

Energy, Environment, and the Fundamental Task of the Person

J. Steven Brown

The “problems” of energy and its associated environmental impacts are two of the most important and pressing problems facing society nowadays.

To address these complex and urgent problems we would fall short if we limited our efforts to technical, scientific, economic, sociological, or political proposals. Undoubtedly, these are valuable in themselves. Yet they can only be fruitful if they adequately address the crux of the matter: the conception of the human person that undergirds and informs any account of energy, environment, and our relation to them.

“God looked at everything he had made, and found it very good.”

(Gn 1:31)

“The Lord God then took the man and settled him in the garden of Eden, to cultivate and care for it.”

(Gn 2:15)

“What is man that you are mindful of him, and a son of man that you care for him? Yet you have made him little less than a god, crowned him with glory and honor.”

(Ps 8:4-5)

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“Stand unshod upon it, for the ground is holy, being even as it came from the Creator. Keep it, guard it, care for it, for it keeps men, guards men, cares for men. Destroy it and man is destroyed.”

Alan Paton, *Cry, The Beloved Country*

“Tell me, moon, what good is the shepherd’s life to him or yours to you? Tell me: where is it heading, my brief wandering, your immortal journey? Often, when I watch you standing so still above the empty plain whose last horizon closes with the sky, or follow, step by step, as I wander with my flock, and when I see the stars burn up in heaven, I ask myself: Why all these lights? What does the endless air do, and that deep eternal blue? What does this enormous solitude portend? And what am I?”

Giacomo Leopardi, *Cry, Night-Song of a Wandering Shepherd of Asia*

The “problems” of energy and its associated environmental impacts are two of the most important and pressing problems facing society today. Being a practically oriented engineer, my immediate reaction is to ask: How are we to go about solving these problems? Are we to develop technical or scientific solutions? Are we to implement political, economic, or sociological solutions? Before rolling up our sleeves and commencing work, I would caution that we need to ask an even more fundamental question. Why do I make this claim? I taught first-year engineering students Introduction to Engineering Design for 14 years. One problem-solving principle I emphasized in this course was that before setting out to solve a problem one has to clearly identify it. While this may sound obvious, we often cause ourselves all sorts of trouble by incorrectly formulating a problem and sometimes even end up solving the wrong problem as a result of this mistaken formulation.

To illustrate what I mean, consider a somewhat silly example. Imagine I am on one side of the Charles River but desire to be on the other. It would seem that the problem becomes to construct a bridge to walk across or perhaps find the already constructed Mass Ave. Bridge to make it even easier. But what is the problem really? Is it that I need to construct/find a bridge? While it may be so, is it perhaps even more fundamental than this? Namely, is it not the fact that I want to find myself on the opposite bank from where I currently stand? By assuming that the problem is that I need to construct/find a bridge, what have I done? I have excluded other perfectly legitimate solutions such as catapulting myself across the river, swimming, or using a helicopter, boat, or zip line. The point of this example is to demonstrate that if we are to address and solve the complex and urgent “problems” of energy and its associated environmental impacts, we will fall short if we limit our efforts to technical, scientific, economic, sociological, or political proposals. Undoubtedly, these are valuable in themselves. Yet, they can only be fruitful if they adequately address the crux of the matter: the conception of the human person that undergirds and informs any account of energy, environment, and our relation to them.

If, as one tends to think today, we consider the person to be *homo technicus*, everything cannot but be conceived in terms of mastery and potentialities. In this view, energy and environment are resources to be used or to domesticate, and our relations to them and to each other are relations of power. As such, conflict and violence will remain at the heart of any attempt to seek the common good. Furthermore, as we will see later, this technical anthropology needs and, on the other hand, fosters fragmentation of the person, between persons, of persons and the world, and of the sciences and other disciplines. If, instead, the person is understood in terms of gift we will be able to have adequate reasons to care for our common home and do so in a way that respects both our work and each human being. It is crucial that our attempts to account for, cultivate, and contribute to fruitfulness of the environment be rooted in a perception of the world and oneself as gift. Therefore, what is needed in the academy are academics whose work lets the authentic depth of what things are be seen anew.

My paper will unfold in three parts. In the first, I present some background material, touch on the status of energy and its associated environmental impacts, and briefly discuss the recognition by engineers, scientists, politicians, and recent pontiffs of the enormity of the problems of energy and the environment. The second part discusses the reduction by today's global, all-encompassing technocratic paradigm of the gift character of reality as something to be manipulated and domesticated. I argue that care for the environment and, in fact, all of creation needs to be rooted in an adequate anthropology grounded in a perception of the world and oneself as gift. Finally, in the concluding part, I suggest some ways forward and possible contributions that could be made by those who are privileged to work in the academy.

Understanding the problem

It would be a herculean task to provide any type of comprehensive recent historical summary of energy and the environment in these few short pages. Even were I not to assume such an ambitious undertaking, the much more modest task of simply highlighting a few topics in any comprehensive way is still beyond the scope of this paper. However, I do believe it is necessary to establish the landscape by at least mentioning a few issues, knowing full well that I will not be able to adequately treat any of them and will necessarily need to leave many others for another day's discussion.

How Big Are the Problems Really? Review of Energy and Its Environmental Impacts

In 2013, the world's primary energy consumption totaled 568.5×10^{18} J, with the U.S. representing a little over 18% of this amount.¹ To begin to put the world's primary energy consumption in some context, let me point out that this represents the energy content contained in 92.9 billion barrels of oil.² In 2013, the U.S. had proven petroleum reserves

1 U.S. Department of Energy, Energy Information Administration (DOE/EIA), <http://www.eia.gov/beta/international/?src=-f3>.

