Vassiliko Cement: Is There a Business Case for a Green Energy Project?

Introduction

October 13th, 2018, Cyprus. It was a sunny Saturday morning, and George Savva was reading local newspapers over a cup of morning coffee. A headline from *Financial Mirror* caught his attention:

Rarely has a half degree meant so much to humanity

The author was writing about the worrisome consequences of climate change and the importance of limiting global warming to 1.5 degrees instead of 2 degrees above the levels recorded in the pre-industrial era. He was referring to the latest report by the Intergovernmental Panel on Climate Change (IPCC) and urging to stop "behaving as if we had plenty of time" (see the highlights of the report in **Exhibit 1**). The author concluded his article by asking how we could "succeed in discarding the dogma that taking action now will be too expensive" (Rokke, 2018). The latter echoed very much with Mr Savva's own thoughts. As the Deputy General Manager and CFO of Vassiliko Cement Works (VCW), the leading industrial energy consumer in Cyprus, he was involved, together with a team of engineers, in preparing a feasibility study for a green energy project: Vassiliko Cement wanted to build its own photovoltaics park to contribute to the reduction of carbon dioxide (CO2) emissions. VCW was the biggest consumer of electricity in Cyprus. A switch towards clean solar energy instead of continuing to rely on electricity produced using conventional fuels was one of the fundamental principles of the company's recently adopted energy management policy.

Feeling enthusiastic about this project because of its positive impact on environment, Mr Savva had however to investigate its impact on the company's finances. *"Initially, when we began our first studies for this project at the end of 2016, there was reluctance to invest in this project because the power was so cheap. The difficulty was to have people understand what will happen in three years, five years, ten years… Usually human brain is not very good at looking into the future,"* commented Mr Savva. He had to prepare realistic financial projections for a 20-year period as well as suggest appropriate financing options and list possible risks. The Board was waiting to see if there was indeed a strong business case for this green energy project.

Vassiliko Cement: Company History and Current Strategy

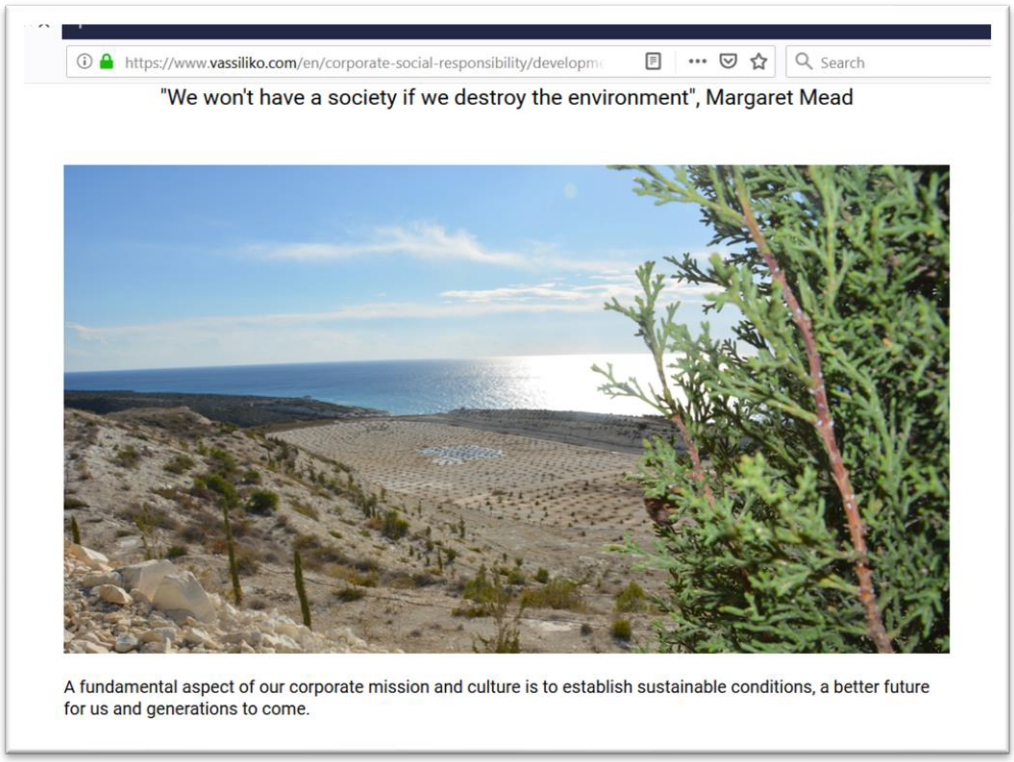
Vassiliko Cement Works (VCW) was established in Cyprus in 1963 by Hellenic Mining Company and started the operation of its first 150,000-ton production facility in 1967. The adjacent Vassiliko Port began its operation in 1984 enabling the company to better serve its international customers and facilitating the imports of raw materials. Vassiliko Cement soon developed into a largest cement producer in the region. A publicly listed company from 1996, the VCW's main shareholders included the Holy Archbishopric of Cyprus - directly (19.52%), the Holy Archbishopric of Cyprus - indirectly (through KEO Plc) (6.49%), Heidelberg Cement AG (25.98%), the Cyprus Cement Public Company Ltd (25.30%), Anastasios G. Leventis Foundation (5.34%) and the public (17.37%).

