



Munich Personal RePEc Archive

# **Transition towards renewable energy supply in Croatia**

Vidakovic, Neven

Effectus University College for Finance and Law

July 2014

Online at <https://mpra.ub.uni-muenchen.de/63957/>  
MPRA Paper No. 63957, posted 29 Apr 2015 09:26 UTC

## **Transition towards renewable energy supply in Croatia**

### Summary

This paper analyses the current state of the renewable energy in Croatia and proposes what can be done to speed up the process of transition towards the increase in consumption of renewable energy in Croatia. The process of transition is analyzed from the perspective of three main participants who are relevant for the process: academic researches, government as policy makers and investors. The paper finds that the academic research has done a significant progress towards renewable energies and has thoroughly researched many opportunities for renewable energies in Croatia, but lack of clearly defined government policies has hindered investors and new projects. In several cases the policies are obsolete or undefined. There is a need for fast and focused government action. Because of the short time span, large scale strategies should be avoided and project-focused policies should be implemented. This paper proposes several actions which could be implemented in a short time span to make the Croatian transition towards renewable energy faster.

JEL: Q28, H23, H54

Key words: renewable energy, strategy, economic policies

NEVEN VIDAKOVIĆ

Effectus University College for Law and Finance

Trg J.F.Kennedy 2,

10000 Zagreb

Croatia

nvidakovic@vsfp.eu

## 1. Introduction

The main objective of this paper is to present a framework for Croatia to increase its use of renewable energy (RE). This process can also be called a transition towards renewable energy sources. However, this transition process has to be broken down into several different but strongly related parts, which all have a significant impact on the increase in the production of energy from renewable sources. In order to build an analysis framework, we have to consider both the macro and the micro perspective on the problem.

From the macro perspective, there are current and expected market conditions regarding the economic situation in Croatia and how it will develop in the next few years. The current economic crisis presents a significant constraint concerning the process of increasing the use of renewable energy sources. Apart from the existing internal macro constraints, there are expectations regarding the exogenous tasks imposed by the EU as presented in the Europe 2020 plan. This plan makes clear demands for the use of renewable energies.

From the micro perspective, there are issues regarding which sources of renewable energy to use (sun, wind, water) and through which projects the goals set can be achieved. A micro framework is also important in terms of who will fund the investments and from which sources. There is also a need for a considerable amount of preparation in terms of locations, investment plans and energy grid capacities. Therefore, any general goals and objectives need to have strongly developed micro support and infrastructure.

The two perspectives on renewable energy in Croatia can also be presented from the viewpoint of the three main participants in RE in Croatia. Those three participants are the Government, the academic community and investors. The Government is in charge of the policies and laws pertaining to RE in Croatia. The main role of the Government in the process should be to facilitate the investors and create solid foundations for investments in RE. The second participant is the academic community in Croatia, which should be responsible for the research on the potential of RE and the possible environmental and economic impacts of RE on the Croatian economy. A special focus of the academic community should be the impact on the environment, but the main challenge lies in the interdisciplinary approach, which has to combine economics, ecology and engineering. The third and possibly the most important group of participants in the RE process is the investors, who are supposed to invest in RE projects in order to increase the RE production in Croatia. The investors need to have profitable projects and clear financing facilities.

All of the above participants have equal weight and importance. In this paper, we aim to investigate the current state of each of the aforementioned participants, how the participants can be brought together and how the targets set for the Croatian economy in terms of renewable energy sources can be achieved.

This paper is separated into the following parts. The second part provides a short macroeconomic overview to allow a full understanding of the harsh economic conditions that Croatia is facing. Part three presents the current state of energy consumption in Croatia and the long-term importance of increasing the use of

renewable energy in Croatia. Parts four and five present the achievements of the academic community and government policies in terms of RE. Part six addresses the discrepancy between the academic research and the government policies. Part seven proposes several clear policies that can be implemented in order to stimulate investments in RE, and part eight contains the conclusions.

## **2. Recent economic conditions**

The macro economy and the state of the fiscal policy in Croatia have considerably deteriorated during the recession. Consequently, for the general understanding of the Croatian economic environment, it is useful to present a brief overview of the impact of the crisis.