2 The U.S. Internal Revenue Service defines a barrel-of-oil-equivalent to be 5.8×10^6 Btu (6.119×10^9 J), Cf. https://www.irs.gov/irb/2012-18_IRB/ar13.html.

of 33.7 billion barrels of oil,³ meaning that the U.S.'s proven petroleum reserves could meet only about four months of the world's primary energy consumption demand were they all to be used for this purpose. So is all lost? No, because the U.S. is not the only country with petroleum reserves and petroleum is not the only energy source. In fact, in the U.S.,⁴ the primary energy consumption breakdown is 81.5% from fossil fuels, 8.6% from nuclear, and 9.9% from renewables.⁵ Thus, not all is hopeless because renewables, other alternative energy sources, and reductions in consumption could all be parts of an overall energy "solution." Take solar/PV⁶ as an example. It currently meets only 0.6% of the total primary energy consumed in the U.S.,⁷ although if every square inch of the earth could be covered with PV, the solar flux impinging the earth in approximately one-half day would be enough to supply the world's total energy demand for a year.⁸ So, if it is so simple, why are we not pursuing this goal? First of all, it is not practicable. In addition, the solar flux is also needed for photosynthesis, to sustain life, and to maintain a habitable environment. Regardless, while PV meets a small amount of the total demand, its installed capacity is rapidly increasing primarily due to regulation and tax incentives. For example, 22 states plus the District of Columbia now have a Renewable Portfolio Standard with specific solar PV callouts,⁹ and others are likely to follow in the future. To be sure, however, there is enormous inertia to remain tied to the current energy sources, infrastructure, methods, and consumptive habits. While there are many complex reasons for this state of affairs, I would only like to mention two: (1) the modern economy is tied to energy and thus there are enormous financial interests in

3 U.S. DOE/EIA, http://www.eia.gov/dnav/pet/pet_crd_pres_dcu_NU.S._a.htm.

4 The energy breakdown presented in this section would differ country by country and for the world as a whole, though not significantly, so I have elected to use data for the U.S. for illustrative purposes.

5 U.S. DOE. *Monthly Energy Review*. DOE/EIA-0035(2016/6), p. 3. Note: the renewable breakdown is 24.7% from hydro, 22.1% from biofuels, 21.1% from wood, 18.8% from wind, 5.7% from solar/PV, 5.3% from waste, and 2.3% geothermal (p. 151.) To further break down the renewables, if hydro and biomass are excluded, the others (wind, solar/PV, and geothermal) represent 26.8% of the renewables or 2.7% of the total primary energy consumption in the U.S. (pp. 3 and 151).

6 PV is short for photovoltaics, a.k.a. solar cells. PV are typically semiconductor materials which convert photons (light) to electric potential (voltage) or electric current when connected to an electrical load.

7 U.S. DOE. *Monthly Energy Review*. DOE/EIA-0035(2016/6), pp. 3 and 151.

8 The theoretical potential of the solar power impinging the earth per day is 89,300 TW, Cf. <http://www.sandia.gov/~jytsao/Solar%20FAQs.pdf>. Assuming commercial scale PV efficiencies of 10-20% (Cf. <http://www.nrel.gov/docs/fy12osti/53347.pdf>), the theoretical PV potential would be 8,900-17,800 TW per day.

9 Renewable Portfolio Standards (RPS) are regulatory mandates of states to increase energy production from renewable resources; typically the mandates specify the amount of electric energy generation that needs to come from renewable energy resources by a certain date. Currently 29 states plus the District of Columbia have RPS. In addition, 22 states plus the District of Columbia specify the minimum amount that needs to come from solar PV, Cf. <http://www.dsireusa.org/resources/detailed-summary-maps/>, Cf. also http://www.nrel.gov/tech_deployment/state_local_governments/basics_portfolio_standards.html.

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wherever, and however we demand it.*

play,¹⁰ and (2) we have come to expect access to energy whenever, wherever, and however we demand it. Regarding the latter, think about our own habits. We demand access to lighting, heating, cooling, refrigeration, transportation, manufactured goods of all sorts, smartphones, computers, etc. All of these consume energy, and lots of it.¹¹ Furthermore, to illustrate the difficulty we face in trying to change our habits to reduce consumption, consider an example from an alternative energy course I offered to undergraduate engineering students a few years back. When discussing the enormity of the “energy problem,” I raised effecting changes in personal consumptive habits as one possible “solution.” Most thought it was a good idea as long as the proposal remained abstract and was someone else’s problem to solve; however, when I suggested putting aside our smartphones¹² most thought it was a ridiculous suggestion and justified owning them by saying that in effect they are “necessities” of modern life.

To conclude this subsection, I will turn briefly to the environmental impacts of energy. Though there are many,¹³ because of limited space I will discuss only the production of the global warming gas carbon dioxide (CO₂). In particular, 98% of the U.S.’s CO₂ emissions result from the combustion of fossil fuels.¹⁴ Furthermore, since the U.S. consumes approximately 18% of the world’s primary energy, it also produces a correspondingly large proportion (16.3%)¹⁵ of the world’s CO₂ emissions. In terms of real numbers, in 2015, the U.S. produced 5262 million metric tons of CO₂ emissions.¹⁶ But what does such a number mean? It implies that forestlands approximately 12 times the size of Texas would be needed to absorb this amount of CO₂.¹⁷

10 In 2013, U.S. energy expenditures represented 8.3% of GDP. Cf. U.S. DOE. *Monthly Energy Review*. DOE/EIA-0035(2016/6), p. 17.

