

EDAM Climate Action Paper Series 2016/1



Integrating Industrial Policy with

Climate Change Policy:

The Case for Turkey

Gökşin Bavbek

Research Assistant, EDAM

April 2016

Introduction

As the concerns over the global phenomenon of climate change are growing, it is becoming more important for countries to adopt green industrial policies. According to the Paris Agreement reached at the end of 2015, nearly all of the countries in the world have pledged to keep the levels of human induced global temperature increases to 2 °C above pre-industrial levels with efforts to limit the increase to 1.5 °C¹. Green industrial policies aimed at carbon mitigation will have to play an increased role in this effort if this agreed target is to be met. Additionally, more localized environmental troubles are a growing problem in many different countries. As a result of increasing environmental degradation and the threat of climate change, it is safe to assume that environmentally sustainable policies will be given more consideration in the near future.

Industrial policy and climate change policy are inevitably intertwined since the bulk of the climate change inducing greenhouse gas(GHG) emissions in the world are caused from energy related and industrial activities. According to the figures provided by the Intergovernmental Panel on Climate Change, electricity and heat generation accounted for 25% of total global emissions, industry accounted for 21%, transportation accounted for 14% and other energy related activities accounted for 10%². Historically, the majority of these GHG emissions in the world originated from the industrialized nations. However, as the developing nations underwent rapid industrialization in the past decades, their responsibility in causing climate change also greatly increased. Currently, China is the leading GHG emitter in the world, while still being considered a developing nation. The share of the developing countries in total world emissions was 59% on the year 2012, compared to 41% combined for the developed nations³. As a result, many of the developing nations in the world are currently utilizing policies aimed at low carbon growth and additional mitigation efforts will be required from the developing world in order to limit global temperature increases to safe levels. This necessity raises questions about the compatibility of developmental policies with climate policies as these countries also have significant developmental challenges that need to be addressed. According to the International Energy Agency, around 1.2 billion people in the world still lack access to electricity and around 2.7 billion people still rely on traditional biomass sources for cooking⁴. The

¹ UNFCCC, 'Adoption of the Paris Agreement, Proposal by the President', accessed from <http://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf> on 13.12.2015

² Intergovernmental Panel on Climate Change, 'Climate Change 2014, Mitigation of Climate Change, Summary for Policymakers'(2014), p. 9

³ Carbon Brief, 1.11.2013, accessed from <http://www.carbonbrief.org/2012s-carbon-emissions-in-five-graphs> on 17.1.2016

⁴ International Energy Agency, 'World Energy Outlook 2015, Executive Summary'(2015), p. 3

main challenge faced by new industrial policies will be to achieve environmentally sustainable growth paths without undermining the developmental needs of the countries they are applied in.

As one of the emerging markets in the world, the Turkish economy experienced rapid growth in the recent past. However, as its economy grew rapidly, the GHG emissions of the country also boomed and the various environmental problems faced by the country multiplied. Because of these reasons, it is important for Turkey to devise a comprehensive green industrial policy aimed at achieving an environmentally sustainable growth path. An investigation of the growing literature on green growth across the world can help Turkey in devising a strategy that will balance the developmental needs of the country and the country's responsibilities in the struggle against climate change. Economic development and environmental concerns are generally viewed to be in contention with each other but several practices in the world have shown that good green policies can also help spur economic development. The aim of this report is to investigate the inter-relation between industrial policy and climate change policy in a theoretical framework in order to help in the formulation of an effective green development strategy for Turkey.

Industrial Policy and its Economic Justification

In general terms, industrial Policy can be defined as any set of government policies that selectively favor the development of certain industries over others. The concept of industrial policy has been a contentious topic in economic theory since its basic premise of state intervention runs counter to the presuppositions of classical market theory. However, both developing and developed countries around the world continue to use various policies to influence their economic development for achieving various outcomes⁵. The main objective of industrial policy is bringing about structural change in economies by removing any obstacles and addressing certain market failures that can't be corrected solely by free market mechanisms. These market failures include issues like 'Marshallian externalities' and the need to protect infant industries, coordination failures, self-discovery and diversification problems, credit market imperfections and environmental externalities⁶.

The concept of industrial policy has witnessed a recent revival after the global financial crisis on 2007-2008 as many developed country governments sought to reinvigorate the global economy through the use of financial support to the industrial sector and stimulus packages aimed at boosting domestic demand. It seems that industrial policy will continue to be influential in the world economy

⁵ Schwarzer, Johannes, 'Industrial Policy for a Green Economy'(2013), International Institute for Sustainable Development, p.1

⁶ Schwarzer, Johannes, 'Industrial Policy for a Green Economy'(2013), International Institute for Sustainable Development, pp. 4-7

for the foreseeable future for 'inducing industrial transformation, diversification and upgrading towards more resilient and competitive, as well as environmentally friendly and socially inclusive, industries'⁷. Currently, the predominant question is no longer whether countries should implement industrial policy but rather how best to implement such policies. The need to mitigate and adapt to the negative effects of climate change currently stands out as an additional rationale for implementing industrial policies⁸.

In recent years, environmental concerns have increasingly started to influence the industrial policies of many countries. Green industries are currently being supported throughout the world with various types of industrial policies that aim to promote the development of industries which are less harmful for the environment and cause lower amounts of GHG emissions. However, especially for the developing countries, there are concerns that pursuing green policies may undermine economic growth and employment opportunities⁹. Traditionally, climate change policies are viewed as detrimental to industrial competitiveness and restricting to economic development. However, it has also been observed that well-designed green energy policies have the potential to be drivers of economic growth instead of being obstacles. There are several successful examples in the world that show environmental sustainability and economic development can go hand in hand¹⁰.