Croatia has been in recession for 5 years (2009–2013) and 2014<sup>1</sup> is expected to continue the trend. Overall, the GDP has decreased by 12% since the start of the crisis. The impact of the recession on investments has been greater. Using GDP data in terms of fixed 2005 prices, the gross investments as a percentage of the GDP were 31.5% in 2008 and 21.5% in 2013.<sup>2</sup> In terms of money, this is a 5 billion euro decrease per year. If we use 2008 as the base year and hold the investments constant as a percentage of the GDP, we can calculate the amount of money that was not invested in the time period 2009–2013 to be 21 billion euros. This number represents the value of investments lost due to the crisis. Therefore, the main long-term contributor to the crisis is the decrease in investments. It is clear that the investments have to be the main contributor to the economic growth that will end the recession.

A similar analysis can be performed with the total value of the GDP. The total GDP, in 2005 prices, in 2013 was on par with the 2006 GDP, so Croatia has achieved no economic real growth for seven years. Given these conditions, it is exceptionally challenging to promote clean energy since clean energy projects are investment- and capital-intensive.

The decreases in the GDP and the recession have also been accompanied by a decrease in employment. During the crisis, in the time period 2009–2014, Croatia has lost 200 000 jobs, which is 13% of the total employment or 4.5% of the total population. These numbers clearly indicate the depth of the crisis in Croatia, which is so prolonged that it can be called a full-blown depression.

This short macroeconomic introduction was important in order to present clearly the principal macroeconomic constraint for any policy or development strategy. However, even given the prolonged recession and severe economic conditions, there are still economic tools that can be used through fiscal and monetary policy in order to increase the quantity of sources of renewable energy and in this paper we aim to propose several possible solutions.

## **3. Energy consumption in Croatia**

---

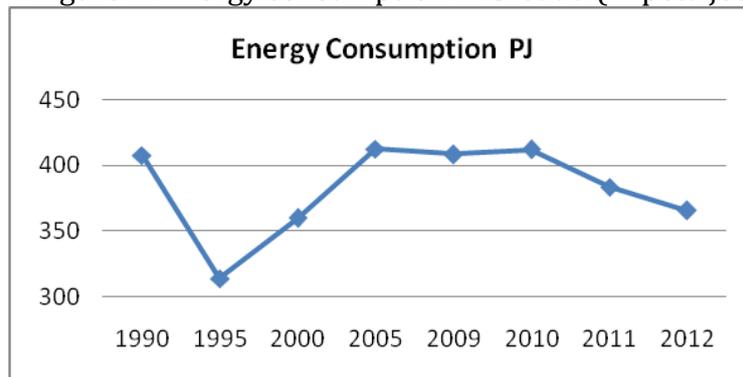
<sup>1</sup> The S&P rating agency estimates that Croatia's real GDP will also decrease by 0.5% in 2014.

<sup>2</sup> Data taken from the Croatian Statistical Institute ([www.dzs.hr](http://www.dzs.hr)) and calculated by the author.

We will now briefly review the energy consumption and energy dependence to determine the potential of renewable energy in Croatia. The consumption of energy in Croatia has not had a clear constant over the last 25 years. Figure 1 shows that the energy consumption is unsurprisingly heavily dependent on the political and economic conditions.

The decrease in consumption during the period from 1990 to 1995 can be attributed to war, while the decrease in the period from 2010 to 2012 can be attributed to the deterioration of economic conditions due to recession. Industrial production has decreased by ca 15% since 2008<sup>3</sup> and this has decreased the energy demands.

Figure 1: Energy consumption in Croatia (in peta joules)