11 In the U.S., the buildings sector represents approximately 41% of the total primary energy consumed, with space heating, space cooling, and lighting accounting for just over one-half of the total. Cf. U.S. DOE, *Buildings Energy Databook*, <http://buildingsdatabook.eren.doe.gov/>.

12 Computers and electronics represent over 9% of the total buildings sector energy consumption, or nearly 3.7% of the total U.S. primary energy consumption. Cf. U.S. DOE, *Buildings Energy Databook*.

13 There are too many to mention here, but a few include the emissions of sulfur dioxide, nitrous oxides, and mercury; impacts on land and water resources through drilling, fracking, and mining; and thermal emissions and other harmful effluents into streams, rivers, lakes, and oceans.

14 U.S. DOE. *Monthly Energy Review*. DOE/EIA-0035(2016/6), p. 183.

15 U.S. Department of Energy, Energy Information Administration (DOE/EIA), <http://www.eia.gov/beta/international/?src=-f3>.

16 U.S. DOE. *Monthly Energy Review*. DOE/EIA-0035(2016/6), p. 175.

17 An acre of trees absorbs about 5,880 pounds of CO₂, Cf. http://www.forestecologynetwork.org/climate_change/sequestration_facts.html.

Suffice it to say, the problems of energy and its associated environmental impacts are big, real, and require urgent attention.

Does Everyone Recognize the Problems?

As a way to demonstrate that nowadays everyone seems to recognize energy and its associated environmental impacts as important and pressing problems, I will select a few illustrative examples from science and engineering organizations, governmental bodies, my own research, and recent pontificates.

Engineering, Science, and Governmental Actions/Policies

In February 2008, the National Academy of Engineering (NAE) published its 14 Grand Challenges for the 21st Century.¹⁸ These problems cut across all disciplines and are large societal problems that in the opinion of the NAE need to be solved for the flourishing of humanity in the twenty-first century. Leaving aside whether this assertion is true or not, five of the grand challenges are arguably related to energy and the environment.¹⁹

Regarding the environment, and more specifically global warming and climate change, the United Nations established the Intergovernmental Panel on Climate Change (IPCC)²⁰ in 1988 to assess climate change and its impacts. It then organized the so-called Earth Summit in Rio de Janeiro, Brazil, in 1992, where, among other things, the parties negotiated the international treaty known as the United Nations Framework Convention on Climate Change (UNFCCC)²¹ and established the Conference of Parties (COP) as the decision-making body for the treaty. The COP has convened a conference each December since 1994, with the third conference (COP-3) having been held in Kyoto, Japan. An agreement resulting from this COP meeting was dubbed the Kyoto Protocol.²² The agreement placed binding targets for reductions in greenhouse gas emissions on the ratifying countries.

Let us now turn briefly to some examples from the United States. The Environmental Protection Agency (EPA) was founded in 1970 by the Republican president Richard Nixon to address growing concerns of environmental pollution.²³ Following the so-called “energy crisis”²⁴ of the mid-1970s, the Democratic president Jimmy Carter

18 National Academy of Engineering. *Grand Challenges for Engineering*, <http://www.engineeringchallenges.org/>.

19 Make Solar Energy Economical; Provide Access to Clean Water; Provide Energy from Fusion; Manage the Nitrogen Cycle; Develop Carbon Sequestration Methods. The other nine are Advance Personalized Learning; Enhance Virtual Reality; Reverse-Engineer the Brain; Engineer Better Medicines; Advance Health Informatics; Restore and Improve Urban Infrastructure; Secure Cyberspace; Prevent Nuclear Terror; Engineer the Tools of Scientific Discovery.

20 Intergovernmental Panel on Climate Change (IPCC), <http://www.ipcc.ch/>.

21 United Nations Framework Convention on Climate Change (UNFCCC), <http://unfccc.int/2860.php>.

22 Kyoto Protocol. 1997. United Nations Framework Convention on Climate Change, Bonn, Germany, http://unfccc.int/kyoto_protocol/items/2830.php.

23 Cf <https://www.epa.gov/aboutepa/epa-history> for a brief history of the EPA.

24 Note that while we use the term “energy crisis,” energy is a conserved quantity (1st Law of Thermodynamics). What we really have is a “2nd Law of Thermodynamics problem.” By this I mean

established the Department of Energy (DOE), in part to address the nation's energy challenges.²⁵ I mention these two examples together to link the problems of energy and the environment. I also mention the party affiliations of the presidents to make clear that these problems are neither of the “left” or of the “right” but “belong to all of us.” In fact, it would be unthinkable nowadays to have a presidential campaign without platforms on energy and the environment.²⁶

Many more examples could be discussed but now I will turn my attention to my own research and discuss how it is being driven by the problems of energy and the environment.

My Own Scholarship—Energy and Environmental Drivers

One of my own research interests involves identifying and characterizing more “environmentally-friendly” working fluids for energy systems of all types, including refrigeration and air conditioning applications. Particularly regarding refrigerants, the constraints and criteria for designing and using them have shifted considerably over the last 40 or so years driven primarily by the desire to reduce energy consumption and by the twin environmental problems of destruction of stratospheric ozone and global warming. Regarding energy, the air conditioning and refrigeration sector consumes an enormous amount of energy, accounting for approximately 10.4% of the total primary energy consumed in the U.S.²⁷ Thus, there is a strong need for more energy-efficient working fluids, which hence is one of the drivers for my own scholarly pursuits. Regarding the environmental problems, the first was identified in a landmark paper by Molina and

that the “crisis” has to do with the “quality” of energy; that is, we continuously degrade the usefulness of energy through generation of entropy in irreversible (“non-ideal”) processes.

