



## Renewable Energy School of NZ (RESONZ)

Draft text for discussion ( copyright EWA-TEC Limited, Eric Jansseune)

« **The day we stop learning, is the day we start dying** »  
« **It's not where you are , but where you want to be that is important** »

HOME

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### HOME =INTRODUCTION

*RESONZ has developed a specialised and unique program to promote the use of Renewable Energy and sustainable technologies worldwide and in New Zealand in specific .*

*Education on all levels of the society is the key factor to implement more Renewable Energy and will inspire our next generation.*

*Worldwide the use of Renewable Energy is rising and shows a booming industry where New Zealand can not stay behind.*

Energy is an essential ingredient of the society and is fundamental for socio-economic growth. Energy should enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life without comprising the needs of future generations to satisfy their own needs.

The search for sustainable energy will further dominate the twenty-first century and is one of the greatest challenges of humanity.

Further the use of Renewable Energy is increasingly essential to achieve the Kyoto Protocol commitment for 2012 by reducing greenhouse emissions as well as reducing the ecological footprint of every energy user.

RESONZ is established to promote environmental technologies, as well as the use of more Renewable Energy through educational programs and practical information on state-of-the art technologies, based on International Best Practice and Best Available Technology. A panel of experienced Engineers and Trainers will prepare the participants to implement Renewable Energy Technologies in society or even to re-orientate their careers.

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## LECTURERS .....ABOUT THE INSTRUCTORS

**Eric Jansseune** is a Professional Engineer with degrees in Environmental Science and Mechanical Engineering (ME, Antwerp). Eric is a New Zealand resident from Belgium since 2005. Eric has been actively involved in solar projects since 1990 and started his career as an Environmental Engineer in the fields of wastewater treatment and air pollution filtration. Eric has meanwhile been responsible for the design and project engineering of numerous successful solar projects in many fields including passive, active, solar hot water heating, space heating, swimming pool heating, solar electric and solar cooling. His solar house in Belgium was awarded by the Belgian Government and Eric organised many open home days for schools and public. As a Trainer and Educator with experience in domestic, commercial and industrial solar systems, Eric organised general or specialised workshops on all levels including architects and engineers. He has provided solar training for different Educational and Professional organisations in Belgium and New Zealand. Since 1995 Eric routinely provides design, consulting, training and education services related to the development and installation of Domestic, Commercial and Industrial Solar Applications.

In 2005 Eric started to work as project engineer at Water Systems, Auckland, and created then his own engineering company EWA-TEC Limited since 2006.

Eric is member of IPENZ, New Zealand, and is also listed on the Auckland City Council (ACC) authors list for Producer Statements.

Eric is founder of the Repower NZ plan and designed/built his own Positive Energy House in Kaiwaka, where state-of-the-art solar applications are demonstrated in order to reduce the ecological footprint without loss of comfort. As a Guest lecturer at AUT-Auckland, Eric developed 12 specialised workshops on Solar Energy for engineers.

**Stefan Fortuin** is an Industrial Design Engineer (MSc, Delft) and also has a master's degree in Energy Management (MTech, Massey) with a focus on solar thermal collector development. He is currently working at Fraunhofer ISE in Freiburg (Germany) on projects related to solar research, design and applications. Before that, he worked at the National Centre for Energy Solutions of NIWA, a Crown Research Institute in New Zealand.

Stefan has a broad and interdisciplinary engineering background. His core competence is in renewable energy technologies with a specialisation in solar thermal systems. He has managed improvement projects in the areas of production, engineering, information technology and business processes. Stefan was also a lecturer in Supply Chain Management at Massey University and a guest lecturer in solar thermal performance measurement and simulation at the Auckland University of Technology.

He has experience in various simulation and design software. His other qualifications include certifications in Physical Distribution Management

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(CPDM) and SAP R/3. His specific fields of interest are Solar Thermal & Optics (thermal collector development and CSP), and Simulations & Modeling.