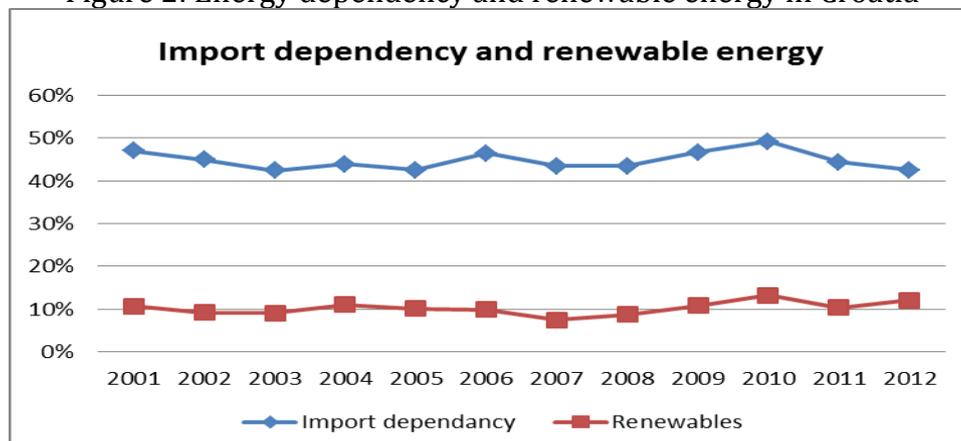


Source: Energy in Croatia

From the perspective of this paper, it is necessary to verify the current state of renewable energy in Croatia and how RE affects the Croatian dependency on energy imports.

Figure 2 presents the importance of energy imports for Croatia in the time period 2001–2012. The variable import dependency was obtained by using the following formula:  $(\text{energy imports} - \text{energy export}) / (\text{total inland consumption})$ . As we can see, about half of the energy needs are produced in Croatia and the rest is imported.

Figure 2: Energy dependency and renewable energy in Croatia



Source: Energy in Croatia

<sup>3</sup> Data taken from the CNB Bulletin.

The second variable is renewables; this is the percentage of the renewable energy produced of the total inland consumption. What is clear from Figure 2 is that Croatia has a great need for energy imports and that it is energy-dependent, but at the same time very little energy is obtained from the RE sources. Therefore, there is clearly potential for investments in RE and for RE to be used to decrease the Croatian dependency on imported energy.

Following this basic overview of energy consumption in Croatia and the current level of RE in Croatian production, we will split our analysis into two fronts. First, we will present the efforts made in terms of research and the importance of RE and then we will analyze the government's actions to bring together the academic research and actual business projects.

#### **4. Research on the renewable energy potential in Croatia**

In order to understand fully the importance of the transition of Croatia towards RE, we can start with the study by Pašičko and Vlašić (2010), which projects that the potential of new jobs from RE sources could be 14 500 new jobs created directly and another 58 000 jobs created indirectly from RE investments. Together, these amount to more than one-third of the total jobs lost during the recession. This analysis creates another dimension to RE energy, in which renewable energy is not just a source of energy, but a large opportunity to create new jobs.

We can separate the approach to the research on the potential of RE in Croatia into two separate segments. The first segment is the macro segment, which deals with broader issues of energy and the Croatian economy in general. The second approach to research focuses on one specific topic or issue.

An example of the macro approach to RE in Croatia can be found in the work by Vitaljić (2006), who has an ambitious agenda. In this master's thesis, Vitaljić investigates the potential of RE to decrease the total emission of CO<sub>2</sub>. Through scenario tests, Vitaljić investigates the CO<sub>2</sub> emission in Croatia. Another example of this broad kind of research is provided by Duić et al (2012), who investigate Croatia and the Kyoto Protocol.

However, for our research, a much more important approach is the micro approach, which focuses on very specific and focused problems dealing with renewable energy in Croatia.

The potential of RE has been investigated in terms of use on isolated islands as well. For example, Bačelić et al (2013) investigate what can be undertaken in terms of RE on Hvar, a remote island in the Adriatic Sea. The main conclusion of the paper is that RE should be the main source of energy on most Croatian islands. The use of RE can lead to the total energy independence of Croatian islands. Although this research focuses on Hvar, similar scenarios can be used on other islands.

Ridjan et al (2013) investigate the possibility to incorporate RE energy into transportation systems. The previous research was conducted on a geographically specific area; this research is an example of target-specific research oriented towards what can be achieved when focusing directly on one sector of the economy.

While the previous two research examples investigate the possibility of RE in terms of supply, Pukšec et al (2013) examine the energy demand of the Croatian transportation sector. Other sector-oriented research relating to energy demands can be found in Pukšec et al (2013), who investigate the energy demand of households in Croatia, or Irsag, and Pukšec and Duić (2012), who explore the use of energy in tourism and the potential for energy savings in the tourism sector.