25 The DOE is a cabinet-level department, Cf. <http://energy.gov/management/office-management/operational-management/history/brief-history-department-energy> for a brief history of the DOE.

26 The reader is referred to the following representative sources for non-technical summaries and discussion of the issues of energy and the environment during a few recent presidential campaigns, Cf. <http://www.nytimes.com/2000/09/29/us/the-2000-campaign-the-energy-issue-supply-vs-demand-ideas-separate-gore-and-bush.html?pagewanted=all> for Bush vs. Gore in 2000; cf. <http://discovermagazine.com/2004/oct/bush-vs-kerry-on-science> for Bush vs. Kerry in 2004; cf. <http://www.cnn.com/2008/POLITICS/08/05/energy.plans/> for McCain vs. Obama in 2008; cf. <http://www.cfr.org/united-states/candidates-energy-policy/p26796> for Obama vs. Romney in 2012. For the 2016 presidential campaign, refer to <https://www.hillaryclinton.com/issues/climate/> for Hillary Clinton's energy and environment platform and refer to <https://www.donaldjtrump.com/press-releases/an-america-first-energy-plan> for a speech by Donald Trump regarding his plans for energy and the environment. Clinton wished within 10 years to power all homes in the U.S. with renewable energies and to reduce oil consumption by a third by improving energy efficiency in the transportation sector. She also planned to reduce greenhouse gas emissions and mitigate climate change through the use of clean/renewable energies. Trump, on the other hand, linked energy and the economy and proposed to double down on fossil fuels. He also proposed to reverse some environmental regulations and “to get bureaucracy out of the way of innovation so we can pursue all forms of energy.” Make no mistake, the understanding of the issues/problems and proposed actions/plans of Clinton and Trump were dramatically different; however, both recognized that energy and the environment are big and important problems facing the nation and thus must be dealt with by a president.

27 Cf. U.S. DOE, *Buildings Energy Databook*, <http://buildingsdatabook.eren.doe.gov/>.

Rowland,²⁸ which set in motion the international agreement known as the Montreal Protocol,²⁹ a binding agreement for reducing the production and consumption of ozone-depleting substances. The second issue, already mentioned above, is global warming and climate change. The Kyoto Protocol³⁰ identified what it dubbed as six “baskets of global warming gases,” one being hydrofluorocarbons (HFCs), which are widely used in refrigeration and air conditioning applications. The environmentally driven sea change occurring in the refrigeration and air conditioning industry, and hence my own scholarly pursuits, since about the mid-2000s results primarily from regulations enacted in the European Union (E.U.). In particular, the E.U. formally adopted the Kyoto Protocol in 2002³¹ and followed with regulatory action in 2006 by enacting the F-Gas Regulations³² and the Mobile Directive.³³ Thus, my research agenda for about the last 15 years has been driven primarily by energy usage and the environmental impacts of working fluids used in energy systems, particularly in air conditioning and refrigeration applications.

Finally, I will briefly mention a few statements from pontificates going back to Blessed Pope Paul VI.

28 Mario José Molina, Frank Sherwood Rowland, “Stratospheric Sink for Chlorofluoromethanes: Chlorine Atom-Catalysed Destruction of Ozone,” *Nature* 274 (1974): 810-812. Mario Molina and Sherwood Rowland shared the Nobel Prize in Chemistry, 1995 with Paul Crutzen “for their work in atmospheric chemistry, particularly concerning the formation and decomposition of ozone.” See http://www.nobelprize.org/nobel_prizes/chemistry/laureates/1995/.

29 The full title of the agreement is “The Montreal Protocol on Substances that Deplete the Ozone Layer.” It was agreed upon on September 16, 1987 and entered into force on January 1, 1989, and has been amended four times: London (1990), Copenhagen (1992), Montreal (1997), and Beijing (1999). See <http://ozone.unep.org/en/treaties-and-decisions/montreal-protocol-substances-deplete-ozone-layer>. The purpose of the Montreal Protocol is to control the production and consumption of certain chlorinated and brominated substances with the aim to reducing their presence in the atmosphere to protect stratospheric ozone since, as demonstrated by Molina and Rowland, the chlorine and bromine in these substances act as catalysts to continuously break down ozone in the presence of UV radiation at low temperatures.

30 Kyoto Protocol, 1997, United Nations Framework Convention on Climate Change, Bonn, Germany, http://unfccc.int/kyoto_protocol/items/2830.php.

31 “Council Decision 2002/358/EC of 25 April 2002 Concerning the Approval, on Behalf of the European Community, of the Kyoto Protocol to the United Nations Framework Convention on Climate Change and the Joint Fulfillment of Commitments Thereunder,” *Official Journal of the European Union*, 45(L 130): 1-20.

32 “Regulation (EC) No 842/2006 of the European Parliament and of the Council of 17 May 2006 on Certain Fluorinated Greenhouse Gases,” *Official Journal of the European Union*, 49(L 161): 1-11.