Rationale for a Green Industrial Policy

The process of industrialization can greatly transform societies by boosting job creation and economic growth. Living standards of populations can be enhanced through industrialization and the gaps between rich and poor countries can be narrowed. However, not all effects of industrialization are positive as industrial processes significantly contribute to environmental degradation, global GHG emissions and the depletion of natural resources. Most of our daily economic activities cause the releasing of GHG emissions into the atmosphere, which are the leading cause of climate change. Along with its many existing and anticipated negative effects, climate change increases the global risks associated with food security, water scarcity, and energy security¹¹. Scientists have been warning that a global temperature increase of more than 2 ° Celsius could lead to disastrous

⁷ Günther, Tillman and Alcorta, Ludovico, 'Industrial Policy for Prosperity: Reasoning and Approach'(2011), United Nations Industrial Development Organization, p.2

⁸ Naudé, Wim, 'Climate Change and Industrial Policy'(2011), Sustainability, 3, p.1003

⁹ Aiginger, Karl, 'Industrial Policy for a sustainable growth path'(2014), Welfare, Wealth, Work for Europe, p.2

¹⁰ Aiginger, Karl, 'The "greening" of industrial policy, headwinds and a possible symbiosis'(2013), Welfare, Wealth, Work for Europe, p.4

¹¹ 'Development and Climate Change, A Strategic Framework for the World Bank Group Technical Report'(2008), p.11

consequences for humankind, worsening the already observable effects of climate change including sea level rise, increased droughts and the threat of extreme weather events. Climate change can perhaps be regarded as the greatest market failure that the global economy has ever faced. GHG emissions are negative externalities since the creators of the emissions don't pay for them directly but the cost is distributed on the whole global society¹². Thus, the price of the emissions is not internalized and this constitutes a market failure which can't be remedied under the mechanisms of classical market economics. Therefore, government intervention is required to spur the climate change mitigation effort and steer economies toward sustainable growth pathways. This can be achieved through providing the appropriate incentives, disincentives and regulations for different sectors.

In line with the view that negative externalities should be internalized by the parties responsible, economists have for long tried to appraise the cost of carbon emissions in order to establish a proper price for carbon. Several different estimations have been used for the price of carbon but the uncertainty over the social costs of climate change remains high. A study undertaken in 2009 by Tol signifies this uncertainty. Tol analyzed estimates from 232 different studies made on carbon pricing and the results showed a mean value of 105 US dollars per ton of carbon whereas the median was only 29 US dollars per ton and the mode value was 13 US dollars per ton¹³. A more recent study undertaken by the US Environmental Protection Agency estimated the social cost of carbon dioxide emissions at 37 US dollars per metric ton for the year 2015¹⁴. On the other hand, yet another recent study estimates a much higher figure at 220 US dollars per metric ton¹⁵. The estimations for the costs of carbon emissions can greatly vary according to the methodology used. Despite the uncertainties and disagreements over the overall costs of carbon emissions, one point of general agreement is that the excluded costs of carbon emissions are very significant and they need to be addressed.

Industrial policy is central to this effort since industrial activity has a considerable role in causing GHG emissions. In total, industrial demand constitutes around 30% of global final energy demand and is

¹² Günther, Tillman and Alcorta, Ludovico, 'Industrial Policy for Prosperity: Reasoning and Approach' (2011), United Nations Industrial Development Organization, p. 10

¹³ S. J. Tol, Richard, 'The Economic Effects of Climate Change' (2009), The Journal of Economic Perspectives, Vol. 23, No. 2, p. 41

¹⁴ Yale Climate Connections, 12.2.2015, 'Understanding the Social Cost of Carbon and Connecting it to Our Lives', accessed from <http://www.yaleclimateconnections.org/2015/02/understanding-the-social-cost-of-carbon-and-connecting-it-to-our-lives/> on 13.1.2016

¹⁵ C. Moore, Frances and B. Diaz, Delavane, 'Temperature Impacts on Economic Growth Warrant Stringent Mitigation Policy' (2015), Nature Climate Change 5, pp. 127-131

responsible for approximately 40% of all energy related emissions¹⁶. Several industrial sectors such as iron and steel, cement, chemicals, pulp and paper and aluminum production are among the most carbon intensive. Because of this, the industrial sector also has great potential to curb the emission levels through adopting cleaner and more efficient technologies. The high interrelation between industry, economic development and climate change means that designing proper industrial policies will be crucial in achieving GHG mitigation while ensuring the industry's role as a facilitator of growth and employment¹⁷.

Green growth is broadly defined as economic growth that is deemed environmentally sustainable. It is based on sustainable use of non-renewable resources and the aim is to fully internalize environmental costs. Green growth is required to enable countries to achieve economic growth without being locked into environmentally unsustainable patterns. The World Bank defines green growth as economic growth that is 'efficient in its use of natural resources, clean in that it minimizes pollution and resilient in that it accounts for natural hazards and disasters'¹⁸. A main characteristic of green growth should be the delinking of GHG emissions from economic growth, thus enabling economies to grow without creating a comparable increase in hazardous emissions. The utilization of green technologies that aim to economize on exhaustible resources and that cause lower GHG emissions is key to achieving green growth. One of the main responsibilities of the policymakers will be to ensure that adequate investments are made into green technologies in order to achieve green growth. It makes economic sense for green technologies to be subsidized by the governments. One reason is the general mispricing of carbon caused by the costs of climate change and the existing subsidies in support of fossil fuel sources. Another reason is to capture the positive spillovers that will be generated by new low carbon technologies which can't be fully captured by the first investors into these technologies¹⁹.

Designing effective green industrial policies can be considered more significant and problematic for developing countries for a number of reasons. Most of the developing countries are witnessing particularly rapid growth in energy intensive industries and are set to experience more growth in these industries because of their generally large needs for infrastructure investments. The rapid industrialization the developing countries are undergoing can make it harder for them to mitigate their emissions but the widespread infrastructural transformation can also provide opportunities.

