossil fuels is needed to send stronger and unmistakable

market signals to businesses for an accelerated transition to a greener and more sustainable economy.

Although it is a tough sell in the current economic downturn, an eco tax reform putting a price on greenhouse gases like carbon dioxide, thus raising the price of fossil fuel consumption, is the most effective policy. In conjunction with price subsidies for the renewable energy, the eco tax will push the U.S. economy to transform toward a clean, efficient energy future. In addition to discouraging polluting and carbon-intensive economic activities, eco tax revenues can also be used to finance the transition to RES.

The German Government has a consistent legal and incentive-based RES system to promote the replacement of the existing carbon-based energy structure. On the one hand, Germany underwent an eco tax reform to tax fossil fuels ("bads"). On the other, it introduced "Grid Feed-In Law for RES" in 1991 and updated it to "Renewable Energy Act" in 2000 to subsidize RES ("goods"). This foresighted legal framework ensured the increased investment in RES installations in Germany [8].

The core of the German EEG is to ensure renewable generators a differentiated, guaranteed, yet regressive "premium" or "over market" price, which will phase out in 30 years for hydropower and 20 years for all other RES [3]. This means, a renewable generator will receive a guaranteed payment, which will reduce by 0 to 6.5 percent depending on technologies every year so that a generator beginning operation in 2009 will receive a higher payment than a generator beginning operation in 2010.

This design is intended to encourage cost reductions based on improved efficiencies from economies of scale over time. The EEG also differentiates between technologies such that each RES receives a different payment guaranteed price according to its generation cost, ranging from 3.58 - 9.67 €-Cents per kilowatt-hour for hydropower to 35.49 – 51.7 €-Cents per kilowatt-hour for solar power [9][10].

The grid feed-in tariffs provide incentives to every company involved in renewable energy business, especially the small and medium-sized energy firms, to invest in developing and generating RES, decrease initial market entry barrier for these businesses, and reduce the costs of RES for production and consumption over a period of time. Various studies reveal that the feed-in tariff is more cost effective and less bureaucratic than other support schemes such as investment or production tax credits, quota based renewable portfolio standards and auction mechanisms because it provides financial certainty. Also, it generates more competition, more jobs and more rapid deployment for manufacturing, and does not pick technological winners [11][12][13][14].

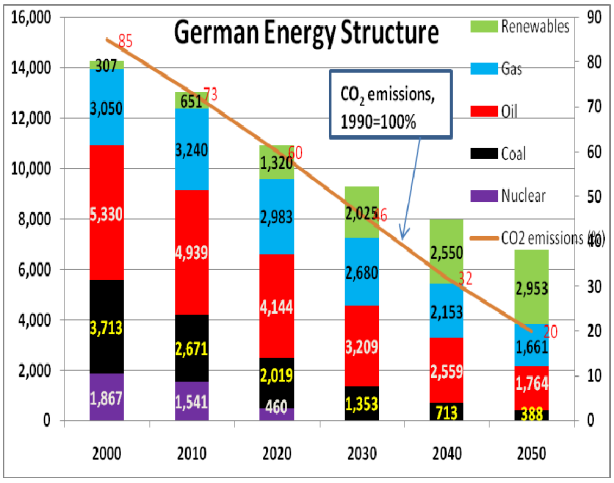

Fig. 2 German Energy Structure – Current and Outlook [14]

Fig. 2 presents the existing and projected results of the implementation of the German EEG. Germany's eco tax reform and renewable energy policy achieved remarkable positive results. Its eco tax reform demonstrated a clear success in reducing its oil dependency, and its renewable energy policy facilitated the takeoff of its renewable energy sector. Before Germany introduced its market incentive program for RES and the related grid feed-in method in 1991, the annual installations of RES were considerably below those in the U.S. Since then, however, the installed capacity of German RES has increased steadily, and accelerated after the updated EEG started being implemented in 2000.

The share of electricity generated from RES in Germany rose from 6.3 percent in 2000 to over 14 percent in 2007. The capacity of RES reached more than $11.31 billion in 2006 alone [14]. The German EEG market incentives, which are financed by revenues from eco-tax, reduced the costs of RES over time. By 2015, the price of wind power will be cheaper than fossil fuel generated power. Now, Germany takes the lead in RES and sets a 45 percent target by 2050. At the same time, its CO_2 emissions will decrease from its current 80 percent to 20 percent of the 1990 level (Fig. 2).