Located on a beautiful Mediterranean island of Cyprus, a well-known tourism destination, Vassiliko Cement from its early days had been focused on the protection of the natural environment. In 2002, the company installed a new type of cement mill contributing to CO2 emissions reduction. In 2011, VCW launched the new best available technology clinker production line with a capacity of 6,000 tons per day. The installation of this state-of-the-art clinker plant, fully compliant with new European standards, contributed significantly to improving environmental performance, reducing production costs as well as increasing the production capacity of the company to two million tons annually. The VCW's production unit was the largest single line in Europe, among 310 factories in 33 countries. Furthermore, an alternative fuels and raw materials feeding system was installed in 2015 (Vassiliko – Milestones, n.d.).

> *"Vassiliko Cement as one of the largest heavy industries in Cyprus, continuously strives to develop across all levels of its operations, whilst upgrading and investing in line with the latest in environmentally friendly technology. It has adopted as its fundamental principles, the ongoing quality improvement of its products, with the aim to be recognized as offering the best customer experience. These principles are inextricably linked to the achievement of its strategic goals."* (Vassiliko – Strategy, n.d.)

The company's web site highlighted that a fundamental aspect of their mission and culture was to establish sustainable conditions and a better future for generations to come (see **Figure 1** below).

Figure 1. Vassiliko – Environment Oriented Development (print screen from the web site)



Source: Vassiliko – Environment Oriented Development (n.d.)

VCW had been investing in major works of European standards, which improved environmental practices and performance, reduced cost production and upgraded capacity and capability. In its commitment in progressing across all levels – entrepreneurship, technology and environment - the company applied prevention policies with the involvement of all employees, in the following key areas:

- Health & Safety Policy
- Energy Management Policy
- Corporate Responsibility Policy
- Environmental Management Policy
- Quality Policy
- Privacy Policy

In 2016, VCW issued its first *Corporate Responsibility and Sustainable Development Report for the year 2017,* which opened with the message from the Executive Chairman:

> *"... Amongst other parameters, the company currently perceives Corporate Social Responsibility as an all-time value governing decision making, not only in relation to financial factors but also on the basis of its activities which have a long term social and*

environmental impact. Our commitment to sustainability, adhering faithfully to our priorities, adapting to changes, processing new solutions and seeking innovations without backtracking on our values is part of our Mission."