Pukšec and Duić (2011) provide an overview of the efforts made in the agriculture industry in terms of biogas and the potential of biogas in the Croatian farming industry. Croatian agriculture is experiencing a decline in terms of the share of GDP; agriculture declined from 5.38% of the GDP in 2000 to 3.97% of the GDP in 2013. This paper indicates the unexplored potential for Croatian agriculture. Pukšec and Duić's (2011) paper also opens up the broader topic of the use of government subsidies for agriculture and how subsidies could be directed into other related areas and not just crops.

Even from this brief overview of the state of the research in Croatia, it is clear that the academic community has played its part in contributing to the implementation and the increase of RE in Croatia. However, the main problem remains on the side of the government and what it is contributing to RE.

## 5. Government strategies and the relation with renewable energy

One of the aspects of joining the EU is the demands made by the EU for clear leadership and directions in all key areas. Consequently, the EU is trying to create long-term targets and projections in order to bring the EU member countries together. The main objectives of the EU in terms of the time horizon can be found in the EU plan Europe 2020. This long-term plan has five main targets:

1. Employment: 75% of 20–64 year olds to be employed
2. Research and development: 3% of the EU's GDP to be invested in research and development
3. Climate change and energy sustainability: greenhouse gas emissions 20% (or even 30%, if the conditions are right) lower than 1990, **20% of energy from renewables**, a 20% increase in energy efficiency
4. Education: reducing the rates of early school leaving below 10%; at least 40% of 30–34 year olds completing tertiary-level education
5. Fighting poverty and social exclusion: at least 20 million fewer people in or at risk of poverty and social exclusion

Europe 2020 clearly states that in EU countries 20% of the energy should come from renewable sources. However, in reality, this calculation is not exactly 20% of the energy used in each country, but a complex calculation based on the starting position of each country and the per capita contribution. Therefore, each country has a different target and the total target for the EU should be 20%. The actual figure for Croatia has not

yet been defined.<sup>4</sup> In order to achieve these aims, Croatia has produced three important strategies, which should, if implemented, make sure that Croatia achieves all of the above-stated targets. The three main strategies are:

- The Croatian Strategy for Education, Technologies and Science
- The Croatian Industrial Strategy 2014–2020
- The Croatian Strategy for Energy Development

The Croatian Industrial Strategy 2014–2020 and the Croatian Strategy for Education, Technologies and Science were created and presented in 2013 and 2014, respectively, while the Croatian Strategy for Energy Development was presented in 2009.

Although the Strategy for Education, Technologies and Science is not directly connected to renewable sources of energy, it is important because of the sources of future labor for the renewable energy industry. The education strategy heavily emphasizes the importance of research and the connection of scientific research and scientific institutions with industry. From this strategy, it is clear there is a long-term objective to make the Croatian scientific community a source of new knowledge for the industry. For Croatia, for the transition towards increasing the use of renewable energy, such support from the academic community is important. In the previous chapter, we saw that in terms of research on renewable energy, the Croatian academic community has contributed its share.

The Croatian Industrial Strategy clearly states that there is a need for renewable sources of energy. This is not just due to the EU goal, but is a necessity for Croatia. Since Croatia is not able to satisfy all its energy needs from fossil fuels, there is a need to develop renewable sources of energy in order to increase Croatia's energy independence (page 61 of the Industrial Strategy). There are numerous mentions of renewable sources of energy in the Industrial Strategy; there is also a table presenting clear objectives for which EU funding (page 82 of the Industrial Strategy) could be obtained for renewable energy projects. However, in the rest of the strategy, there are no other quantifiable data regarding how the renewable energy industry can help Croatia or what can be achieved in terms of employment or GDP growth if considerable investments are made in renewable sources of energy. There is also no mention of specific RE industry projects or investments.

On the other hand, the Croatian Energy Strategy places considerable emphasis on renewable sources of energy. Throughout the strategy, there are numerous references to how renewable energy could be used or the possible investments in RE projects, especially in water power plants. However, the Energy Strategy was developed mostly in 2008 and officially adopted in 2009, when the economic crisis had just started. The creators of the strategy did not take into consideration a prolonged recession and the effects of a recession on the Croatian economy. With the change of government in 2012, some energy projects were initiated, such as the water power plant Ombla. However,

---

<sup>4</sup> These data were taken from the Europe 2020 website ([http://ec.europa.eu/europe2020/europe-2020-in-your-country/hrvatska/progress-towards-2020-targets/index\\_en.htm](http://ec.europa.eu/europe2020/europe-2020-in-your-country/hrvatska/progress-towards-2020-targets/index_en.htm)). As of May 1, 2020, the national energy target for Croatia is stated in the national targets as undefined.

due to bureaucratic procedures and environmental concerns, most of those projects have been put on hold. Because of the change of government and unclear statuses for energy projects, the Energy Strategy is of little impact or consequence at this point in time.

