Chapter 9
The Problem of Education in Developing Renewable Energy

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Abstract The Indonesian government's energy development program consists of nine policies, namely, (1) achieving clean, accountable, effective, efficient energy and serving the bureaucracy well, (2) completing the regulations, (3) simplifying licensing and non-licensing, (4) providing incentives, (5) providing energy subsidies, (6) improving coordination with ministries, (7) promoting energy-saving campaigns, (8) renewing new and renewable energy potential data, and (9) strengthening networking.

Of course, it is not easy to realize all these targets. There are many challenges to face. Some of them are the same pattern thinking in the development of new and renewable energy. Some of the buffers for intensive business schemes are not yet optimal and the technology is still dependent on sources abroad; consequently the domestic content is still small. Therefore, at this time renewable energy is still expensive, but in the future this barrier can be overcome. The next challenge is that some people are still resistant to the development of renewable energy. Therefore, here the importance of policy in education needs to be added specifically to socialize new energy for society. Thus, community education for the people is crucial.

This chapter used the following theoretical framework: first, the concept of Bloom's taxonomy; second, the four education principles of UNESCO; third, the four steps of maintaining energy; fourth, the nine programs of the Indonesian Government about energy.

In the fourth step, the policies are namely (a) implementing intensification, (b) diversification, (c) conservation, and (d) indexation of energy policies. The concept of conservation can make energy durable, to not run out quickly, although in practice this policy is more psychosocial because it involves awareness of community members in future energy needs. Indexation is the policy of selecting the right energy source for a region: for example, solar panels for housing and windmills to run factories. The nine programs were mentioned in the beginning, the Introduction (Chap. 1).

The main problem is whether the Indonesian people as a whole understand the concept of government energy policy in general and how the state of energy is provided for the future, both the existence of socialization or education of awareness

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for future energy needs because we are no longer dependent on fossil fuels. Therefore, the author is certain that education of the people about energy must be starting now, or we will be too late to do so.

This education about renewable energy should be socialized in formal education or in informal education, then provided also according to the level of education, so it is necessary to arrange education, including the curriculum, according to education level (preliminary, secondary, even university) and formally or informally in daily living. In Indonesia, education and socialization about oil palm issues has already taken place and is completed with more education examples, especially for children. So the understanding of renewable energy must come from an early age. In implementing energy knowledge for rural or urban children, we purpose to include their mothers or their families, to reach more attendants.

9.1 Introduction

I believe that God Almighty is the One and the only one of the ultimate energy resources and it is Unlimited forever. One of God's creations that is the source of energy on Earth is the sun. The sun shines upon the whole world. Solar energy is absorbed by all living things, including plankton that absorb energy and then die and sink and, under heavy pressure, eventually become a petroleum resource: this is called fossil energy. Some of the other energy is absorbed by plants and animals, as well as by humans. This is where the human exceeds; in addition to energy absorbed by the physical, energy is also absorbed also by the brain, both physically and non-physically. The absorption of energy by the human brain makes people think, so I dare to conclude that the law of conservation of energy will last forever: "Energy will not be lost, but change shape." An illustration: the sun is shining on the grass, the sun's energy is absorbed by the grass, the grass is eaten by the cow, and the beef is eaten by humans. Man continues to live with the energy he consumes from this realm. The human brain that will think about energy is an educated brain. So the role of education is to make people smart. With this intelligence, humans seek and keep energy to support their life. Thus, to build the nation's economic growth of 6%, it must be supported by doubling energy growth by 12%: energy must increase. So, when fossil energy later runs out, new and renewable energy is needed. Here I dare to state that human beings think with the ability of brain energy . The human step in maintaining this energy, among others, through the first process, intensification, is to expand the existing state in the sense of the creation of the types of fuel: there is a high (low) premium octane value (premix), intensification also in the sense of expanding the region with search and exploration. Second, diversification, multiplying the choice of energy options in various forms, whether fossil and non-fossil, is called bio-energy. Third, conservation, which is to conserve usage, among other means by regulating electrical lighting, limiting the use to be effective and efficient, and recommending that energy is used only if really necessary. The four indexes are

choosing and sorting for energy to be in accordance with their usage. For example, gas energy is more appropriate for household use. In subsequent chapters, we describe more fully how the process takes place. All processes of maintaining and supplying energy must be in an environmentally friendly context. The problem is, when humans understand all that.

So here is my chapter, inviting you to think that energy understanding should be an important task for education, where I am a high school teacher, elementary teacher, and even a lecturer at a college. This is my field every day. My advice is that energy understanding should start at an early age. Of course, it should not be discontinued at an early age, but should be taught according to the level of education. The consequence, of course, differs in the material taught for elementary school level compared with university level. So, it will be a different curriculum. If curriculum change is difficult, then it could be a renewable energy theme, only in a lecture course on a particular relevant subject.