¹⁶ Naudé, Wim, 'Climate Change and Industrial Policy' (2011), p. 1004

¹⁷ Ibid., p. 1004

¹⁸ The World Bank, 'Inclusive Green Growth, The Pathway to Sustainable Development' (2012), p.30

¹⁹ Rodrik, Dani, 'Green Industrial Policy' (2014), Oxford Review of Economic Policy, Volume 30, Number 3, p. 470

Additionally, most of the developing countries have to prioritize the developmental needs of their citizens much more compared to industrialized countries.

Because of these reasons, some make the argument for developing countries to stress economic growth for today and deal with the environmental consequences of that growth only after a certain level of development is achieved. That is a flawed argument due to a number of reasons. One reason is the fact that the costs of cleaning up pollution would be much higher at the later stages of development and therefore it would make more economic sense to act earlier instead of later. Also, there is the risk that earlier choices of technology and infrastructure can lock in a country's future economic structure to a high carbon pathway of growth which can be hard and costly to overturn. This issue can be especially important for developing countries where significant infrastructure investments are set to be made over the coming decade²⁰. Adequate infrastructure can be regarded as a prerequisite for following successful green policies, therefore it would be more cost effective for countries to invest in green infrastructure beforehand rather than replacing the existing infrastructure later on. The developing countries are more advantageous in this regard compared to many industrialized countries because developed economies have already sunk capital in irreversible investments in different kinds of infrastructure such as outdated power supplies, transport networks and urban structures. This can potentially give the developing economies a first mover advantage against the industrialized markets²¹.

Also, the argument advocating economic growth at the expense of the environment overlooks the likely possibility that many of the negative effects of climate change and environmental degradation may in fact be irreversible, such as the loss of biodiversity or the prevalence of extreme weather events²². Moreover, for many rapidly industrializing countries, the current costs of environmental damages might already be too much to bear. An appropriate example can be the case of China which was recently forced to reverse its policies to significantly limit the utilization of coal power, the conventional energy source it has freely utilized and relied on for decades. This drastic shift of policy happened because the social and economic costs of pollution became too much to bear for the Chinese politicians. China has dire air and water pollution problems which are largely caused by unrestrained use of coal power. It was estimated that the overall adverse effects of water and air pollution was costing between 3% and 7.7% of the nation's gross domestic product each year, which

²⁰ The World Bank, 'Inclusive Green Growth, The Pathway to Sustainable Development'(2012), p.32

²¹ Schwarzer, Johannes, 'Industrial Policy for a Green Economy'(2013), International Institute for Sustainable Development, pp. 33-34

²² Ibid., pp. 33-34

without doubt places an overwhelming burden on the society and the economy²³. The argument that dismisses the environmental problems in favor of economic development fails to realize that economic production also ultimately depends on a limited stock of natural resources and the quality of the environment. Failing to see the relation between the environment and the economy can lead to sacrificing the opportunities for long sighted development for immediate economic growth. Dealing with environmental problems can directly increase human well-being, including in ways that may not be captured in conventional calculations of GDP²⁴.

Another rationale for adopting green policies is the more widespread adoption of environmental regulations and standards by the developed countries. Many of the developed countries are adopting more comprehensive environmental legislations that can have a significant impact on developing country exports made into these markets. Therefore, those countries that do not adapt their production structures to the appropriate standards may face the risk of losing shares of their export markets in the future. Aside from legal standards, evolving consumer preferences in the developed countries can also be influential in bringing about this outcome. Therefore, the countries that fail to raise their environmental standards may run the risk of losing their competitive advantage in the export markets²⁵. Additionally, many of the developing countries are well situated to benefit from various sources of renewable energy sources which can help reduce their reliance on imported fossil fuels with volatile prices.

Moreover, developing countries will need to make significant effort for climate change adaptation. Climate change is set to have a variety of economic and social impacts which are expected to considerably differ based on geographical location. Scientific studies show that most of the developing countries are located in regions that are projected to be the worst affected by the negative effects of climate change²⁶. This will pose an additional challenge for many of the developing countries to adapt their economies to the negative effects of climate change along with the challenges of climate change mitigation and economic development.

²³ Aden, Nathaniel, Fridley, David and Zheng, Nina, 'China's Coal: Demand, Constraints, and Externalities'(2009), Ernest Orlando Lawrence Berkeley National Laboratory, pp. 37-38

²⁴ The World Bank, 'Inclusive Green Growth, The Pathway to Sustainable Development'(2012), p.34

²⁵ Schwarzer, Johannes, 'Industrial Policy for a Green Economy'(2013), International Institute for Sustainable Development, pp. 33-34

²⁶ The Guardian, 27.13.2013, 'Climate Change will hit Poor Countries Most, Study Shows', accessed from <http://www.theguardian.com/global-development/2013/sep/27/climate-change-poor-countries-ipcc> on 18.1.2016

Many of the points made for developing countries in general are also applicable for the case of Turkey. Turkey is a developing country which still has significant developmental needs and which has been experiencing growing environmental problems and rapid increases in its emissions stock over the recent years. Moreover, the current energy structure in Turkey is largely dependent on fossil fuel imports which are creating considerable energy security risks for the country. Adopting a comprehensive and appropriate green industrial policy can help address the environmental problems the country is facing, create new opportunities for employment and economic development and help reduce the import dependence of the country's energy system. Under the current trajectory, Turkey runs the risks of committing its economy to a long term economic growth pathway based on a high reliance on carbon based energy sources. However, with the right policies, this trend can still be overturned. There are several different ways by which green industrial policies can promote low carbon economic growth for Turkey and for the world.

Basic Components of Green Industrial Policy

The basic factors influencing the accumulation of GHG emissions in the world can be shown by an equation referred to as the Kaya Identity. The equation shows that total GHG emissions in the world equals population multiplied by GDP per capita multiplied by energy intensity of GDP multiplied by carbon intensity of energy production. Utilizing Kaya Identity shows that industrialization contributes to the accumulation of GHG emissions in a number of ways. The process of industrialization can increase GHG emissions by increasing GDP per capita, by increasing energy demand per unit of GDP and by increasing the carbon intensity of energy generation²⁷.

