

## Renewable Energy Education: From Kindergarten to University

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Our planet is at crossroads. On one side, with the continuous increase in world population and the spread of industrialization, as well as urbanization of nations, there is a huge increasing demand for energy. On the other side, with the burning of fossil fuels at ever increasing rates to satisfy energy demand, there is environmental pollution and climate change, which can threaten the very existence of the human civilization on the planet earth. If you add to that the fact that there is only a limited supply of fossil fuels, which may run out in the next 40-50 years, the picture becomes frightful. But, if you consider the fact that the Sun is our primary source of energy, and that all the other energy sources are secondary to the Sun's energy, earth dwellers will have sufficient energy to carry out their activities for another billion years. In order to harness that energy, it is necessary to maintain the equilibrium of our ecosystem.

Use of renewable energy sources, such as solar energy, wind energy, and hydro energy can be considered as the long term solution to energy scarcity and climate change. Renewable energy sources have unlimited supply capacity, and do not contribute to greenhouse gas generation. Furthermore, energy generation through renewable sources has only a limited contribution to environmental pollution.

Apart from the technical issues related to connecting renewable

energy sources on a large scale to the power grid, the main barrier with regard to renewable energy penetration in Sri Lanka is the lack of awareness about renewable energy among the general population, and the scarcity of skilled engineers and technicians necessary to sustain the renewable energy industry. Therefore, renewable energy education in Sri Lanka should be geared towards increasing awareness about renewable energy among the general public as well as producing skilled engineers and technicians



Figure 01 : Middle school pupils participate in hands-on activities on wind energy

necessary to sustain the renewable energy industry. It is necessary to look into how renewable energy education can be planned and designed to achieve such objectives. In order to inculcate awareness about renewable energy among the general populace it is essential that concepts such as sustainability, environment protection, and responsible use of natural resources be introduced as early as possible in the curricula. It may come as training the kindergarten children in the practice of separating household waste that can be recycled, or teaching the primary school children the practice of switching off unnecessary lights. It is easy to train small children to reuse things so that resources can be better utilized, and carbon footprint minimized. Attitudes of small children can be easily molded to be environmental and sustainability conscious.

Middle school (grades 6 to 11) science and civics curricula offer a valuable opportunity to deliver sustainable energy education to children, who are in the process of forming their opinions and attitudes. Concepts related to environmental protection, sustainability, and climate change

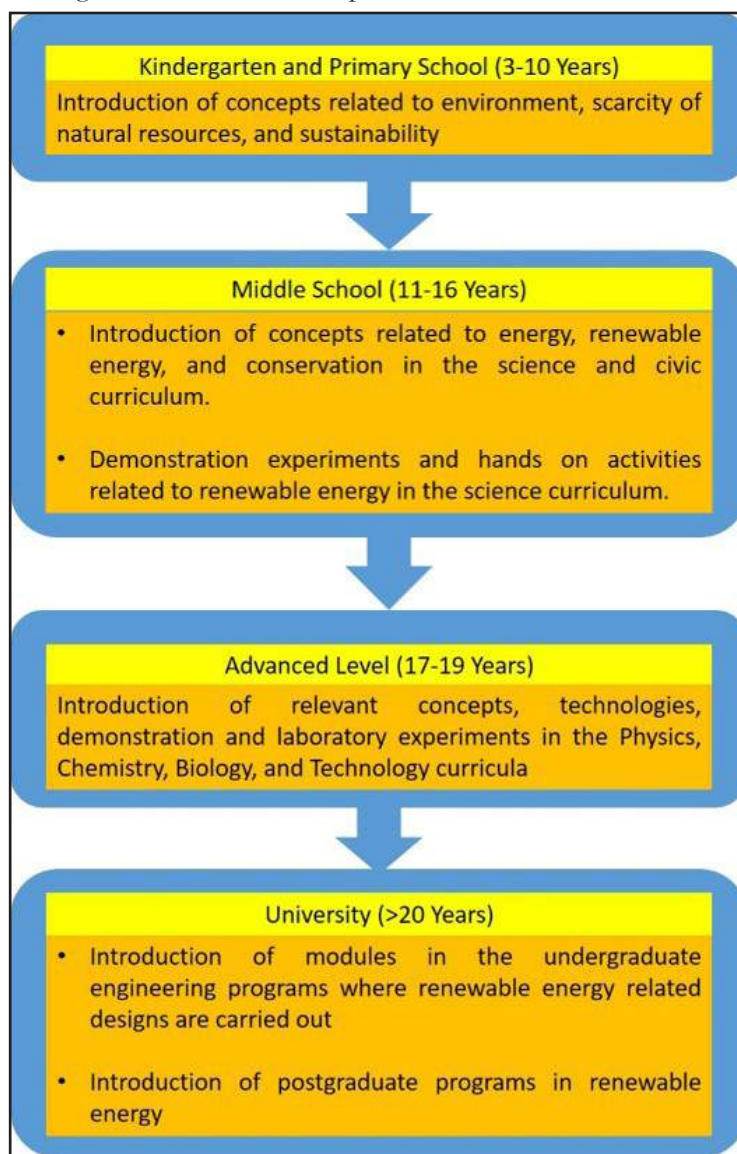
can be explained in depth in those subjects. For example, basic knowledge on how a house or a building can be designed to have a minimum carbon footprint can be shared at the middle school level. First steps towards technical