33 “Directive 2006/40/EC of the European Parliament & of the Council of 17 May 2006 Relating to Emissions from Air-Conditioning Systems in Motor Vehicles & Amending Council Directive 70/156/EC,” *Official Journal of the European Union*, 49(L 161): 12-18. The Mobile Directive specified that beginning on January 1, 2011, new models and on January 1, 2017, new vehicles fitted with air conditioning cannot be manufactured with fluorinated greenhouse gases having global warming potentials greater than 150. So while the Montreal Protocol led to the replacement of dichlorodifluoromethane (R12) with 1,1,1,2-tetrafluoroethane (R134a) in automotive air conditioning applications in the mid-1990s because of ozone depletion, the E.U. Mobile Directive is currently leading to the replacement of R134a with 2,3,3,3-tetrafluoroprop-1-ene (R1234yf) because of global warming.

Recent Pontificates

The recent popes, going back as far as Blessed Pope Paul VI, have written on the topics of energy and the environment, with each pontificate expanding more and more on these themes, and not surprisingly so since society has become more and more aware of the urgency of these issues. Again, the few examples I provide below are not meant to be exhaustive of the thinking of these popes on these topics, but rather are meant to be illustrative of their concerns.

Blessed Pope Paul VI dedicated one of the 52 paragraphs of his Apostolic Letter *Octogesima Adveniens* to the environment, where he wrote, “Man is suddenly becoming aware that by an ill-considered exploitation of nature he risks destroying it and becoming in his turn the victim of this degradation.”³⁴

St. Pope John Paul II addressed the ecological crisis on a number of occasions, but perhaps most explicitly in his 1990 *Message for the World Day of Peace*, where he linked peace and the ecological question and insisted that, above all, the ecological crisis is a moral issue.³⁵

Pope Benedict XVI addressed energy and the environment on a number of occasions including his 2008 *Message for the World Day of Peace*,³⁶ his 2010 *Message for the World Day of Peace*,³⁷ and his third encyclical *Caritas in Veritate*.³⁸ Here I wish to highlight

34 Pope Paul VI, Apostolic Letter *Octogesima Adveniens* (1971), 21, http://w2.vatican.va/content/paul-vi/en/apost_letters/documents/hf_p-vi_apl_19710514_octogesima-adveniens.html.

35 Pope John Paul II, *Message for the Celebration of the 23rd World Day of Peace* (1990), 5-7, http://w2.vatican.va/content/john-paul-ii/en/messages/peace/documents/hf_jp-ii_mes_19891208_xxiii-world-day-for-peace.html.

36 Pope Benedict XVI, *Message for the Celebration of the 41st World Day of Peace* (2008), 8, http://w2.vatican.va/content/benedict-xvi/en/messages/peace/documents/hf_ben-xvi_mes_20071208_xli-world-day-peace.html. “[I]t is essential to ‘sense’ that the earth is ‘our common home’ and, in our stewardship and service to all, to choose the path of dialogue rather than the path of unilateral decisions. [...] The problems looming on the horizon are complex and time is short. [...] One area where there is a particular need to intensify dialogue between nations is that of the *stewardship of the earth’s energy resources*. The technologically advanced countries are facing two pressing needs in this regard: on the one hand, to reassess the high levels of consumption due to the present model of development, and on the other hand to invest sufficient resources in the search for alternative sources of energy and for greater energy efficiency.” (Original emphasis.)

37 Pope Benedict XVI, *Message for the Celebration of the 43rd World Day of Peace* (2010), 9, http://w2.vatican.va/content/benedict-xvi/en/messages/peace/documents/hf_ben-xvi_mes_20091208_xliiii-world-day-peace.html. “To be sure, among the basic problems which the international community has to address is that of energy resources and the development of joint and sustainable strategies to satisfy the energy needs of the present and future generations. This means that technologically advanced societies must be prepared to encourage more sober lifestyles, while reducing their energy consumption and improving its efficiency. At the same time there is a need to encourage research into, and utilization of, forms of energy with lower impact on the environment and ‘a world-wide redistribution of energy resources, so that countries lacking those resources can have access to them’. The ecological crisis offers an historic opportunity to develop a common plan of action aimed at orienting the model of global development towards greater respect for creation and for an integral human development inspired by the values proper to charity in truth.”

38 Pope Benedict XVI, Encyclical Letter *Caritas in Veritate* (CV) (2009), 48-51, <http://w2.vatican.va/>

Caritas in Veritate where Pope Benedict XVI linked energy and the environment to the development of peoples in paragraphs 48-51. Some excerpts include the following: “Today the subject of development is also closely related to the duties arising from *our relationship to the natural environment*.”³⁹ “Questions linked to the care and preservation of the environment today need to give due consideration to *the energy problem*.”⁴⁰ “*The way humanity treats the environment influences the way it treats itself, and vice versa*.”⁴¹ “The deterioration of nature is in fact closely connected to the culture that shapes human coexistence: *when ‘human ecology’ is respected within society, environmental ecology also benefits*.”⁴² (Original emphasis.)

Finally, Pope Francis has expanded significantly on these themes, placing them at the center of his pontificate, and placing them in front of the whole world by dedicating an entire encyclical to them. Since *Laudato Si*⁴³ is too rich in thought to provide any adequate treatment here, I will reserve my comments to Chapter 3, a beautiful meditation on the human roots of the ecological crisis. In this chapter, Pope Francis links the technocratic paradigm of the modern world (where the person is viewed as *homo technicus*) to the environmental crisis.

Absent an anthropology of gift, attempts to solve the energy and environmental problems remain partial and in the end only will exasperate them.