From this, we can see that the Croatian Government has achieved very little in terms of renewable energy. Because of the recession, the Energy Strategy needs to be completely redefined to include the new economic circumstances. The Industrial Strategy has to be augmented with clearer and more precise projects to involve RE in order to attract investors. The fact that Croatia has put major projects and investments on hold, like the project Ombla, makes government-sponsored transition towards renewable energy sources highly unlikely.

## **6. Discontinuity between the government and science**

The last two chapters have presented us with the main problem of RE in Croatia. On one side, there is the academic research, which has been thorough and focused on energy problems in Croatia. On the other side, there is the Government and its policies, which are clearly lagging.

The government documents are strategies that make little contribution in terms of the state of the real world and lack focused implementation. The implementation of any strategy and therefore the achievement of the Europe 2020 targets are also in question because of the time constraint. The Europe 2020 targets are targets that require several years of planning and implementation. At this point in time, in the year 2014 or the year 2015, a country should be well into the implementation stage of policies, not at the planning stage or, as presented in terms of the Energy Strategy in Croatia, practically at the beginning stages of implementation. Considering a time span of just six years before the Europe 2020 targets have to be reached, it is hard to believe that Croatia can, at least in terms of energy targets, move from the strategy creation stage towards target achievement.

However, the situation is not lost or incredibly complex. As this paper has presented, there is an existing body of research that can be implemented in order to move more quickly towards the Europe 2020 targets. Nevertheless, in order to benefit from the scientific research completely, investors need to see investment opportunities in renewable energy in Croatia. To achieve the targets, the Government has to move from the planning state into the fast implementation state and that cannot be achieved without clear and targeted government policies.

## **7. Proposals for increasing renewable energy projects**

So far, this paper has presented the clear potential for RE energy in Croatia since Croatia is energy-dependent. It has also shown that there is a discrepancy between the state of the academic research, which is highly advanced, and the government strategies, which are either obsolete or undefined. The Government is still in the planning stages, while it should be in the implementation stages. The only way to move the Government from planning to action is to implement clear and targeted policies to foster the growth

of RE investments in Croatia. This part of the paper will present several possible proposals to speed up the investments in RE in Croatia.

As presented in the Europe 2020 plan, renewable energy is a long-term strategic target for the EU and therefore for Croatia as well. If Croatia has a clear stance that renewable energy is an important product and project, then there has to be clear support for this policy direction from both the monetary and the fiscal side. Considering the short time span, it is important for Croatia to focus on the execution of the projects and not on cumbersome strategic planning.

To achieve a full transition to large-scale consumption of RE, there are several policies that could be implemented. The policies presented here are focused, targeted and easily executed policies that could be used in order to speed up the process of creation of new energy sources. The proposals here are concrete, matter-of-fact proposals and not abstract notions about the strategic planning needed. We shall start with the monetary policy and banking industry.

**The monetary policy** in Croatia does not directly control banks' credit policy. However, the capital adequacy rules, which are proscribed by the Central Bank, can be used effectively to stir banks' decisions in order to increase or decrease certain credits in the banks' balance sheet. Currently, there are no distinctions in terms of capital adequacy when it comes to loans for RE. The Croatian Central Bank could introduce a new capital adequacy ponder for loans for RE projects. This new capital adequacy ponder should be 0 or 0.2 so that the banks have very few or no capital demands on RE projects.

In November 2013, the Croatian Central Bank proposed a decrease in regulation, which was conditioned on the increase in loans. However, the measure has had a limited result, as described by Vidaković and Zbašnik (2014). A similar measure could be used in the case of renewable energy. There could also be a decrease in regulation for loans used for renewable energy projects. For example, loans given for renewable energy projects could be used as a deduction from the reserve requirement. This would significantly decrease the cost of funds for the banks, consequently decreasing the interest rates and making RE loans more attractive.