beneficial if the concepts related to energy conservation and energy conversion are discussed at a basic level in the middle school. Most importantly hands on activities related to solar energy, wind energy, and other renewable energy sources

can be integrated to the science curriculum. With participation in hands on activities, students could develop an interest towards renewable energy generation.

In depth exploration of fundamental principles related to renewable energy can be done in the advanced level curriculum. Subjects such as Physics, Chemistry, Biology, and Technology are perfect vehicles to deliver such contents. For example, fundamental physical principles related to harnessing of solar, wind, and geothermal energy, can be discussed in the Physics curriculum. It is possible to discuss fundamental principles related to electro-chemical energy storage in the Chemistry curriculum. Biomass energy related fundamental principles can be discussed through Chemistry and Biology curricula. The technology stream is geared to producing technologists

for future industries. As such, it would be possible to deliver system level knowledge related to renewable energy through the technology curriculum. Parallel to the above modifications, laboratory experiments and demonstrations



**Figure 02 : Different stages of renewable energy education**

education related to renewable energy can be taken at the middle school level. Concepts related to heat, power, energy, electricity, and energy storage are already included in the middle school science curriculum. It would be

need to be introduced to cement the knowledge. Any of above mentioned modifications to curricula need to be done in such way that the modifications do not harm the integrity and cohesion of the syllabus.

A student who has successfully completed school education, and is dreaming of entering into the renewable energy industry, should be able to fulfill his or her ambition by following an undergraduate engineering programme. In order to ensure that such a dream becomes a reality, undergraduate engineering curriculum should consist of modules where students develop their skills in designing renewable energy

generation and distribution systems. The traditional electrical, mechanical, or chemical engineering curricula consists of a great deal of fundamental engineering knowledge that is necessary to work in the renewable energy industry. But, new modules are necessary to introduce students to design and deployment of renewable energy systems. With that knowledge students will be able to directly enter into the renewable energy industry after graduation. Specialized modules could be on PV system generation, biomass energy systems, etc.

Novel renewable energy systems are not as mature as traditional energy generation systems. Therefore, a great deal of research is going on to improve the efficiency and effectiveness of such renewable energy systems. Postgraduate programmes are a useful way of carrying out research on renewable energy. Sri Lanka does not have postgraduate programmes dedicated to renewable energy

A kindergarten to university approach is necessary for renewable energy education. Successful implementation of such an approach will result in an attitude change of the society towards renewable energy, environmental conservation, and sustainability. Furthermore, this approach will provide qualified engineering professionals who can drive the renewable energy industry forward.



Figure 03 : School children participate in hands-on activities on solar energy

systems. This is one area that universities should be looking into when introducing new postgraduate programmes related to engineering. Even without dedicated postgraduate programmes, research on renewable energy can be carried out with available local expertise. In order to update the workforce in the renewable energy industry with state of the art knowledge, experts need to carry out continuous professional development activities. Universities are capable of organizing such programmes with the help of relevant experts in the academic staff.



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