Amalas Photovoltaics Project

In line with its energy management policy, in October 2016, VCW initiated the studies for the construction of a photovoltaics (PV) park in Amalas, which was the area of inactive quarry, about 8 km from the Vassiliko plant. The available plot of 250,000 sq. m. belonged to VCW and was not used. The area was rather remote and abandoned, with a relatively low land value. It was adequate for the construction of a solar park of 8-10 MW (megawatt), which required 100,000 sq. m. The first step was to conduct technical studies and to get approvals from several bodies, such as the Electricity Authority of Cyprus (EAC), the Cyprus Energy Regulatory Authority (CERA) and the Cyprus Ministry of Energy, Commerce and Industry.
At the time, the electricity generation in Cyprus was effectively a monopoly by the state-owned EAC, and VCW was its biggest customer and the only consumer in Cyprus that used the high voltage tariff. The government was committed however to plans to open up the electricity market to private companies, scheduled for summer 2021. It was the CERA's task to facilitate this transition. Encouraging the use of renewable energy sources (RES), such as solar power, was another important task of the CERA. **Exhibit 2**, at the end, presents the information posted at the CERA's web site explaining about the RES and their advantages.

The EAC also promoted renewable energy sources (EAC – Information on RES, n.d.), but in fact it lagged dramatically in switching to RES: it generated 92% of its power from power stations that were using conventional liquid fuel. The Cyprus government encouraged private companies to bid for RES projects. The government however had fallen behind the EU requirements to convert 13% of the energy output by 2020 to generation from RES (European Commission, n.d.). In 2017, the share of energy from RES was 9.9% of the gross final energy consumption in Cyprus. It was the 5th lowest rate in the EU. The EU average was 17.5%, while the highest share of RES was in Sweden (54.5%) (Eurostat, 2019).

"The target for Cyprus is to generate 240 MW from RES by summer 2020, but by autumn 2018 the approved projects accounted for only 60 MW. One such approved project is our Amalas photovoltaics park, approved by the EAC for a maximum capacity of 8 MW. The biggest photovoltaics park in Cyprus is currently of 4 MW, in the Frenaros area, run by the private company GDL. When in operation, Amalas PV park will cover approx. 8% to 10% of the VCW's annual electricity demand, which currently stands at 150 million KWh," explained Mr Savva.

He continued: *"Our Amalas PV park will be connected to the EAC grid and will be effectively an independent power producer. For Vassiliko, it will mean that about 10% of our electricity needs will be soon covered via clean solar energy – meaning zero emissions. Keep in mind that the EAC emissions are around 730kg CO2 and the fuel used is around 245kg per MWh produced. Since our electricity consumption is the highest in Cyprus, we think this is an important project, along with our other measures to reduce CO2 emissions such as, for example, using alternative fuels for the production of cement in our plant. By using alternative fuels, which are essentially different types of treated streams of waste that fulfil certain physical and chemical properties, we save fossil fuel, thus making cement production more eco-efficient. In fact, our alternative fuel project in cooperation with our Dutch associates N+P received the 1st award in the category 'Outstanding Alternative Fuel Project' at the Global CemFuels 2018 conference held in February in Germany. VCW was ranked 2nd in the category of companies that use alternative fuels – 'Global Alternative Fuels Using Company of the Year'. With the Amalas Project, we continue our efforts to reduce carbon emissions. Every effort counts, I believe."*

Financial Appraisal for Amalas Project

The Amalas Project feasibility study was expected to be completed in January 2019, and the financial plan under the responsibility of the CFO was an important element of the study. *"Creating a projection of cash flows for a 20-year period is not an easy task because inevitably you need to rely on a number of assumptions about the future. The quality of the financial appraisal depends on the quality of the assumptions, and you choose those that seem most reasonable at the moment, but also the quality of the appraisal will depend on the ability to foresee future trends as well as anticipate the risks,"* emphasized Mr Savva. He had been with Vassiliko Cement since 2001 and had supervised many various projects of the company.

Table 1 below presents some the key financial inputs. To come up with the inputfor the average future EAC fuel price, Mr Savva had to look at the behaviour of this price in the past (see **Figure 2)**, think of future trends and evaluate the outcome of different possible scenarios with more favourable or more adverse conditions.