Kaya Identity

$$\text{CO2 Emissions from Energy} = \text{Population} * (\text{GDP per Capita}) * (\text{Energy intensity of GDP}) * (\text{Carbon Intensity of Energy})$$

The way to mitigate the GHG emissions can be made through addressing the factors that determine the emission levels as shown in the Kaya Identity. The increase of GDP per capita is obviously a desired outcome of industrialization and population growth is a factor that is outside the scope of industrial policy. On the other hand, both energy intensity of GDP and carbon intensity of energy can be reduced through the use of appropriate policies. Energy use per unit of GDP can be reduced by pursuing structural changes in the economy by targeting the development of less energy intensive sectors and increasing the energy efficiency of the existing industries. Carbon intensity of energy generation can be reduced by following policies that favor low carbon energy sources such as

²⁷ Naudé, Wim, 'Climate Change and Industrial Policy'(2011), Sustainability 3, p. 1005

renewable sources and nuclear energy. These policies should be used in coordination with each other for establishing an overarching low carbon growth strategy. Moreover, a complete green policy shouldn't be limited to the mitigation side of the climate change challenge. As the negative impacts of climate change are being felt more acutely each day, it is becoming more important to make the appropriate policy modifications in order to ensure proper adaptation measures against climate change are being taken.

-Reducing the Energy Intensity of Industry

There are several ways by which the energy intensity levels of the economy can be reduced. Structural change in the economy towards less energy intensive sectors is the principle way by which the developed countries have reduced their economy's energy intensity. A strategy aimed at this would entail promoting the sectors that are less energy intensive against those that require high amounts of energy input. However, it is often the case that large scale structural changes in an economy happen more gradually and over long periods of time. Increasing the levels of energy efficiency of the existing industries can be regarded as a more viable option for the short term. This can be particularly important for developing countries experiencing rapid growth in their energy intensive industries. Increased energy efficiency entails using less energy in production and in consumption for the production of the same amount of goods and services. The examples to this include the development of smart grids, improving the energy efficiency of buildings, improving efficiency in the transportation sector and improving efficiency of the industry²⁸.

There is a great potential for energy efficiency gains in the industrial sector. The International Energy Agency claims that the industrial sector holds the greatest potential for achieving energy savings in the global economy. According to their estimates, energy savings in the industrial sector could amount to a cumulative reduction of more than 100 Gt of CO₂ emissions by the year 2050 if the global temperature increases are to be limited to 2° Celsius²⁹. Reportedly, significant efficiency gains and emission reductions can be realized across different industrial sectors if the best available practices are adopted. It is estimated that around 30-35% untapped energy efficiency potential exists in today's industrial processes³⁰. For example, it is reported that if the best available practices are used in the global steel industry, global CO₂ emissions could be reduced by around 340 million tons

²⁸ Naudé, Wim, 'Climate Change and Industrial Policy'(2011), pp. 1011-1012

²⁹ International Energy Agency, 'Energy Technology Perspectives 2015, Mobilising Innovation to Accelerate Climate Action'(2015), p.4

³⁰ Günther, Tillman and Alcorta, Ludovico, 'Industrial Policy for Prosperity: Reasoning and Approach'(2011), United Nations Industrial Development Organization, p.11

annually. Similar reductions could be also obtained if coal plants adopted the best available practices³¹. Important financial savings and an increase in competitiveness can also be achieved through improving energy efficiency in industry. Energy costs make up an important amount of total costs in many types of industries. The costs of energy can make up around 30% of total costs in industries like basic metals, paper and pulp, mineral products, rubber and plastics, and chemicals³².

Increasing resource efficiency should also be one of the focuses of green industrial policy. Resource inputs are a significant cost to many industrial sectors. Reportedly, the costs of resources can account for up to 65% for the total costs of food and beverage sectors and up to 70-80% of the total costs of the steel sector³³. Therefore, along with increases in energy efficiency, resource efficiency can play an important role in cutting the costs of many industries thus increasing the overall competitiveness of a country's industry.

Despite the several advantages of industrial energy efficiency, markets often don't function as smoothly as expected. There are a number of barriers that prevent achieving potential efficiency gains to be realized. Many times, potential industrial investors are not informed about the opportunities of investing into efficient technologies or they just can't easily obtain the funding required to purchase the new equipment or the necessary modifications. Moreover, the decision-makers are often not the sole beneficiaries from efficiency investments and it is hard to calculate all the costs and benefits associated with investments in to energy efficiency. Another factor that limits the attractiveness of energy efficiency investments is the utilization of energy prices subsidies in many countries³⁴.

Because of these reasons, the utilization of public policy can be helpful in ensuring a more rapid proliferation of efficiency measures. Some of the important points in the design of energy efficiency policies involve finding the right policy mix, putting a special focus on small and medium sized enterprises and a continuous assessment of the effectiveness of policies in order to be able to make the necessary adjustments. Any potential rebound effect that may arise is also another factor that needs to be taken into account. The specific policy measures can include providing support for developing new and more efficient technologies, providing information on and disseminating new

³¹ Naudé, Wim, 'Climate Change and Industrial Policy'(2011), pp. 1011-1012

³² Schwarzer, Johannes, 'Industrial Policy for a Green Economy'(2013), International Institute for Sustainable Development, pp. 31-32

³³ Ibid.

³⁴ Günther, Tillman and Alcorta, Ludovico, 'Industrial Policy for Prosperity: Reasoning and Approach'(2011), United Nations Industrial Development Organization, p.11

technologies, introducing fiscal incentives for energy efficiency gains, streamlining the energy prices, establishing financial mechanisms aimed at increasing industrial energy efficiency and using voluntary agreements³⁵.