**The Croatian Bank for Reconstruction and Development (HBOR)** can also be used to fund loans for RE projects. HBOR operates lending projects for RE energy sources and the funds can be obtained directly from HBOR or from a commercial bank, but those projects are only available to corporations or local government, not to individuals. In addition, there are specifications regarding the project's purpose – wind or solar energy – or project scale – small business or households. For RE to be fully implemented as an investment opportunity, specialized projects are needed in order to stimulate lending for specific purposes and specific clients.

HBOR could also give loans to banks with the purpose of funding renewable energy projects and the Croatian National Bank should exclude this type of funding from the reserve requirement, making the cost of funds smaller for individual banks.

Currently, the **banking industry** in Croatia does not have large-scale credit plans in order to fund RE. This is clearly indicated in terms of banks that are part of large international conglomerates. For example, Privredna banka Zagreb is a member of the Intesa Sanpaolo banking group and Privredna banka Zagreb does not have any special loans or credit facilities for RE projects. At the same time, Banka Koper, which is a

member of the same banking group in Slovenia, has specialized loans for solar panel projects. The same banking group has different banking products in two different countries. This is a clear indication that the banks in Croatia do not view RE projects as worth funding. Therefore, a push from external sources, i.e. the Central Bank or the Government, is needed in order to increase the lending for RE.

The majority of funding for RE projects has to come from commercial banks, but as we have presented, there is an important role to be played by the Central Bank and HBOR. A combination of the proposed measure from the Central Bank with HBOR funding could be that push for the banks to start funding RE projects in Croatia.

**Government policies** can also contribute to increasing the investments in RE. In terms of the macro perspective, a new energy strategy is needed, which incorporates the existing economic conditions and proposes clear projects that can be implemented. The Energy Strategy from 2009 is a general document that does not have specific quantitative targets.

In terms of an economic policy for Croatia to increase the importance of RE in the Croatian economy, the basic approach is usually the simplest: a tax policy. The Croatian Government should foster RE investments through tax deductions, tax subsidies and lower tax rates. Furthermore, the household individual solar panel project, which was started by the Croatian Electrical Company (Hrvatska elektroprivreda), was abandoned. This project has to be reinstated. The starting of the subsidized solar panel project for households and then the abolishment of this project is a clear example of the lack of general direction and focus on the part of the Government.

Another clear government policy that can be used is government subsidies. By restructuring to whom the subsidies are given, the Croatian Government could entice investments into RE. For example, moving subsidies from the shipyards and agriculture to RE could produce a considerable increase in the RE investments in Croatia; however, when and if this measure will be implemented remains to be seen.

Regarding the possibilities from implementing focused policies, a great suggestion was given by Pukšec and Duić (2011), who investigated the potential for methane production from farms. Directing subsidies from crops into the production of biogas plants can result in a more effective distribution of government subsidies. Redirecting subsidies towards another economic activity is just one of the possibilities whereby the Government can increase the RE energy in Croatia without increasing the cost or the government expenditures.

## **8. Conclusion**

The main objective of this paper was to define the involved parties and try to establish what each of the participants in the process of transition towards renewable energy has achieved so far.

There is a clear objective in terms of RE in Croatia. This objective was given exogenously to Croatia from the EU. However, there are several important constraints that Croatia is facing when it comes to the implementation of the EU plans.

One major constraint is the lack of a clear energy strategy. The last Energy Strategy was created in 2009 and it did not take into effect the prolonged economic recession

that Croatia is experiencing. The existing Energy Strategy also does not have clear projects, participants and deadlines. Therefore, a new strategy is needed, one that takes into consideration the current economic conditions.

Most work on moving Croatia closer to the objectives was undertaken by the academic community. From the academic perspective, the possibilities of RE in Croatia have been heavily researched, both on the supply side and on the demand side. Thus, there are opportunities to implement RE in Croatia. There is research clearly showing that RE could be a great source of new jobs. In spite of all this, the Government has done little to improve the RE and the use of RE in Croatia, since the Government is still in the stages of planning and creating strategies, not executing them. There are three main strategies that pertain to renewable energy, but that is all. In addition, the strategies themselves are not at the implementation stage, but at the discussion stage. The most important of them, the Energy Strategy, is obsolete, and given the existing economic conditions, it cannot be implemented.