Mr Savva explained further about the future EAC fuel price: *"The EAC fuel price is comprised of all fuel costs plus environmental costs that relate to CO2 emission rights. The latter have had a dramatic price spike in the last two years: increasing from €5 to €25 per emission allowance. You can find online the prices for emission allowances - EUA Futures - traded at the Intercontinental Exchange (ICE)* https://www.theice.com/products/197/EUA-Futures/data?marketId=5115274&span=3. *For those not familiar with the market for emission allowances: it is an important element of the EU drive towards cleaner energy sources and is called EU Emissions Trading Scheme (EU ETS). Introduced in 2005, it is a cornerstone of the EU's policy to combat climate change and its key tool for reducing greenhouse gas emissions cost-effectively. The EU ETS covers 11,000 power stations and manufacturing plants in 28 EU countries plus Iceland, Liechtenstein and Norway. The scheme is now in its third phase: 2013-2020. The idea is that the businesses that are polluting the environment have to buy an increasing proportion of their emission allowances at market price. In other words, EU is taking steps to give incentives to producers to switch to cleaner technologies and processes. Since Cyprus joined EU only in 2004, we are allowed, up till 2019, some freely allocated allowances. We still need to buy additional emission rights above our allowances, and after 2019 it may be even a higher cost. The market price of allowances – otherwise known as the 'carbon price' – creates a greater incentive as it increases."*

Table 1. Key Inputs for the Free Cash Flow Projections

Average future EAC fuel price per ton	€	380
Basic EAC fuel price per ton used as the basis for electricity rates	€	300
Projected power generation for the 8 MW PV park in year 1, in KWh (kilowatt-hour) per annum		13,520,000
Yearly decrease in power generation due to solar panels degradation		0.5%
Annual operating expenses	€	80,000
Capex	€	8,000,000
Annual depreciation for 10 years	€	800,000
Tax rate		12.5%
Discount rate		7.0%

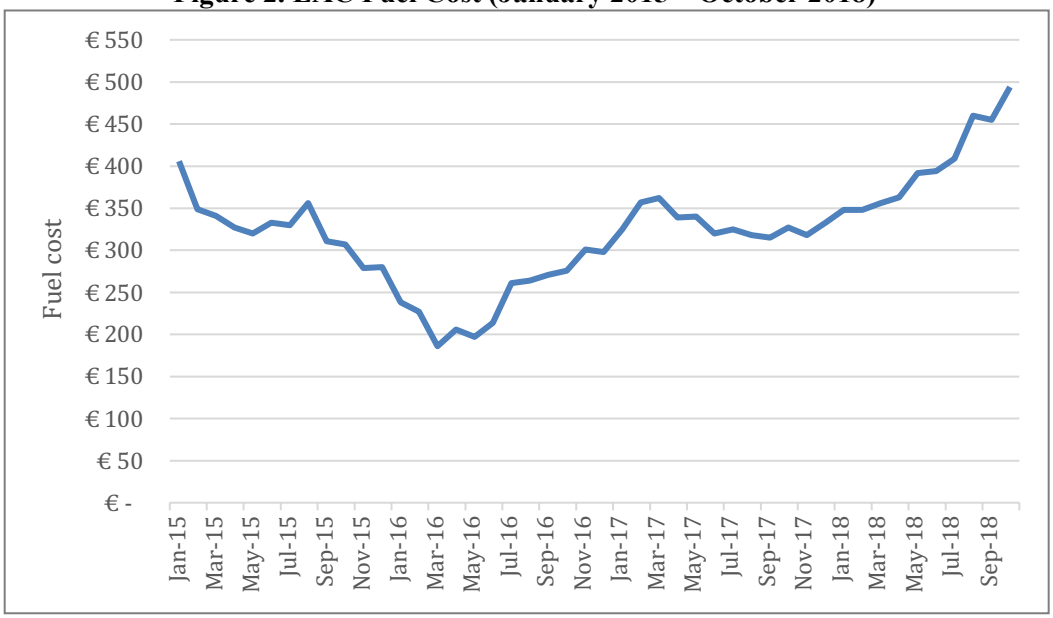
Source: From Company's Materials

The basic EAC fuel price per ton (used as the basis for electricity rates) was needed in order to calculate the power cost savings from running the solar park, i.e. net price benefit, or avoidance cost (the basic EAC fuel price per ton was €300, as shown in **Table 1**). Other inputs to estimate the net price benefit are presented in **Table 2** below. They show a typical monthly production profile of a