The progressive German energy policy represented by its EEG has proved superior to the U.S. carbon-based energy policy. Under the motto, "expanding the export and ensuring the future." The German EEG has promoted the R&D of RES through subsidies funded by revenues from the eco tax reform. As a result, Germany now has the largest solar PV market and the second largest installed wind power capacity in the world, and the largest solar thermal market in Europe. Its leadership in the world in solar energy production is an incredible success for Germany with heavy clouds covering during 60 percent of daylight hours. In addition, Germany also reduced its energy consumption and import. For example, Germany reduced its oil imports by 23 percent in 2007compared with 1998 [15], whereas the U.S. increased its oil imports by 15 percent [16]. In addition, the German energy policy innovation also proved to be a particularly important

stimulus for environmental innovations of the German manufacturing, especially the automotive sector [17].

Certainly the U.S. wind power energy also experienced a significant expansion during the last two years as a combined result of market response to oil price surge and government incentives for renewable energy; the U.S. even overtook Germany as the number one wind power operator in cumulative wind power capacity in 2008 (Fig. 3). However, the U.S. needs to more strategically transform and upgrade its energy structure and products. The lack of a renewable energy policy that resembles the German feed-in policy and related government incentives has prevented corporate America from more fully embracing the drive to meet the structural and environmental challenges and correct the market failure by strategically transforming the existing carbon-based economy to a greener economy.

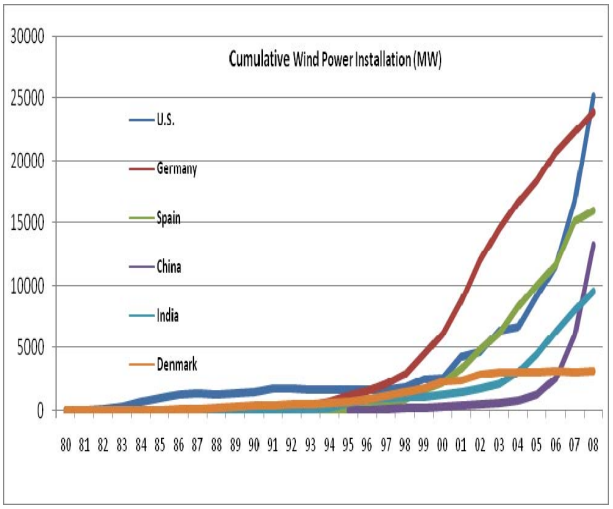

Fig. 3 Cumulative Wind Power Capacity [7][18][19][20][21][22] [23]

Although the feed-in tariffs are government subsidies, they are different from direct government intervention such as direct tax credit of investment in businesses because the former credits the output and the latter credits the input. The output-based green stimulus plan from Uncle Sam can avoid the dangers feared by many that a) investments could be steered to the wrong technologies, b) inventions supported by such government credit could be manufactured abroad because of the U.S. manufacturers' "second-tier player" position in renewable energy technology such as solar energy [3], or c) only big companies or technology winners that are already relative manure, e.g., wind power versus solar PV, would be rewarded. Fig. 4 shows that the differentiated feed-in tariffs allowed Germany to grow its solar power installation much more aggressively than any other country.

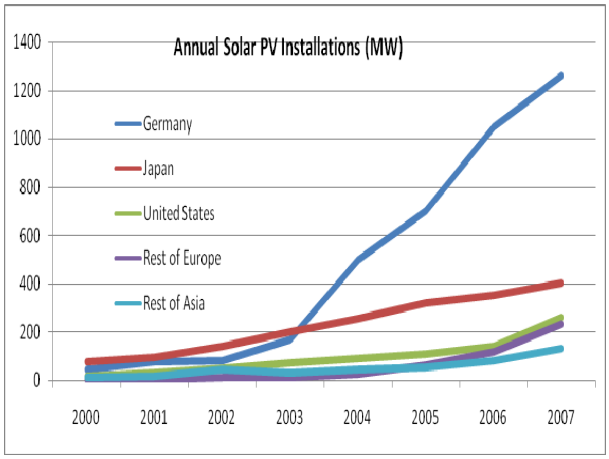

Fig. 4 Annual Solar PV Installations [24]

Indeed, the feed-in tariffs can send the intended market signal to businesses to correct the market failure in developing the green economy. These market incentives will mobilize the market forces to increase green, clean energy. It will encourage the corporate America to stop greening out and start greening up and the advanced foreign renewable businesses to "green in," i.e., invest in and produce RES and more energy-efficient products in the U.S.