## **Jeroen Brand**

Jeroen is managing director of Alphatron Pacific Ltd based in Albany, Auckland. Jeroen received his Masters degree in Electrical Engineering from the Delft University of Technology, the Netherlands, in 1995. From 96 to 97, Jeroen was responsible for ensuring that products manufactured by Alphatron Medical Systems would comply with the newly introduced European CE conformity regime. In 1998, Jeroen moved to New Zealand to set-up and lead Alphatron Pacific Ltd, which is the New Zealand branch of Dutch technology company Alphatron. Core business of Alphatron Pacific Ltd is the distribution of power conversion and power generation equipment. The company is preferred supplier to most New Zealand OEM's in the marine and motor home industry and supplies inverters and PV modules to many installers and system integrators in the renewable energy industry. In addition to supply of equipment and local repair services, Alphatron provides design and project management services to its clients. Jeroen was seconded to the SEANZ Board in March 2008 as an industry practitioner and importer of small scale renewable technologies, to assist with development of the Standards and Accreditation program. He has been appointed to the Australian and NZ EL042 standards committee and provides hands-on-support for the organisation. He also leads the contracts and technical component within SEANZ

## **Anthony Dowsett BSc (Hons) MSc PGCE PhD**



Tony is a researcher and educator in energy and sustainability. He has a technical background in the sciences from NZ, Australia and the UK. Consultancy work covers the areas of resource use consents, waste water projects, eco-building, energy efficiency and renewable energy schemes. Previous work at the Institute of Energy and Sustainable Development (IESD) in the UK, has involved lecturing, research projects and training for a range of people at all levels. This has included education for schools to masters and PhD students, small businesses, government agencies and international energy professionals. Resources for distance learning and web-based dissemination have also been developed from work at the Open University and at IESD, including consultancy work for EU & UK government-funded projects and commercial agencies.

## **Jerome Partington**

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## **Ian Thain**

Ian has extensive experience in design and project engineering of geothermal projects.

HNC Electrical Engineering, Paisley College of Technology – Glasgow

Fellow of the Institute of mechanical Engineers, UK

Inaugural President NZ Geothermal Association

Member of the UK I MechE renewable Power Committee

## **Why RESONZ in New Zealand?**

Worldwide the challenge of global climate change is huge, and there is a lot of uncertainty over the cost and availability of conventional fuels and power. Energy prices have been rising continuously in a world with increasing energy consumption and on-going water, soil and air pollution. Many Building Owners, Managers, Architects and Politicians are beginning to take a hard look at Renewable Energy. New Zealand has infinite possibilities to develop a larger sustainable industry based on Renewable Energy. NZ's location and climate are ideal to promote energy conservation and to demonstrate the many different forms of Renewable Energy. There is a huge shortage of professional education and practical state-of-the-art aspects of Sustainable Engineering and Renewable Energy in a holistic approach.

Technical, institutional, cultural and educative barriers have to be overcome to market the further development of the Renewable Energy Industry

New Zealand's location and climate conditions are extremely suited for all applications of Renewable Energy but the development of Renewable Energy needs to be encouraged because the application is not widely spread.

During many decades NZ has already built up an important knowledge on Geothermal Energy and Hydropower but there is a lack of education on state-of-the-art technology in many other fields of Sustainable Engineering, Technology and Renewable Energy.

Worldwide the use of Renewable Energy is rising and shows a booming industry and New Zealand must keep pace after decades of low energy conversion and pollution.

New Zealand's location and climate conditions are extremely suited for all applications of Renewable Energy but the development of Renewable Energy needs to be encouraged because the application is not widely spread.

During many decades NZ has already built up an important knowledge on Geothermal Energy and Hydropower but there is a lack of education on state-of-the-art technology in many other fields of Renewable Energy and sustainable technologies in general.

## **OBJECTIVES**

RESONZ offers a series of courses being developed to meet the public's growing interest and need for practical information about Renewable technologies. RESONZ provides a unique education program in Renewable Energy science and technologies, to prepare participants for employment or business opportunities in this field.

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The program provides proficiency in all subjects through applied research, educational programs and practical information on state-of-the-art technology. The program will put strong emphasis on technical and practical aspects of Energy Efficiency in general and Renewable Energy specifically in the fields of Biomass, Solar Energy, Wind Energy, Hydropower, Geothermal Energy, and Marine Energy.

The RESONZ program will be a unique experience to learn from leading practitioners and professionals in the field of sustainable architecture and Renewable Energy. A team of building designers, engineers, energy experts and researchers will inform the participants through training and classes, education materials and technical data. Participants from these courses will become versatile and familiar with a range of Renewable Energy Technologies

The main academic objective and goal of RESONZ is to offer excellent education programmes in renewable energy science and sustainable technologies, as well as to strengthen future cooperation between leading NZ and international research institutions in the utilisation of renewable energies.

What is already happening worldwide in the job market, and is to be expected soon in more countries is a shift of jobs and skilled people towards the renewable industry. A lot of new jobs have already been created because of the extended renewable activities in countries like Germany, Denmark, US and China where Renewable Energy is now covering important parts of the country's Energy Mix. Education by field experts, and experienced engineers from industry and academia, plays a key role to deliver skilled people to the growing Renewable Industry.