-Promotion of Low Carbon Energy Sources

In order to reduce the carbon intensity of energy generation, increasing the share of low carbon sources in the energy generation mix is necessary. Low carbon energy sources include nuclear energy and several types of renewable energy sources such as wind, solar, hydro, geothermal and biomass. Diversification of energy sources is getting prioritized by many countries, not solely based on the climate change concerns, but also because of concerns about energy security and the potential opportunities for job creation and economic development.

The main concern of public policies with regard to low carbon energy sources is to reduce the relative costs of these sources. Currently, many of the renewable energy sources are more expensive compared to conventional fossil fuel based sources. Lowering the costs of renewable sources will not only involve technological innovation in the energy generation process but also in complementary technologies in the processes of transmission and storage. This is especially crucial for solar and wind energy which are intermittent in nature and where the resources are often located at a distance from where the energy is demanded. The promotion of renewables can also be made through putting a high price on carbon sources by removing the existing subsidies or by pricing carbon through the use of taxing or through using various other market mechanisms³⁶.

Even though most of the renewable energy sources are still more costly compared to conventional fuel sources, the renewables sector has made significant advances in bringing down costs in the recent years. This decline in costs have started to challenge the fossil fuel alternatives in many places, even when the health, environmental and other externalities are not factored in³⁷. For example, the average cost of solar panels has considerably declined from around 4 dollars per watt on 2005 to 0.7 dollars per watt on 2013³⁸. It is to be expected that as the renewable technologies further advance,

³⁵ Günther, Tillman and Alcorta, Ludovico, 'Industrial Policy for Prosperity: Reasoning and Approach'(2011), United Nations Industrial Development Organization, p.11

³⁶ Naudé , Wim, 'Climate Change and Industrial Policy'(2011), p.1012

³⁷ Schwarzer, Johannes, 'Industrial Policy for a Green Economy'(2013), International Institute for Sustainable Development, pp. 34-36

³⁸Feldman,David,Barbose,Galen, Margolis,Robert James, Ted, Weaver,Samantha, Darghouth,Naïm, Fu,Ran, Davidson,Carolyn, Booth,Sam and Wiser,Ryan(2014), "Photovoltaic System Pricing Trends: Historical, Recent and Near Term Projections"

the costs of renewable energy systems will further decline in the future making them more competitive against conventional sources of energy.

In order to fully reap the employment and development benefits of renewable energy sources, countries should also be involved in the manufacturing of renewable energy systems. Thus, the manufacturing of renewable energy components should be another focus of green industrial policies. Green industry is a term that is used to describe those industries that are involved in providing environmental goods and services. It includes the companies that manufacture and install renewable energy components and companies that are active in a variety of other environment related fields such as material recovery, recycling, waste treatment and environmental and energy consultants³⁹.

Modern renewable markets have originated in the industrialized countries but they are currently increasingly expanding to developing markets. The renewables manufacturing industry has also originated in the developed world but has been shifting towards several developing countries. China and India are both playing an increased role both as markets and in manufacturing. Several other players are also emerging in parts of Asia, Latin America, the Middle East and North Africa⁴⁰.

An increased reliance on renewable sources for energy generation instead of conventional fossil fuel sources can significantly promote job creation. According to the figures provided by the World Bank, several of the renewable energy sources are more labor intensive compared to conventional sources of energy. Reportedly, 1 million US dollars of investment into oil and gas industries can create a total of 5.2 jobs, while the same amount of investment into the coal industry can create 6.9 jobs. On the other hand, the same figure was 13.3 for wind energy, 13.7 for solar energy and 17.4 for biomass energy⁴¹.

Across different countries in the world, the renewable energy industry has proven to be capable of spurring economic growth and creating a considerable amount of employment opportunities. The amount of jobs created by the global renewable energy industry was around 7.7 million on the year 2014. Among the renewable sources, solar photovoltaic created the most employment opportunities with 2.5 million, followed by liquid biofuels with almost 1.8 million and wind energy with 1 million

³⁹ Schwarzer, Johannes, 'Industrial Policy for a Green Economy'(2013), International Institute for Sustainable Development, pp. 34-36

⁴⁰ Ibid.

⁴¹ Bacon, Robert and Kojima, Masami,(2011) 'Issues in estimating the employment generated by energy sector activities', Sustainable Energy Department', World Bank, p. 38

jobs worldwide⁴². Furthermore, it is estimated that by the year 2030, the total number of global renewable energy jobs will amount to 13.5 million⁴³. Aside from the sheer number of employment opportunities, it is also important to consider that the quality of the jobs created by the renewables sector is most often significantly higher compared to the jobs created by the fossil fuel industry. It can be observed that renewable energy investments are currently functioning as drivers of economic growth and development in different parts of the world. It is important to grab this opportunity and promote suitable renewable energy industries in order to capture several benefits including reducing carbon emissions, boosting economic growth, creating more and better employment opportunities and reducing the reliance on fossil fuel imports.