Technical Anthropology and Its Link to the Environmental Crisis

It is to this technical anthropology and its link to the environmental crisis that I wish to turn my attention because absent an anthropology of gift, attempts to solve the energy and environmental problems remain partial and in the end only will exasperate them. Without recognizing the gift character of reality, one ultimately does not see the problem for what it is and thus does not address the root cause of it. Said differently, absent an adequate anthropology, one simply does not see the problem for what it is and thus while attempting to solve it often will only make it worse. To illustrate this point, I will provide two simple examples. The first is the Three Gorges Dam project on the Yangtze River in Hubei Province, China. Construction of the dam began in 1994 and now has

content/benedict-xvi/en/encyclicals/documents/hf_ben-xvi_enc_20090629_caritas-in-veritate.html.

39 CV 48.

40 CV 49.

41 CV 51.

42 CV 51.

43 Pope Francis, Encyclical Letter *Laudato Si'* (2015), http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html.

installed capacity of 22,500 MW, which is 11 times the capacity of Hoover Dam,⁴⁴ and about 20-30 times the capacity of a typical large coal-fired power plant in the eastern United States.⁴⁵ China is consuming enormous amounts of energy⁴⁶ driven in part by its population, its growing domestic economy, and the fact that it produces a considerable amount of the world's manufactured goods. Moreover, given the growth rate in its energy consumption, China will need to add considerably more electricity capacity in the coming decades.⁴⁷ None of this growth comes without a cost. The Three Gorges Dam has permanently changed the local land and water resources, with ripple effects much beyond the immediate geographic location. Furthermore, it has permanently changed ecosystems and impacted their biodiversity, and because of its construction 1.3 million people were forced from their homes and their lands, including the destruction of 13 cities, 140 towns, and over 1,600 villages.⁴⁸ The second example regards a proposal to lessen the global warming impact from humans via population control. It appeared in a 2007 article published in the *Medical Journal of Australia*. Specifically, the author proposed the imposition of a carbon tax on newborns in families having more than two children.⁴⁹ He suggested to impose on these children a one-time tax of \$5,000 at birth and an annual tax of \$400-\$800 to offset their lifetime production of CO₂. While I could recount other examples of solutions to "energy and environmental problems" employing out-of-control technical anthropologies, I believe these two sufficiently illustrate the need for an anthropology of gift which recognizes the gift character of all of reality. It is to this anthropology of gift that I turn my attention in the next section.

44 Gus Lubin and Isabelle Schafer, "17 Earthshaking Facts About the Three Gorges Dam and China's Next Even Bigger Water Project," *Business Insider* (2010), <http://www.businessinsider.com/three-gorges-dam-south-to-north-water-diverson-project-china-2010-7>.

45 A typical coal-fired power plant might have on the order of 750 MW to 1000 MW of installed capacity.

46 China consumes approximately 21.7% of the world's primary energy. (Compare this to approximately 18% for the U.S.) U.S. Department of Energy, Energy Information Administration (DOE/EIA), <http://www.eia.gov/beta/international/?src=-f3>.

47 Over the 10-year period from 2004 to 2013, China's primary energy consumption increased an average of 5.1% per year. (Compare this to approximately an average 0.3% decrease for the U.S. over the same 10-year period.) U.S. Department of Energy, Energy Information Administration (DOE/EIA), <http://www.eia.gov/beta/international/?src=-f3>.

48 Lubin and Schafer, "17 Earthshaking Facts About the Three Gorges Dam and China's Next Even Bigger Water Project," *Business Insider* (2010), <http://www.businessinsider.com/three-gorges-dam-south-to-north-water-diverson-project-china-2010-7>.

49 Barry N.J. Walters, "Personal Carbon Trading: A Potential 'Stealth Intervention' for Obesity Reduction?" *Medical Journal of Australia*, 187, no. 11-12 (2007): 668, https://www.mja.com.au/system/files/issues/187_11_031207/wal10921_fm.pdf. Specifically, the author proposed a "'Baby Levy' in the form of a carbon tax should apply, in line with the 'polluter pays' principle. Every family choosing to have more than a defined number of children (Sustainable Population Australia suggests a maximum of two) should be charged a carbon tax that would fund the planting of enough trees to offset the carbon cost generated by a new human being." Furthermore, he proposed "a levy per child of at least \$5000 at birth (to purchase the land needed and plant trees) and an annual tax of \$400-\$800 thereafter for the life of the child (for maintenance of the afforestation project)."

There can be no ecology without an adequate anthropology⁵⁰

The creation stories in Genesis recount both the Love that brought into being all of reality, particularly man and woman, and the fact that man and woman were charged with the responsibility to cultivate and care for creation. Both aspects are gifts, and thus are good in themselves. Furthermore, in giving man⁵¹ the responsibility to cultivate and care for creation not only with his hands but also with his intelligence, reason, freedom, and love, God elevated man's work to the dignity of participating in His ongoing creative act. Thus, man's work is charged with meaning and ultimately is a response to and participation in God's love.