9.2 Theory of Education and Energy Knowledge

The concepts of educational theories to be used in the analysis of this chapter include (a) Bloom's Taxonomy, (b) the UNESCO Concept, (c) the Four Concept of Energy Policy of the Indonesian Government, and (d) nine principles from the National Energy Committee of the Republic of Indonesia. According to Bloom et al. [1], in teaching a person we must divide this into three domains, namely, (1) cognitive, (2) affective, and (3) psychomotor. Cognitive is something related to science without being associated with reality and other variables beyond the education knowledge. Affective is associated with the interest of learners for the science being taught; the interest is because science can add to self-confidence in facing nature. Psychomotor is referring to what we can do by learning this subject after completion of the knowledge, and imagine what variables will be found in the real world. By creating research questions and then developing these to become a model that approaches real nature, then it can be concluded and continue to be analyzed [1].

Moreover, according to UNESCO the education process should cover these four stages: (1) learning to know, (2) learning to do, (3) learning to be, and (4) learning to live together. First, a learner must know something. Second, he must know how to implement, and third, he must how to be himself. Fourth, he lives with others, and he must do so for the best for all mankind.

The main program of the Indonesian government has been introduced as follows:

1. Intensification
2. Diversification
3. Conservation
4. Indexation

The questions asked are according to the type of the government program.

9.2.1 Intensification of Energy Resources Policy

The need is to improve the survey and exploration of resources in an effort to determine potential resources that could be used to meet the needs and improve the welfare of the people, especially in using available energy (Dept. of Energy and Natural Resources).

Types of Energy: Existing, Live, Potential, Notes

Number	Energy type	Existing	Age	Measurement	Potential developed	Notes
1	Gas					
2	Petroleum					
3	Carbon					
4	Solar					
5	Wind					
6	Hydro					
7	Bio-diesel					
10	Biomass					
11	Bio-gas					
12	Bio-ethanol					
13	Waves					
14	Tides					

9.2.2 Energy Conservation Resources

The need is to use resources efficiently in an effort to preserve resources through wise use to achieve balanced development and environmental conservation or effectively utilization (appropriate, effective, and efficient).

9.2.3 Government Indexation

Using the scientific way, for each sector of activity, it is necessary to determine the type of energy used where the most appropriate resource is available: that is, Insights/Sustainability/Development of environment wisely/Indexation (decision for the appropriate use of energy).

Beside the four concepts of intensification, diversification, conservation, and indexation, the government of Indonesia announced the nine principles of the renewable energy program (Ministry of Energy and Mineral Resources).

1. Achieve clean, accountable, effective, efficient energy while serving bureaucrats well.
2. Complete the regulations.
3. Simplify licensing and non-licensing.
4. Provide incentives.
5. Provide subsidized energy subsidies.
6. Improve coordination with ministries.
7. Promote energy-saving campaigns.
8. Renew new and renewable energy potential data.
9. Strengthen networking.

9.3 Implementation of Concepts in Practice

Just as an illustration, for the first 5 years we teach images that give the impression of the importance of energy. For example, we show pictures of trees and forests. Students are asked to choose whether the green or red color will beautify the forest image. If a child chooses a red image, this means the symbol of a forest fire; explain what it is to lose a forest by burning. Should it be a green color, it is an early invitation that the forest should be preserved. It is the human task that lives today, for the life of our children and future generations. In university education, students are taken to the laboratory, where they study mixtures of chemical compounds relevant to energy. They are required to create energy from growing plants or solar and wind energy as well as other energy options. If we follow the concept of Bloom's taxonomy, then make a formulation embodied in the concept of Bloom, namely, (1) cognitive domain, (2) affective domain, and (3) psychomotor domain.

1. Cognitive Domain. For this domain, we will teach more technical renewable energy, accomplished with the related fields of science being taught. For example, we are teachers/lecturers of mathematics, meaning we will teach students math problems related to the calculation of its use. Just for example, what size energy-efficient lighting is needed in a room of 5×5 m^2? This is a more technical domain about energy, a particular knowledge about energy.
2. Affective Domain. After students understand the calculation of the power of lighting in a room, then the lesson must be made interesting, for example, how to lay out the room: where to put the window, the ventilation, etc. All the concepts of the lessons are made so that learners are interested in using cognitive science to implement in the real world.
3. Psychomotor Domain. In the next step, the students must be taught to do, then do, the experiments that reflect how something that is taught actually happens in the real world. Of course, some variables should be considered, for example, aesthetics, strength, then the issue of the price of the goods we be using, and no less importantly, other requirements. Of course, because the energy equipment, whether electricity or fire, is concerned, there must be a specification, and other provisions that govern its use.