-Carbon Capture and Storage

An alternative way proposed for climate change mitigation is by way of utilizing carbon capture and storage (CCS) technologies. CCS technologies could theoretically allow for a continued reliance on fossil fuels, especially coal power. They essentially entail the capture, compression and transportation of the carbon emissions to ultimately be buried in underground geological formations from where they would not be released into the atmosphere. Some of the emission reduction scenarios assume the adoption of CCS technologies at a large scale but the viability of CCS technologies has still not been demonstrated at a commercial scale. Moreover, there are concerns that even if utilizing CCS can make economic sense as technologies develop, it may only be a temporary solution and the leakage of the stored gases into the atmosphere can be expected in the long term. The current CCS demonstration projects are largely being abandoned due to unexpected technological challenges, unanticipated increases in costs and lower fuel efficiencies⁴⁴. It is currently impossible to know whether CCS will have a significant effect in the future GHG mitigation effort. The economic feasibility and social acceptability of the CCS technologies are not proven. If CCS technologies can be improved, they can be used as a useful transition technology. However, at their

⁴² International Renewable Energy Agency, 'Renewable Energy and Jobs: Annual Review 2015'(2015), pp. 1-4, accessed from http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2015.pdf on 22.01.2016

⁴³ International Renewable Energy Agency, 'Renewable Energy Benefits: Measuring the Economics'(2016), p. 41, accessed from http://www.irena.org/DocumentDownloads/Publications/IRENA_Measuring-the-Economics_2016.pdf on 22.1.2016

⁴⁴ Lütkenhorst, Wilfried, Altenburg, Tilman, Pegels, Anna and Vidican, Georgeta, 'Green Industrial Policy, Managing Transformation under Uncertainty'(2014), Discussion Paper / Deutsches Institut für Entwicklungspolitik, p. 18

current state, it is not very logical to rely on CCS technologies for future carbon mitigation, especially when the costs of proven low carbon technologies are rapidly falling.

-Climate Change Adaptation

Another important linkage between industrial policy and climate change is about the existing and the anticipated effects of climate change on the economy. Adaptation of industry to the negative effects of climate change will be of increasing importance in the near future as the severity of climate change increases. In the past, climate and the environment in general have been regarded as exogenous factors to economy. However, that can no longer be the case. New development models will have to incorporate climate as an indigenous factor to the economy as the changing climate effects will bring about new economic threats and for some cases, new opportunities. In particular, the developing countries which are more prone to climate change risks due to geographical location and due to lack of adaptive capacity will have to design their energy and industry policies with a perspective that includes climate resilience.

The anticipated effects of climate change on the economy are manifold including physical, social and economic impacts. The physical impacts include increased temperatures, the rising of sea levels, changes in rainfall patterns and increased incidence and severity of extreme weather events. These impacts lead to serious social consequences like reduced productivity in agriculture and fisheries, water scarcity, increased prevalence of diseases, forced migration and increased damages to human life and infrastructure from natural disasters. Economically speaking, these effects would lead to several outcomes such as reduced food and supplies and increased prices, changes in agricultural cropping patterns, changes in the distribution of labor supply, disruptions of supply and final markets and increased costs of insurance among many other anticipated and unanticipated effects⁴⁵.

Any adaptation policy should address these vulnerabilities. Climate resilience of the industry and the economy in general should be enhanced by taking a number of measures. Most of the adaptation measures have traditionally been aimed at reducing vulnerabilities by increasing the local capacities to respond to the effects of climate change such as climate monitoring and disaster response. However, such reactive measures can't be sufficient in the climate change adaptation challenge. In order to achieve a successful adaptation, developing countries should increase the resilience at their agricultural and industrial sectors and promote the healthcare services.

⁴⁵ Zarsky, Lyuba, 'Climate-Resilient Industrial Development Paths: Design Principles and Alternative Models'(2010), Global Development and Environment Institute Working Paper No. 10-01, p. 4

The main aims of an industrial adaptation policy should include a variety of issues like the diversification of the industry, reducing the dependency on imported energy, reducing vulnerability to natural disasters and improving food security⁴⁶. The diversification of the economy is important for many developing countries since many of them have based their industrial development strategies to a single or a few export sectors integrated to the global supply chains. This makes livelihoods vulnerable to exogenous shifts such as rapid exchange rate changes, the emergence of lower cost competitors and global market collapses. As the effects of climate change get more severe, it can be expected that the issue of industrial diversification will become more central. That is mainly due to two reasons. Firstly, even though the prices of fossil fuels have been very low in the past year, there is the risk that they may rise due to climate policies. Secondly, climate events have the risk of making global supply chains more prone to disruption⁴⁷.

One important characteristic of climate change effects is uncertainty. There are considerable gaps in our understanding of climate change effects and thus it should be accepted that there will always be outcomes that were previously unanticipated. Therefore, climate adaptation policies should be regularly re-evaluated and re-designed to both the anticipated and unanticipated effects of climate change, according to our updated understanding of climate change effects⁴⁸.

Main Types of Policy Instruments

There are several different types of policy tools available for designing an effective industrial policy. The main types of policy measures can be classified under the three broad categories of regulatory policies, behavioral change instruments and market based instruments.

-Regulatory Measures

Regulatory measures are policies that aim to affect outcomes with technical or performance oriented prescriptions including standards, limit values and prohibitions. Regulatory measures have for some time been the main types of policies employed for realizing environmental aims. Regulatory measures can be expected to provide benefits when coordination failures, principal-agent problems or agglomeration effects prevents firms from making the necessary investments into efficiency measures and into innovation when they are not being regulated. Many countries are experienced in following regulatory policies, so often it is easier for countries to adopt regulatory measures building

⁴⁶ The World Bank, 'Inclusive Green Growth, The Pathway to Sustainable Development'(2012), p. 159

⁴⁷ Zarsky, Lyuba, 'Climate-Resilient Industrial Development Paths: Design Principles and Alternative Models'(2010), Global Development and Environment Institute Working Paper No. 10-01, p. 11

⁴⁸ Ibid., p. 13

on the existing legislation. However, the enforcement of regulations can often be challenging for governments.

-Behavioral Change Instruments

These types of policy tools are those that aim to alter the choices of people without forbidding any options and without any significant changes in economic incentives. The examples to such policies include information disclosure requirements and the more prominent display of healthy foods in cafeterias. Such policies can be helpful in areas such as promoting more sustainable consumption and recycling. The basic premise of these policies is to use behavioral sciences and decision research to steer individual decision towards desired outcomes. When applied to the environmental purposes, this would mean presenting the customers with the environmental impacts of the choices they are making in order to affect their decisions to achieve more environmentally friendly outcomes. More information being made available to the customers can, for example, affect them to purchase more resource efficient technologies they otherwise wouldn't even though it made economic sense⁴⁹.