RESONZ will not only initiate and upgrade the technical training on Renewable Energy specifically for students in architecture and engineering, but also wants to educate other target groups from a variety of backgrounds.

The RESONZ courses will promote and create a positive mental attitude towards Energy Efficiency and Renewable Energy. The RESONZ program will contribute in placing ever increasing numbers of engineers, architects, scientists, and other professionals in various companies, universities, and other institutions in New Zealand and around the world.

Further objectives of the sustainable engineering department are (a) to support educational work for participants in the development and implementation of environmental friendly energy technologies; (b) to help students and participants to find suitable thesis projects, internships and jobs; (c) to form a network of interested people worldwide.

Specifically for New Zealand the RESONZ program hopes to attract international students and visitors in order to develop a new form of eco-tourism which will contribute to the NZ Economy and Tourism in particular.

#### KEY COURSE LEARNING ....OUTCOME

By the completion of the workshops and courses, the participants should be able to demonstrate understanding of (a) the basic concepts of Energy Efficiency and the different Renewable Energy Technologies; (b) how to evaluate and compare renewable and fossil-

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fuel-based resources; (c) economic and environmental impacts and policy; (d) how to realise sustainable energy solutions in different applications.

Upon completion of the RESONZ courses, the participants will have gained different levels of professional competence. General knowledge can be used to excel in their professional development and will help provide solutions to the current and future energy problems. A specific type of knowledge can be acquired to demonstrate an advanced understanding of technical and practical aspects of renewable energy utilization, methods of minimizing environmental impacts of energy use, and in energy economics and energy policies.

Through the practical knowledge the participant will be able to support the local industry and community organizations in utilizing renewable energies on local and state-wide levels. The students will have the competence to take active part in partnerships and research networks focusing on renewable energy technologies to promote the use of it in different locations. The RESONZ course provides a solid, comprehensive and technical foundation for all those that consider future work in the renewable Industry.

#### PREREQUISITES....who should attend ?

The multidisciplinary courses are organised for participants from various backgrounds or experiences, and will be accessible for many levels of education including Building Owners, Specialised Planners, Project Developers, Managers, Architects, Advisors, Engineers and Technicians. Furthermore the RESONZ courses are also very appropriate for Government Authorities, Building Owners, and decision makers in the building industry, or any individual seeking a better understanding of the Renewable technologies. Fundamental understanding or familiarity of basics in physics, electricity, thermodynamics, hydraulics, electronics and related technologies are a bonus but not a must. RESONZ assumes that attendees show a large amount of interest but no specific technical knowledge or expertise is required. RESONZ provides sufficient flexibility to enable a personal programme to be designed for virtually anyone who wishes to up-skill in the field of renewable energy and looking for clarity.

#### EDUCATIONAL PROGRAM

Courses are taught by means of informative seminars, and can include problem solving sessions, computer exercises and study visits. Classroom instructions and class demonstrations are presented in a friendly informal manner to ensure that it will be understood by a variety of people with different backgrounds.

The RESONZ program offers generalised courses for individualists as well as tailor-made training for participants with a specific interest that search for new career opportunities. RESONZ offers a series of courses being developed to meet the growing interest and need for practical information about Renewable Energy technologies.

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## COURSE FORMAT

The courses are offered in different formats which can vary in length between 1 and 5 days.

- Open training on different topics for people with different backgrounds
- Tailor made training for managers, decision makers , engineers and technicians
- Short training courses
- Introductory courses suitable for unqualified persons

All lectures will cover the topic each lasting 2-3 hours. Course materials span from basic definitions to practice and latest developments, from local problems to global solutions, and vice versa. Theories are illustrated and case studies refer to real world solutions. Field trips will be organized where applicable to ensure the learning experience.

RESONZ Courses will cover basic energy technologies, resources, economics, environmental impacts and public policies. Emphasis in the introduction will first be given on energy efficiency for power, transport and the building industry and than focus on clean energy technologies and Renewable Energy. Renewable Energy is a multidisciplinary, modular program consisting of different modules on the aspects in relation to energy and renewable energy.

Each block will consist of theoretical and practical modules, and will also cover topics such as economy and social aspects.