Furthermore, in the provisions of UNESCO that we will use in renewable energy education, then the stages follow the pattern (a) Learning To Know, (b) Learning To Do, (c) Learning To Be, and (d) Learning To Live Together.

(a) Learning To Know. Learners are taught the sciences they should know. For solar energy one must know how to bend solar panels into the roof, for example.
(b) Learning To Do. Learners understand and understand how to practice the science of solar panel installation and how can we operate it in daily living.
(c) Learning to Be. A learners must realize that now, he has become an educated man or woman who should use the knowledge well, what is one's position among communities, and how to be one's self.
(d) Learning to Live Together. Learners should be aware that all knowledge and practice that are mastered are for a wider human life. They must be aware that they will live with other people of different colors, religions, cultures, and behaviors. Therefore, it is not only the energy science that must be understood, but the social culture, tolerance, togetherness, diversity, and other factors that affect every decision taken by the central government as well as local government.

Moreover, UNESCO has also added what is called Education for Sustainable Development, including following the UNESCO concept of ESD (Education for Sustainable Development). I remind us of this concept because of its relationship to sustainable energy for human beings.

ESD encourages people, including these points:

1. Relevant education system. Education for sustainable development equips learners with the knowledge, skills, and values for the social life, environment, and economic challenges of the twenty-first century.
2. Educational transformation. Education for sustainable development uses innovative learning, student-centered instruction, and multiple learning styles. Empower students and make them agents in the process of education, from an early age to old age. It can improve learning beyond the limits of education.
3. Enhance the sense of justice and mutual respect. Education for sustainable development helps learners understand the situations, views, and needs of people living elsewhere or belonging to other (subsequent) generations.
4. Help overcome climate change: 175 million children will be affected by climate-related disasters that occur in the next decade. Sustainable development education prepares students to adapt from the impacts of climate change and empowers them to address the causes.
5. Build an environmentally friendly society. Education for sustainable development equips students with eco-friendly skills to help save or restore environmental quality, and to improve human well-being and social justice, motivating learners to choose a sustainable lifestyle (Source: ESD-UNESCO).

The four principles of maintaining energy consist of (a) intensification, (b) diversification, (c) conservation, and (d) indexation. The educator's job is, in accordance with his capacity, to spread to the community according to his education level, so that everyone understands it.

(a) Intensification. This concept allows for the expansion of energy consumption from existing ones in an area. For example, in a village already using solar panels, the usage is extended to adjacent neighboring villages, especially villages that have not been reached by such electrification.
(b) Diversification. This concept allows the expansion of the type or use of an energy product. For example, in a village that already has solar panels, then develop with wind energy with magnets or biomass. More options are better.
(c) Conservation allows the necessity of austerity measures in all community activities. In my city of Bandung, Indonesia, we have "Concept 17–22" that means we may only turn on electric appliances at 17:00 until 22:00; after this time, the electricity must be switched off.
(d) Indexation is the formulation of appropriate usage for the type of energy in the appropriate tool or place. For example, biomass is only for household needs, and bio-gas is for industrial and bio-diesel for transportation purposes. Finally, the implementation of renewable energy education should support one of the nine government programs:

(1) Achieve clean, accountable, effective, efficient energy and serve bureaucracy. (2) Complete the regulations. (3) Simplify licensing and non-licensing. (4) Provide incentives. (5) Provide energy subsidies. (6) Improve coordination with ministries. (7) Promote energy-saving campaigns. (8) Renew new and renewable energy potential data. (9) Strengthen networking.

Based on the existing capabilities and facilities owned by the education sector, then, the role of education, among others, contributed to the following programs:

1. Complete regulation program: then education can also disseminate the understanding of regulation. From here, the field of education can take grains of provisions that must be known to the public.
2. In the inter-ministerial coordination program, the education sector participates in drafting the concept of what can be coordinated with other ministries; for example, with Kominfo, the nature of the process of dissemination or dissemination of regulatory or austerity procedures.
3. Data potential dissemination program. Can help disseminate data to schools.
4. Network reinforcement program. The field of education is involved in this, so that there is a network of work, a inter-agency both inside and outside the country.

9.4 Conclusion

Important conclusions can be drawn.

1. Energy is the Grace of Almighty God, which must be nurtured and best utilized by mankind. Maintenance and utilization must be well programmed, and there is supervision of its implementation to get more benefits.

2. Education is a very crucial part of the whole life, especially in the dissemination of science on energy as well as forecasts and provision through the four programs of intensification, diversification, conservation, and indexation. Energy education must be done from the early age of children throughout the entire life (long life education).
3. The field of education can have a strategic role in filling four of the nine government programs by utilizing all existing facilitation in the field of education. Education has important roles to ascertain our awareness of energy.

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Further Readings

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