-Market based Instruments

Market based instruments are those that don't mandate actions but provide incentives to steer the behavior of the actors. These types of instruments are gaining more widespread utilization across the world in the context of green industrial policy. Market based instruments seek to address market failures by affecting the specific aspects of existing markets such as price and quantity or by attempting to create totally new markets. There is a wide variety of market based instruments being used to provide incentives for promoting green industries, energy efficiency and renewable energy sources. Utilization of quotas, subsidies and environmental taxes can be shown among the market based instruments used for promoting green industrial policy⁵⁰.

Utilization of quotas with tradable certificates is a way of influencing the market by regulating quantity. Such instruments can be used on a number of areas such as emissions trading exemplified by the EU ETS scheme, the trading of energy savings as exemplified by the use of white certificates in different countries and in renewable energy such as the renewable energy credits system used in the US.

⁴⁹ Pegels, Anna, 'Green Industrial Policy in Emerging Countries' (2014), Routledge Studies in Ecological Economics, Chapter 3

⁵⁰ Ibid.

Subsidies can be defined as transfers of government money to an entity in the private sector or government revenue that is otherwise due is forgone or not collected. Subsidies can take many shapes such as grants, loan guarantees, low interest loans, tax cuts and feed-in tariffs among others⁵¹.

Environmental taxes and charges are generally used with the purpose of internalizing the environmental costs associated with an economic activity. Several types of taxes can be placed under this category including carbon taxation.

Green Policies from the Standpoint of International Trade

In order to promote domestic industries against competition from foreign markets, many countries use a variety of trade barriers which can disrupt international trade. These may include tariffs, duties and other non-tariff measures⁵². Subsidies provided by governments can also often be seen as disruptive to fair trade by creating unfair advantages. Industrial policy is closely related to international trade from the standpoint of competitiveness. Such concerns are also relevant for Turkey and may become more important in the near future. For example, some researchers argue that the EU should impose a block on imports of electricity from countries such as Turkey which generate electricity by causing high amounts of carbon pollution⁵³.

In the recent past, the green industrial policies pursued by individual countries have started to become a point of contention on the arena of international trade. The industrial policies used to support the growth of the nascent renewable energy industries can produce significant environmental and economic benefits but they also sometimes tend to distort trade relations and lead to harsh disputes between trading partners under the framework of the World Trade Organization(WTO)⁵⁴.

Two such disputes that have arisen in the recent past are the trade dispute between US and Brazil and the dispute between US and China. The dispute between US and Brazil involved the trading of ethanol. The conflict arose from the WTO law which forces member states to receive the same treatment for their exports as national products. This would mean that Brazil's ethanol exports into the US would be entitled to receive the subsidy provided for domestic producers in the US. To

⁵¹ Ibid.

⁵² Ramkolowan, Yash, 'Mitigation Action Plans and Scenarios Provocateur Briefing Report'(2014), Forum on Development and Mitigation, p. 10

⁵³ Tindale, Stephen and Hinson, Suzanna, 'Cleaning the Neighbourhood: How the EU can scrub out bad Energy Policy'(2015), Centre for European Reform, p. 7

⁵⁴ Wu, Mark and Salzman, James, 'The Next Generation of Trade and Environment Conflicts: The Rise of Green Industrial Policy'(2014), p. 401

prevent the Brazilian exporters from damaging the producers in the US and to prevent sending US government revenues to Brazil, the US imposed a nearly prohibitive tariff on ethanol imports until the end of 2011 when the subsidies were set to expire⁵⁵.

The dispute between the US and China was a broader one. For an extended amount of time, China has been running a large trade surplus against the US. The policymakers in the US have been trying to make China reduce its trade surplus in order to increase the demand for US exports and to reduce competition in its domestic sectors that face import competition. Even though the main dispute between US and China is not on green industries, the issue does often manifest on such sectoral levels. The recent stimulus packages provided for renewable energy sources in the US have drastically increased the demand for wind and solar energy components. Since this increased demand was met largely by imports from China, there have been calls in the US to restrict the imports of these products on the grounds that they are harming the employment prospects of the US economy⁵⁶.

Key Principles for a Green Industrial Policy

There are several studies made that aim to chart out the basic principles that need to be considered when designing new industrial policies. In his article 'Green Industrial Policy', Dani Rodrik identifies three key attributes that should be adhered to while formulating green industrial policies. These are the principles of embeddedness, discipline and accountability.

Embeddedness refers to the presence of a considerable amount of interaction and communication between the public and private sectors. Rodrik argues that such ties between the public and private sectors would enable the public sector to have the necessary information to design and revise their policies according to the constraints and possible opportunities that the private sector may communicate⁵⁷. However, naturally this kind of interaction should preclude the possibility of bureaucrats being beholden to the interests of the business owners. This concept is also stressed by Pegels using the phrase 'embedded autonomy'. It denotes that bureaucrats should know enough of the market dynamics to be able to design the appropriate incentives, but they should also be autonomous enough to avoid political capture. For this to work, measures such as increased transparency, the introduction of checks and balances and improved performance incentives are

⁵⁵ Karp, Larry and Stevenson, Megan, 'Green Industrial Policy, Trade and Theory'(2012), p.5

⁵⁶ Ibid., pp. 5-6

⁵⁷ Rodrik, Dani, 'Green Industrial Policy'(2014), Oxford Review of Economic Policy, Volume 30, Number 3, pp. 484-485

necessary⁵⁸. According to Rodrik, the required interaction between the government and the businesses can happen in a variety of settings such as ‘deliberation councils, supplier development forums, search networks, regional collaborative innovation centers, investment advisory councils, sectoral round-tables and private-public venture funds’. Rodrik argues that getting accurate information on where the constraints and the opportunities lie in the market may be more crucial for the policy design process as opposed to the specific policy instruments that will be used⁵⁹.