## COURSE DESCRIPTION

The following blocks and topics outline will be offered to the participants:

### **1) INTRODUCTION TO SUSTAINABILITY**

In this introduction you will learn more about the meaning of global sustainability for the world, and the role of renewable energy on the short and long term

The main topics that will be covered are

- Global warming-climate change
- Carbon trading
- Policy and sustainability
- Economics of sustainability
- Barriers to sustainability
- Life Cycle Assessment

### **2) ENERGY FUNDAMENTALS**

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This course is ideal for anyone who is new to energy and renewable energy. The attendees will get a comprehensive overview of energy production with conventional and renewable technologies. It provides technical knowledge of currently available energy and renewable technologies comparing the advantages and disadvantages, including their environmental impacts.

The following topics will be covered in detail:

Energy use in the past-present and future

Energy Conversion, Storage, and systems

Energy efficiency analyses

Carbon Management – sequestration technologies

Comprehensive overview of renewable energy technologies, applications, costs and economics

Overview of the main renewable energy markets and latest market trends

### **3) SUSTAINABLE ENERGY BUILDING DESIGN**

Many factors affect the energy performance of buildings. This topic will provide practical and scientific understanding of the climate impact on building design, the use of energy efficient design principles, energy rating and energy monitoring of buildings.

### **4) RENEWABLE ENERGY**

#### **SOLAR ENERGY:**

Solar Energy Fundamentals and Basics

Solar Water Heater (SWH): production of hot water

Solar Electricity (PV): electricity from the sun

Solar Hot Air: (SHA): production of hot air

Solar Space-Heating (SSH): different concepts

Solar Cooling (SC): refrigeration, air-conditioning and cooling applications

Solar Power

Solar pool heating

Industrial applications of solar energy

Solar Thermal design and modelling

Solar PV design and modelling

Passive Solar Energy in sustainable buildings

#### **WIND ENERGY:**

This course will cover the principles of wind energy and wind power, as well as the design and operation of different types of wind energy converters. It will include the applications of water pumping, remote area power supply and grid electricity generation. It will cover in detail issues of site selection, monitoring and analyzing wind data, estimating output from wind generators, integrating wind generators into hybrid power systems or the grid, economics, standards and environmental impacts.

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## Topics covered by the Wind power modules

- Introduction, status, technology, market, wind climate, turbulence.
- Momentum theory, power coefficient, power curve,
- Annual yield, farm efficiency, capacity factor, dynamics, principles of modeling.
- Rotor Design
- Control strategies, safety, pitch/stall. Drive train, generator characteristics, fixed versus variable rpm, direct drive.
- Wind farm: off shore and onshore
- Overview of wind energy development : Scale of modern wind turbines
- Offshore wind technology: support structures, maintenance and installation techniques, social and environmental aspects: noise, visual, bird impact.
- Case studies
- Environmental impacts , costs and benefits of wind energy
  - Economical aspects : Cost breakdown of turbine, -park, calculation of kWh

## **BIOMASS ENERGY :**

The main blocks in this area of renewable energy can be summarised as following:

- Biomass introduction: chemistry and biochemistry of biomass
- Anaerobic digestion and biogas
- Liquid Biofuels
- Small combustion systems
- Gasification – Pyrolysis and other processes

All these blocks will cover also following aspects in detail:

- Facts and figures / fundamentals
- Sources-energy crops-types of biofuel
- Conversion technologies
- Delivery –storage
- Design and installation
- Environmental impact : emissions and by-products
- Best practice-state of the art and latest developments
- Operation and maintenance aspects
- Economic viability
- Policy and legislation
- Industrial applications and case studies

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## **GEOTHERMIE :**

The introduction will cover the basic aspects of :

- Geothermal resources and basics
- Geothermal Techniques
- Drilling techniques and logging methods
- Reservoir Physics, well test analyses
- Direct and Indirect use of geothermal energy

Additionally the course will look at detailed aspects of the following subjects:

- Low temperature geothermal energy in business applications
  - Business basics
  - Important factors in use of geothermal energy
- Applications of geothermal energy based on temperature.
- Sources of low temperature geothermal energy.
  - Separated geothermal water from power plant
  - Small geothermal fields and hot springs in New Zealand
- Tapping a geothermal resource
  - Direct supply
  - Pressurised drilled well
  - Tapping a non pressurised geothermal aquifer.
  - Geothermal heat pump
- Examples of low temperature geothermal resource use
  - Greenhouse heating
  - Timber drying
- High temperature application
- Design aspects
- Economic aspects

## **HYDROPOWER ENERGY**

Topics covered in this course include:

- Principles of applied hydrology
- River system analyses
- Hydropower production and mechanics
- Hydraulic structures: modelling
- Waterways
- Environmental impacts
- Hydropower mechanics

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- Large and small applications

### **MARINE ENERGY; WAVE AND TIDAL**

This course gives an overview of the fundamental principles behind the main technological solution to convert marine energy into electricity, along with the methodologies to evaluate data and modelling techniques.