It is foreseeable that policy innovations emulating the German grid feed-in tariffs and their possible future evolution [25] will provide investors and entrepreneurs with necessary market incentives for a new green revolution that creates new jobs and international competitiveness in the U.S. Such a vision seems warranted by the Germany experience with RES. The German renewable market incentives helped employ 250,000 jobs in Germany, especially in small and medium sized companies in 2007 (Fig. 5) and expected to help employ more than 400,000 by 2030 [26]. In addition to these benefits to the German economy, the environmental benefits (external, environmental costs avoided) alone already outweigh the costs of government incentives [27].

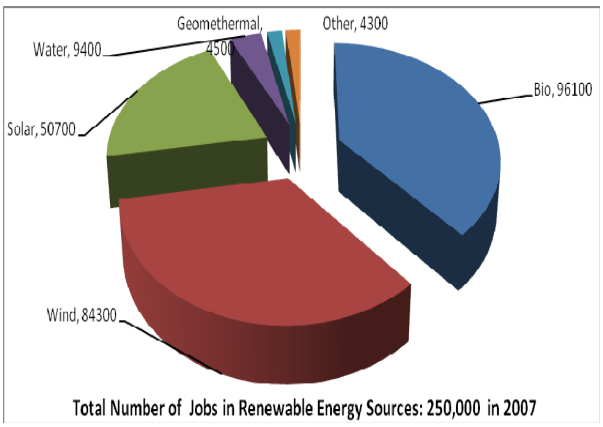

Fig. 5 Employment in RES [28]

The U.S. needs to phase out government subsidies for environmentally harmful industries, and transfer part or all of those funds to RES, efficiency technologies, and other green economic sectors. As far as existing fossil fuels are concerned, the U.S. needs to mandate energy efficiency programs to establish a renewable portfolio standard and to limit CO_2 emissions. The decarbonation of the economy must be facilitated by promoting the improved energy efficiency of fossil fuels through gradually increased carbon taxes in the production and consumption and the clean coal technology through carbon tax rebate in proportion to related reduction of CO_2 emissions.

These eco taxes [29] will emulate the achievements of the existing U.S. antipollution-related regulations, as confirmed by a related study [30]. According to the findings of this study, negative market incentives such as increases in pollution abatement expenditures lead to environmental innovation (as measured by the number of successful environmental patent applications granted to the industry) and international competitiveness.

Eco taxes can also take a negative form to internalize external costs avoided. This means renewable power generation will receive an operating credit or subsidy for the climate and environmental costs avoided through its substitution for fossil fuels. The European Commission, for instance, decided to allow member states to provide operating credit of up to 5€/kWh, based on a thorough research effort, to new renewable energy plants [31]. The ARRA green incentives can be implemented in a similar way.

Finally, the U.S. needs to review its industrial standards, such as fuel efficiency standard for automobiles, to encourage the U.S. manufacturers to drastically increase their investment in much more efficient products. With regard to bailout programs for the ailing U.S. automakers, it makes perfect sense to attach greening-up conditions of meeting improved efficiency standards to rescue packages instead of cutting blank checks to ailing industries.

A powerful economic stimulus package must be backed by high fuel efficiency standards and green regulations and comprise a significant portion of market incentives for the R&D of RES and energy efficient products and services. Setting higher industrial standards and offering tax credits to companies involved in the R&D of technologies for more efficient high-tech products and to buyers interested in purchasing these products as envisioned by Obama can rescue the U.S. manufacturing and the U.S. economy out of the current economic crisis, speed up the U.S. economy's drive toward improving its international competitiveness through R&D of more energy efficient products, and ultimately enable the corporate America to succeed on domestic and global markets in a long run. Furthermore, because of its dominant position in the global market, a greener U.S. economy can lead the world economy through global greening competition to sustained, real economic growth through reducing or avoiding its adverse impact on environment and climate.

IV. Conclusion

This article reviewed the green solution in ARRA stimulus program in comparison with Germany's renewable energy policy. It recommends that it is important for the U.S. Government, in addition to solving the immediate economic and financial crisis by bailing out troubled carbon-based economy, to design and kick off a fundamentally different, consistent, long-term, transformative economic strategy for the green economy, drawing on the experience of leading greener economies, especially Germany. The U.S. Government now has the historic opportunity to accelerate the transformation of its existing carbon-based economy to a greener economy by adopting a comprehensive well designed economic stimulus package as part of the "Global Green New Deal." Because of the current dominant position of the U.S. economy in the global economy, such a green transformation can have a pivotal promising impact on the accelerated globalization and the sustainability of our planet.

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