However, because man is always free, he can use his freedom to accept God's love or to turn away from it. When the latter happens, work becomes toilsome (Cf. Gn 3:17-19) and its meaning clouded. This is, in fact, what happens immediately following the creation stories of Genesis in the account of man's rejection of his creatureliness, when man used his freedom to reject his original dependence on God. In doing so, man began moving away from God as his center and instead placed himself at the center. Said differently, man began moving away from the wonder of his creaturely dependence expressed so well by the Psalmist, "What is man that you are mindful of him, and a son of man that you care for him? Yet you have made him little less than a god, crowned him with glory and honor" (Ps 8:4-5) to seeing himself as "the measure of all things."⁵²

Yet when man places himself at the center, reality moves from being something to behold, love, care for, and cultivate as God's cooperator-worker to being merely something to master and dominate as *homo technicus*. Reality goes from being *datum*⁵³ to behold and be in relation with to being mere "data" as we understand it nowadays, namely, "as a cold body of facts, as a mere 'given,' as an object of utility, as raw material to be hammered into useful shape,"⁵⁴ which, of course, is a partial description of the technocratic paradigm that Pope Francis criticizes in the third chapter of *Laudato Si'*. More broadly, this framework sees and relates to reality as something to be manipulated and mastered; that is, as pure potentiality. Furthermore, it exalts and understands modern science and humanity's technical prowess and capabilities as the only ways of knowing and relating to reality. As Pope Francis writes,

The basic problem goes even deeper: the way that humanity has taken up technology and its development according to an undifferentiated and one-dimensional paradigm. This paradigm exalts the concept of a subject who, using

50 Pope Francis, *Laudato Si'*, 118.

51 Throughout the remainder of the paper, I will use man to indicate man and woman and masculine pronouns to indicate both masculine and feminine pronouns. I am doing so to avoid repeating man and woman each time and to avoid switching back and forth between the masculine and feminine forms for each instance.

52 Cf. José María Galvan, "On Technoethics," *IEEE Robotics and Automation Magazine* 10, no. 4 (2003): 58-63, [http://eticaepolitica.net/tecnoetica/jmg_technoethics\[en\].pdf](http://eticaepolitica.net/tecnoetica/jmg_technoethics[en].pdf).

53 *Datum* as in gift or that which is given, Cf. <http://archives.nd.edu/cgi-bin/wordz.pl?keyword=datum>.

54 Pope Francis, *Laudato Si'* (LS), 115.

This technical anthropology needs and fosters fragmentation: of the person, between persons, of persons and the world, and of the sciences and other disciplines.

logical and rational procedures, progressively approaches and gains control over an external object.⁵⁵

This paradigm is all-encompassing and dominant in man's thinking and acting nowadays. Moreover, in this technocratic paradigm, the meanings of realities (things) are vacated and lose their values as "signs" and thus are no longer capable of unfolding to man their true origins and meanings.

This way of seeing reality, including man himself, ultimately shapes the way man sees and relates to everyone and everything, including the environment. Again, in the words of Pope Francis, "It can be said that many problems of today's world stem from the tendency, at times unconscious, to make the method and aims of science and technology an epistemological paradigm which shapes the lives of individuals and the workings of society."⁵⁶ Furthermore, this technical anthropology needs and fosters fragmentation: of the person, between persons, of persons and the world, and of the sciences and other disciplines. Everything and everyone become discrete facts ("data") to measure, predict, manipulate, and domesticate (control). While this "fragmentation of knowledge proves helpful for concrete applications [...] it often leads to a loss of appreciation for the whole, for the relationships between things, and for the broader horizon, which then becomes irrelevant."⁵⁷ Because man is both body and soul, he ultimately is always seeking unity in his own life and between himself and everything and everyone. Pope Francis very beautifully emphasizes this point by affirming, "it cannot be emphasized enough how everything is interconnected."⁵⁸

Because this technocratic paradigm is devoid of an awareness and lived recognition of the gift character of reality, it places science and technology—not creation—at the center. Then, instead of science and technology serving as tools (*techne*) to help man "cultivate and care for [creation]" (Gn 2:15), they become ends in themselves. Yet "science and technology are [never] neutral [because] from the beginning to the end of a process, various intentions and possibilities are in play and can take on distinct shapes."⁵⁹ Without an adequate awareness, humble acceptance, and embracing by man

55 LS 106.

56 LS 107.

57 LS 110.

58 LS 138. Cf. also 70, 92, 111, and 240.

59 LS 114.

of his creatureliness and the gift character of reality, relationships become reduced to ones of power and not ones at the service of the common good. As a result, even attempts to “solve the environmental problems” remain partial and will eventually fall short because, as I suggested in the introduction, we will be attempting to “solve the wrong problem.” In the words of Pope Francis,

Even the best ecological initiatives can find themselves caught up in the same globalized [technocratic paradigm]. To seek only a technical remedy to each environmental problem which comes up is to separate what is in reality interconnected and to mask the true and deepest problems of the global system.⁶⁰

Furthermore, he writes, “*There can be no ecology without an adequate anthropology.* [...] Human beings cannot be expected to feel responsibility for the world unless, at the same time, their unique capacities of knowledge, will, freedom and responsibility are recognized and valued.”⁶¹ (Emphasis is mine.) Thus, what is urgently needed nowadays is for man to recover his original position of lived dependence on God and to recognize and accept the gift character of all of reality, including himself. And while this is certainly always possible, it is never automatic. Compare the words of Pope Benedict XVI in his 2007 encyclical, *Spe Salvi*:

Incremental progress is possible only in the material sphere. Here, amid our growing knowledge of the structure of matter and in the light of ever more advanced inventions, we clearly see continuous progress towards an ever greater mastery of nature. Yet in the field of ethical awareness and moral decision-making, there is no similar possibility of accumulation for the simple reason that man’s freedom is always new and he must always make his decisions anew. These decisions can never simply be made for us in advance by others—if that were the case, we would no longer be free. Freedom presupposes that in fundamental decisions, every person and every generation is a new beginning. Naturally, new generations can build on the knowledge and experience of those who went before, and they can draw upon the moral treasury of the whole of humanity. But they can also reject it, because it can never be self-evident in the same way as material inventions.⁶²

Conclusion

The duty of every person is to care for our common home (Cf. Gn. 2:15). However, if “man is the measure of all things” as the Renaissance proclaimed⁶³ and not a created being dependent on his creator, God’s invitation to “cultivate and care for it” (Cf. Gn. 2:15) ultimately degenerates into a conception of reality as something to be mastered

60 LS 111.

61 LS 118.

62 Pope Benedict XVI, *Spe Salvi*, 24, http://w2.vatican.va/content/benedict-xvi/en/encyclicals/documents/hf_ben-xvi_enc_20071130_spe-salvi.html.