Another principle he proposes is discipline. In this context, discipline refers to the appliance of penalties on the businesses that are underperforming. This is necessary in order to avoid businesses to abuse the incentives provided by the government. Clear goals should be set and the businesses should be made to know that if they fail to meet their designated targets, they will lose the incentives provided for them. For this to work, clear objectives should be set beforehand for any policy design and ideally there should be a single objective set instead of trying to cover multiple goals. Also, the system should be strictly institutionalized and the same rules should be applied to all private actors rather than functioning on a firm specific basis. Setting appropriate systems for the monitoring and evaluation of policies is also crucial to be able to make the necessary revisions whenever a policy is not delivering the required results. In short, the principle of discipline requires ‘clear objectives, measurable targets, close monitoring, proper evaluation, well-designed rules, and professionalism’⁶⁰.

The final principle that is proposed by Rodrik is the principle of accountability. Whereas the first two principles set the relationship between the businesses and the policymakers, the principle of accountability frames the relation of the policy employed with the general public. This is necessary because the premise of green policy practices is that the policies are employed for the good of the general society and not for the benefits of private businesses and the public agencies. Therefore, the policymakers should be accountable to the public and the successes and the failures of the policies employed should be made transparent. Increased accountability would prevent corruption, increase the general trust to the government institutions and help legitimize the policies that are pursued⁶¹.

⁵⁸ Pegels, Anna, ‘Green Industrial Policy in Emerging Countries’(2014), Routledge Studies in Ecological Economics, Chapter 8

⁵⁹ Rodrik, Dani, ‘Green Industrial Policy’(2014), Oxford Review of Economic Policy, Volume 30, Number 3, pp. 484-485

⁶⁰ Ibid, pp. 485-488

⁶¹ Ibid, p. 488

There are also important aspects of green policies that need to be considered from the standpoint of social welfare and employment. One important point is that green growth should not be considered inherently inclusive. Specific complementary policies would likely be required to guarantee that the poor segments of the society are not excluded from the potential benefits or are not harmed in the transition process⁶². A widespread transformation in the economy towards a green growth pathway would create new employment opportunities in some sectors and regions but would inevitably eliminate some employment opportunities in other sectors and regions. In order to achieve a just transition, the costs and the advantages of the decisions must be shared fairly⁶³. In order to achieve this, temporary support for the so-called 'sunset' industries may be necessary. That could help make the new policies politically feasible and ease the transition for any affected workers⁶⁴.

Green policies have a considerable potential to affect international trade. There has been evidence that import protection can be a viable way to promote local industries but only based on the assumption that there is no retaliation from trade partners. However, this assumption is unlikely to be realized under the current economic conditions⁶⁵. Cosbey argues that instead of using trade barriers, using subsidies can be more useful tools in spurring the growth of domestic green industries⁶⁶. It should be an important consideration to avoid violating WTO legislation while providing support to the domestic industries in order to avoid retaliation.

For green industrial policies to work effectively, it is also important that they are utilized only as a subset of a broader economic and industrial agenda. The success of industrial policies requires an effective policy framework that is conducive to improving economic competitiveness in general. These include the utilization of correct education policies to increase the supply of relevant skills within the workforce, adequate support for research and development efforts and the provision of adequate infrastructure⁶⁷.

Another key point to consider is that successful green policies should be country-specific, designed accordingly to each country's comparative advantage. It is important to identify the comparative

⁶² The World Bank, 'Inclusive Green Growth, The Pathway to Sustainable Development' (2012), p.30

⁶³ Decaillon, Joël and Panneels, Anne, 'Climate change, the industrial policies and the ways out of the crisis' (2010), pp. 73-75

⁶⁴ Schwarzer, Johannes, 'Industrial Policy for a Green Economy' (2013), International Institute for Sustainable Development, p. 27

⁶⁵ Ibid.

⁶⁶ Cosbey, Aaron, 'Green Industrial Policy and the World Trading System' (2013), pp. 8-10

⁶⁷ Schwarzer, Johannes, 'Industrial Policy for a Green Economy' (2013), International Institute for Sustainable Development, p. 27

strengths of a market and devise policies aimed at benefitting from those strengths. The conditions and the strengths of Turkey should be analyzed before designing a comprehensive green industrial strategy for Turkey. By virtue of geographical location, there is ample opportunities for Turkey to develop renewable energy sources like solar and wind energy. There may also be opportunities for the manufacturing and the exporting of renewable energy components for the country, especially when the proximity of the European market is considered. If Turkey can develop a potent manufacturing industry for renewable energy components, it can potentially function as a driver of job creation and economic development for the country. There is also a significant potential for energy efficiency improvements in the country which can be realized with the right policies. Finally, there is a need to develop an effective climate change adaptation policy for the country which is set to be significantly affected from climate change externalities in the coming decades. An important step has been already taken in this regard with the preparation of 'Turkey's National Climate Change Adaptation Strategy and Action Plan' on 2012, in collaboration with the UNDP⁶⁸.

With the declaration of the Paris Agreement, it has once more become clear that the world is moving towards a cleaner economy. Reportedly, 58.5% of all the net additions to the global power capacity consisted of renewable energy sources on 2014, with much higher percentages for many countries in the world⁶⁹. This figure alone shows the direction that the world is heading towards and the acceleration of the growth in green industries. It is important for Turkey to devise its growth policies accordingly in order to benefit from this momentum and to avoid being locked in a fossil fuel based economic growth pathway.

⁶⁸ Turkish Republic, Ministry of Environment and Urbanization, 'Turkey's National Climate Change Adaptation Strategy and Action Plan'(2012)

⁶⁹ Renewable Energy Policy Network for the 21st Century Steering Committee, 'Renewables 2015 Status Report'(2015), p. 30