sample solar park in Cyprus, a smaller one as compared to the Amalas park planned by Vassiliko. The production profile was shown in KWh (kilowatt-hours) per month, so one could calculate the percentage of power generated in different months of the year (see **Table 2**). The peak of power generation by solar panels was expected in summer months, which were also the peak production months for cement industry and the peak price electricity tariff, and that was a very good match. To calculate the net price benefit, in the various fuel cost scenarios, the company used the coefficient of fuel adjustment of 0.00024 (showing for every 1 cent increase or decrease in the basic price of €300 per metric tonne of fuel cost – as specified in the EAC tariff):

Net price benefit, or power cost savings €/MWh = Electricity price in €/MWh + (Average future EAC fuel price – Basic EAC fuel price) × 0.00024 × 1000

Figure 2. EAC Fuel Cost (January 2015 – October 2018)



Source: Created by the author based on the EAC Fuel Cost (n.d.)

The formula used to calculate the power cost savings per month in Year 1 was:

Power cost savings per month in Year 1 = Net price benefit × (Projected power generation per annum for the Amalas PV park / 1000 × Monthly power generation in %)

Starting from Year 2 of the Amalas Project, the power cost savings were expected to be decreasing at the rate 0.5% p/a due to solar panels degradation (see **Table 1**).

The annual operating expenses included cleaning cost, operating and maintenance cost, and insurance. They were expected to be on average €80,000 per year. Capital expenditures (CAPEX) were expected to be around €8 million. They covered the costs of the design studies and permits, the electrical connection line, the road construction, and the installation of the PV park itself. The installation process was expected to be completed in about 4 months, by the end of 2019. The financial model assumed that the PV park would start generating cash flows from January of 2020 (=year 1). Annual cash flow projections would be developed. CAPEX were assumed as cash outflow in 2019 (=year 0). Most of the CAPEX amount would be paid out to contractors after completing the installation of the solar park.

Table 2. Monthly Production Profile of a Sample Solar Park (Historical Data)

	Current monthly power generation, in KWh	Monthly power generation in % to total per year	Electricity price during PV park generation, per MWh (megawatt-hour) – before grid charges, taxes and levies	Net price benefit/power cost savings, per MWh (megawatt-hour) – before grid charges, taxes and levies
Jan	550,000	6.3%	€ 72.71	€ 91.91
Feb	575,000	6.6%	€ 72.71	€ 91.91
Mar	725,000	8.3%	€ 72.71	€ 91.91
Apr	750,000	8.6%	€ 72.71	€ 91.91
May	775,000	8.9%	€ 72.71	€ 91.91
Jun	850,000	9.7%	€ 114.07	€ 133.27
Jul	900,000	10.3%	€ 114.07	€ 133.27
Aug	875,000	10.0%	€ 114.07	€ 133.27
Sep	825,000	9.4%	€ 114.07	€ 133.27
Oct	725,000	8.3%	€ 72.71	€ 91.91
Nov	625,000	7.1%	€ 72.71	€ 91.91
Dec	575,000	6.6%	€ 72.71	€ 91.91
Total	8,750,000	100.0%		

Source: From Company's Materials

The discount rate was somewhat arbitrarily chosen, without assurances that it was truly correct. Operating costs could also be higher. Fuel prices and capital expenditures were also uncertain. The technology for photovoltaics kept improving rapidlyand its cost had a downward trend in the last five years, it was possible that unexpected expenses would occur during the installation)

Amalas Project Financing

Vassiliko Cement had sufficient financial resources to undertake the investment of €8 million required for this project. The CFO was considering however that the company could take a bank loan. He knew that a local bank would be willing to offer favourable terms, i.e. finance up to 80% of CAPEX for this project (€6 million) at 3.0% interest rate via a 7-year loan. What would be then the annual loan payment and the loan amortization schedule?

Would the operating cash flows from the project be adequate to pay for this 3% loan? What would be in this case the projected total net cash flows to equity holders? Were there advantages to use loan financing in this case?