The lack of government action has also discouraged private investors, who are not interested in investing in renewable energies. The best example of the difference between what the RE industry is doing and what the Government is doing was given at the Brown Forum in Zagreb in April 2014, by Mark Crandall, the founder of Continental Wind Partners. Continental Wind Partners, as a clean energy-producing company, is involved in wind projects in almost every country in the region (Poland, Romania, Serbia and Bulgaria<sup>5</sup>), except Croatia. This clearly points to the problem of the connection between the Government and the possible investors.

Because of the lack of government interest, investment facilities are also rare and not defined by the banks, since the banks do not have clear lines of credit for investors in renewable energy projects.

Considering the existing state of renewable energy in Croatia, it is clear that the path should be as follows. Academia has played its part; now the Government should abandon its lengthy strategies and focus on projects that will bring Croatia closer to the Europe 2020 plan. In addition, the monetary and fiscal policies should play their part by creating financial facilities for investors. Some proposals regarding those facilities were made in this paper as well.

### **Bibliography:**

Bačelić Medić, Z., Ćosić, B., Duić, N. (2013) "Sustainability of remote communities: 100% renewable island of Hvar" *Journal of Renewable and Sustainable Energy* volume 5, issue 4;

CNB *Bulletin* (2014) Croatian Central Bank Bulletin number 202 <http://www.hnb.hr/publikac/bilten/arhiv/bilten-02/hbilt202.pdf>

*Energy in Croatia 2012* (2014) Annual energy report, Ministry of Economy, Zagreb 257 pages

*Draft of the proposal for the industrial strategy of Republic of Croatia 2014.-2020* (2014) Ministry of Economy <http://www.mingo.hr/default.aspx?id=4980>

---

<sup>5</sup> <http://www.continentalwind.com/overview>

- Duić, N., Juretić, F., Zeljko, M., Bogdan, Ž., (2005) "Croatia energy planning and Kyoto Protocol" *Energy Policy* 33-8, 1003-1010
- Irsag, B., Pukšec, T., Duić, N., (2012) "Long term energy demand projection and potential for energy savings of Croatian tourism-catering trade sector" *Energy* 48, 1; 398-405
- Pukšec, T., Krajačić, G., Lulić, Z., Mathiesen, B. V., Duić, N., (2013) "Forecasting long-term energy demand of Croatian transport sector" *Energy*. 57 ; 169-176
- Pukšec, T., Mathiesen, B. V., Duić, N., (2013) "Potentials for energy savings and long term energy demand of Croatian households sector" *Applied energy*. 101 ; 15-25
- Pukšec, T., Duić, N. (2011) "GeoFigureic distribution and economic potential of biogas from Croatian farming sector" *Chemical Engineering Transactions* 25; 899-904
- Ridjan, I., Mathiesen, B. V., Connolly, D., Duic, N., (2013) "The feasibility of synthetic fuels in renewable energy systems" *Energy*. 57; 76-84
- Robert P., Sandra, V. (2010) "*Green jobs in Croatia*", UNDP Croatia 2010.
- Strategy of Croatian energy development* (2009) Narodne novine number 130, October 2009
- Strategy of education, science and technology Ministry of Science, Education and Sport* (2014) [http://www.vlada.hr/hr/preuzimanja/strategije/strategija\\_obrazovanja\\_znanosti\\_i\\_tehnologije\\_radni\\_materijal\\_rujan\\_2013](http://www.vlada.hr/hr/preuzimanja/strategije/strategija_obrazovanja_znanosti_i_tehnologije_radni_materijal_rujan_2013)
- Vidaković N., Zbašnik D. (2014) "New CNB measures to stimulate credit growth: problems and solutions" *Bančni Vestnik* March 2014, pages 13-17
- Vitaljić, N. (2006) "Potential of renewable energy sources in reduction of CO2 emissions", MSc thesis, FSB, Zagreb, 132 pp. [http://powerlab.fsb.hr/neven/pdf/supervision\\_of\\_msc\\_thesis/21\\_02\\_2007\\_Vitaljic\\_magistarski\\_rad.pdf](http://powerlab.fsb.hr/neven/pdf/supervision_of_msc_thesis/21_02_2007_Vitaljic_magistarski_rad.pdf)