63 Cf. José María Galvan, “On Technoethics,” *IEEE Robotics and Automation Magazine* 10, no. 4 (2003): 58-63, [http://eticaepolitica.net/tecnoetica/jmg_technoethics\[en\].pdf](http://eticaepolitica.net/tecnoetica/jmg_technoethics[en].pdf).

by *homo technicus* rather than something to behold in wonder. Absent an anthropology of gift, attempts to solve the energy and environmental problems remain partial and in the end only will exasperate them. Without recognizing the gift character of reality, one ultimately does not see the problem for what it is and thus does not address the root cause of it. Therefore, it is crucial that our attempts to account for, cultivate, and contribute to fruitfulness of the environment be rooted in a perception of the world and oneself as gift. Hence, what is needed in the academy are academics whose work lets the authentic depth of what things are be seen anew.

So what are we to do? What can we who teach and research in Catholic colleges and universities do? Throw up our hands? Become activists? Give in to consumerism and unchecked consumption? I would like to challenge us to think of a different and, in my opinion, more efficacious approach: witness. By witness I do not mean being ethical, setting a good example, proselytizing, apologetics, or good teaching but rather allowing one's very life to be conformed to Truth and allowing Love to bear fruit in one's life. It is to make evident with one's life that "I have loved you with an everlasting love" (Jer. 31:3) and that "all is gift."⁶⁴ It is to show the other that "God is all and in all" (Cf. Eph 4:6).⁶⁵ This witness is what is most attractive to modern man and has the ability to move our often encrusted hearts, and with this change of heart, one begins to look at oneself and all of creation with the "eyes of God" and to behold all things in wonder.

*It is the person with a "new heart" that is able to
see things more deeply.*

It is, in fact, this "new heart" that allowed Gerard Manley Hopkins to write "God's Grandeur," or St. Francis of Assisi to write *Canticle of the Sun*. Once one senses the gift character of reality as did these two men, one cannot but stand in front of all of reality in wonder and in humility. It is the person with a "new heart" that is able to see things more deeply. While this person's attempts at solving problems will remain partial, they are more adequate and respectful of the nature of things as they are, because all of reality and man's relationship with it are always charged with meaning and are always the possibility to enter into dialogue with Christ—"the center of the universe and of history."⁶⁶ This dialogue is possible in all disciplines, including my own of engineering. It also is possible in all research, including my own of studying the energy and environmental impacts of working fluids employed in energy systems. But this "original" position, and thus truer way of engaging reality, cannot be explained with words in a way that

64 Georges Bernanos, *Journal d'un curé de campagne* (*The Diary of a Country Priest*): "tout est grâce."

65 "... one God and Father of all, who is over all and through all and in all."

66 John Paul II, Encyclical Letter *Redemptor Hominis* (1979), 1, http://w2.vatican.va/content/john-paul-ii/en/encyclicals/documents/hf_jp-ii_enc_04031979_redemptor-hominis.html.

will move one to conversion; it requires witness. In the words of Blessed Pope Paul VI, “Modern man listens more willingly to witnesses than to teachers, and if he does listen to teachers, it is because they are witnesses.”⁶⁷ It is only in this way, I believe, that one can understand, embrace, and live in a joy-filled way the truer and more somber lifestyle proposed by Pope Francis.⁶⁸ Otherwise the problems of energy stewardship and environmental destruction ultimately remain as someone else’s problems to solve, as my students suggested with the example of their smartphones, and in the words of T.S. Eliot, we will always be “dreaming of systems so perfect that no one will need to be good.”⁶⁹ And we know all too well from human experience that this attitude is doomed to failure because as Pope Benedict XVI reminded us: freedom is never automatic and must be taken up anew by each generation.⁷⁰

67 Pope Paul VI, Apostolic Exhortation *Evangelii Nuntiandi* (1975), 41, http://w2.vatican.va/content/paul-vi/en/apost_exhortations/documents/hf_p-vi_exh_19751208_evangelii-nuntiandi.html.

68 Pope Francis, *Laudato Si*, 211: “A person who could afford to spend and consume more but regularly uses less heating and wears warmer clothes, shows the kind of convictions and attitudes which help to protect the environment. There is a nobility in the duty to care for creation through little daily actions, and it is wonderful how education can bring about real changes in lifestyle. Education in environmental responsibility can encourage ways of acting which directly and significantly affect the world around us, such as avoiding the use of plastic and paper, reducing water consumption, separating refuse, cooking only what can reasonably be consumed, showing care for other living beings, using public transport or car-pooling, planting trees, turning off unnecessary lights, or any number of other practices.”

69 Choruses from “*The Rock*.” T.S. Eliot, *The Complete Poems and Plays: 1909-1950*. (New York: Harcourt Brace & Co., 1952), 106.

70 Pope Benedict XVI, *Spe Salvi*, 24.