What if the company was unable to secure this loan, and had to pay 7%, for example? Would the operating cash flows from the project be adequate to pay for a 7% loan? What would be in this case the projected total net cash flows to equity holders?

Conclusion

Sharing the enthusiasm of the company's top management for the Amalas photovoltaics park project, the CFO had to prepare its full financial appraisal as well as consider its possible risks. Was there a strong business case for this green energy project?

The CERA's web site mentioned high investment costs for RES plants (see **Exhibit 2**), which was true. But the question was whether the benefits would exceed the costs. This would be in line with the most recent publications on the matter. For example, the International Renewable Energy Agency (IRENA) in the chapter that it wrote for the 2018 Global Innovation Index (GII) report, stated:

> *"The business case for renewable power generation is now unquestionable, with power generation costs now falling well within the fossil fuel cost range."* (IRENA, 2018)

The Agency at the same time admitted:

> *"Yet despite the strong business case, achieving the world's full resource potential requires a significant scaling-up of the share of renewable power in global electricity systems from a quarter today, to around 85 per cent by 2050. This requires efforts to promote systems integration by increasing the flexibility of power systems in supply and demand."* (IRENA, 2018)

The latter was a clear evidence that the dogmatic view on renewable energy sources was still strong - probably due to high inertia of both the public and the private sectors. *"Should I recommend for the company to go ahead with the Amalas green energy project? Will we do well by doing good? What are the possible risks and how to mitigate them?"*

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Exhibit 1. IPCC Report

BBC - Five things we have learned from the IPCC report

By Matt McGrath Environment correspondent, Incheon, South Korea
8 October 2018

BBC environment correspondent Matt McGrath outlines five key takeaways from one of the most important reports on rising temperatures issued by the Intergovernmental Panel on Climate Change. Their study, on the impacts and possible methods of keeping temperatures from warming by more than 1.5C, has just been launched in South Korea. There's no doubt that this dense, science-heavy, 33-page summary is the most significant warning about the impact of climate change in 20 years.

It is 'seriously alarming' but surprisingly hopeful

"It is seriously alarming," Amjad Abdulla, a lead author on one of the chapters from the Maldives, told BBC News. "The small islands will be the first, but nobody can escape; it is quite clear." But while the warnings about the dangers of letting temperatures go beyond 1.5C are dire, the report says, surprisingly perhaps, that the world can keep below the limit.
"We face a really large challenge, but it is not impossible to limit warming to 1.5 degrees," said Dr Natalie Mahowald, an IPCC author. "I wouldn't want to be too optimistic as it will require huge changes, but if we don't do it, that will also require huge changes."

Every little helps

The report goes to great lengths to point out the differences between allowing temperatures to rise towards 2 degrees C above pre-industrial times, or keeping them nearer to 1.5. A half a degree doesn't sound like much but whether it is coral reefs, crops, floods or the survival of species, everyone and everything is far better off in a world that keeps below 1.5C.
"Every bit of extra warming makes a difference," said Dr Hans-Otto PörIMer of the IPCC. "By 2100, global mean sea level rise will be around 10cm lower for warming of 1.5 degrees compared with 2C. This could mean up to 10 million fewer people exposed to the risks of rising seas." Similarly, when it comes to heat waves, in a world that's warmed by up to 1.5C, about 14% of the population are exposed to a heat wave every five years. That increases to 37% of the population at 2C.

It's not option A, B or C; it's option A+B+C

The headlines about cutting emissions by 45% by 2030 and getting almost all of our electricity from renewables by the middle of the century, are all very well but a key point of this report is that successfully limiting climate change to 1.5C is not just down to cutting emissions or making lifestyle changes or planting trees - it is all of that and then some, acting in concert at the same time.
"All options need to be exercised in order to achieve 1.5C," said Prof Jim Skea, an IPCC co-chair. "We can make choices about which options and trade off a bit between them, but the idea you can leave anything out is not possible."

We don't need to re-invent the wheel to limit warming

There is a lot of faith put in technology that it can solve many of our environmental problems, especially climate change. This report says that the world doesn't have to come up with some magic machines to curb climate change - we've already got all the tech we need. The report says that carbon will have to be sucked out of the air by machines and stored underground, and that these devices exist already. Billions of trees will have to be planted - and people may have to make hard choices between using land for food or using it for energy crops. But really wacky ideas, such as blocking out the Sun, or adding iron to the oceans have been dismissed by this IPCC report.

It's (partly) down to you!

Where this new study from the IPCC differs from previous approaches is that it clearly links lifestyle choices with warming. The report's authors say that rapid changes must take place in four key parts of society:

- energy generation
- land use
- cities
- industry

Many people might think that they have little personal involvement with any of these - but the IPCC authors say that's not the case. "It's not about remote science; it's about where we live and work," said Dr Debra Roberts. "The energy we buy, we must be putting pressure on policymakers to make options available so that I can use renewable energy in my everyday life." Cutting energy demand by using less of it is a highly effective step.
Similarly, being aware of what you eat, where it comes from, thinking about how you travel, having a greater interest in all these things can impact energy use. This greater awareness, and the changes it might inspire, could even be good for you. "Frankly, the more we are prepared to make changes to behavioural patterns that reduce greenhouse gas emissions, the less we would need to rely later on more difficult options that we don't yet fully understand like carbon dioxide removal," said Prof Jim Skea.
"There are lots of reasons other than climate change for shifting diets. If we changed to fulfil health recommendations, we'd all live longer and bounce around much more and have nicer lives and we'd also reduce greenhouse gas emissions."

Source: BBC (2018, October 8). Five things we have learned from the IPCC report. Available at https://www.bbc.com/news/science-environment-45784892

Exhibit 2. CERA: What is Green Energy?

Green Energy is the energy from renewable non-fossil sources.

Some examples of renewable energy sources are:

- Solar
- Wind
- Hydroelectric
- Geothermal
- Energy from biomass / biogas
- and others

Mineral sources are the

- Petroleum and
- Natural gas

In Cyprus there is mainly exploitation of solar, wind and biomass / biogas energy.

Renewable energy sources

Renewable Energy Sources (RES) are defined as energy sources, which are abundant in the natural environment. It is the first form of energy that man used before turning intensely on the use of fossil fuels. RES are practically unlimited, their use does not pollute the environment and their exploitation is limited only by the development of reliable and economically acceptable technologies that will have the purpose of unlocking their potential. Interest in the development of these technologies first emerged after the first oil crisis of 1974 and was consolidated after awareness of the world's major environmental problems over the last decade. For many countries, RES are a domestic source of energy with favourable prospects of contributing to their energy balance, contributing to reducing dependence on expensive, imported oil and enhancing the security of their energy supply. At the same time, they contribute to improving the quality of the environment, as it has now been established that the energy sector is the industry primarily responsible for environmental pollution.

The main advantages of Renewable Energy Sources are:

- They are practically unlimited sources of energy and help reduce dependence on exhausting conventional energy resources.
- They are environmentally friendly and their use responds to the global effort to reduce pollution.
- Because they are scattered across different areas, they result in the decentralization of the energy system and the dismantling of infrastructures, covering local and regional ones. This dispersion has an additional effect, that of reducing energy transmission losses.
- Because they are domestic, they contribute significantly to national energy independence and security.
- They have low cost of use that is not affected by fluctuations in international fossil fuel prices.
- Investing in RES generates many jobs, especially at a local level.
- In many cases, they contribute to social and economic upgrading and development of local areas, by promoting investment and reducing unemployment.

Renewable energies, apart from their significant advantages, they also have some characteristics that make their exploitation difficult.

- Because they are scattered, there is no possibility of gathering and storing in large quantities of power.
- The density of energy and power contained is generally limited, and so large production requires large installations.
- The rate of exploitation of their facilities is low because their availability is sometimes limited and fluctuating. This also raises the need to use other sources of energy, so that the cost of energy is rising.
- The investment cost for RES power plants is still high compared to conventional forms.

Source: CERA (n.d.) What is Green Energy? Available at https://www.cera.org.cy/en-gb/katanalotes/details/ti-eine-prasini-energeia