- Introduction to marine renewable energy
- Environmental concerns of marine energy – coastal impacts
- Law and policies: Political and governmental issues
- Current market overview and example technologies
- Wave and current hydraulic modelling
- Economics of Wave / Tidal energy

### **ENERGY STORAGE**

This course gives insights in all aspects of energy storage, which is the biggest challenge in the field of renewable energy. Because Renewable Energy can take many forms, innovative storage systems must be developed in both fields of thermal and electrical power. Energy Storage will be a key option in addressing renewable integration issues. Following topics will be covered:

- Different energy storage systems( thermal-electricity)
- Advantages and disadvantages
- Yields and efficiency
- Economics

### **LOCATION SEMINAR**

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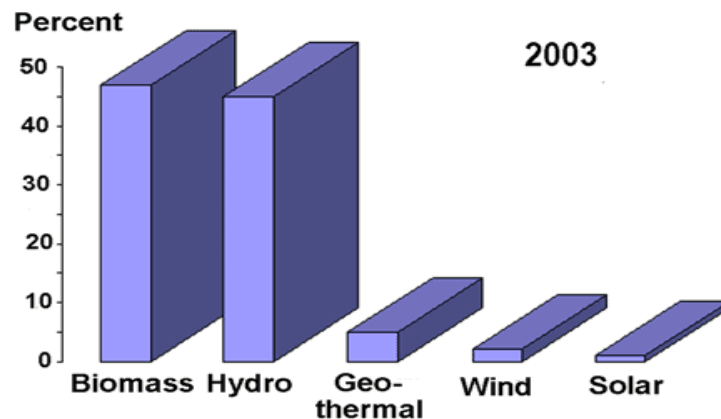


## JOB'S FOR THE FUTURE

*Renewable Energy demand is growing worldwide and the world is in urgent need for trained specialist.*

In future years, the demand for skilled people in Renewable Energy will increase as legislation in this area is tightened up and good practice will be uniformly adapted.

Renewable Energy already meets more than 13% of global energy demand and 6% in the USA. Of the 13%, nearly 80% comes from biomass, which mainly relates to non-commercial uses in Asia.



Source: Renewable Energy Annual 2003

Hydropower is the second largest renewable power with a market share of 2.3%. Geothermal, wind and solar energy provide the remainder. Wind energy installation in 1999 was estimated to be 3,600MW globally (source: American Wind Energy Association) yielding a total installed capacity worldwide of 13,400MW. Of the 3,600MW installed in 1999, the largest markets are estimated as Germany (1200MW), USA (905MW) and Spain (650MW). Solar electric installations totaled 200MW in 1999, 280MW in 2000 and 340MW by 2001 and 427MW in 2002. While growing at a rapid pace, solar electric energy globally still only accounts for more than 0.1% of primary energy demand. However, this means that relatively small increases in market penetration by solar energy as costs decline, lead to very rapid growth rates in this industry.

In 1995, over 45,000 jobs were directly or indirectly related to energy efficiency and renewable energy programs and that number has grown rapidly in the intervening years. The subject pages listed here outline the prospects for jobs in the renewable energy industries and will give you directions where to find out about renewable energy businesses, associations and useful government links.

*Job opportunities on different levels of society are growing worldwide*

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The amount of new 'renewable' jobs on many levels of society is enormous !

What is already happening worldwide in the job market, and is to be expected soon in much more countries is a shift of jobs and skilled people towards the renewable industry. On top of that a lot of new jobs are created because of the extended renewable activities in every country.

The need for 'green jobs' is inevitable in following areas – industries:

Fields	Short Job description
Renewable associations Solar-wind-biomass...etc.	secretaries CEOs .....
Government and councils	Specialised Building inspectors Renewable departments Engineers Economists ... Ecodesigners .....
Military	Renewable Energy specialists Transport Military applications
Renewable Industry	Sales Manufacturing Service and specialised teams Advice and consultancy Etc.
Universities-schools	Professors-lecturers etc. Research and development Test facilities
Transport	Public transport Cars – busses- train ...
Building industry	Architects Specialised plumbers and electricians Supply and manufacturing of related products
Energy production /power industry	Engineers and technicians Service engineers Maintenance operators



**EXEMPLE: DESCRIPTION OF JOBS IN SOLAR ENERGY INDUSTRY**

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“ The pool of solar energy job openings may comprise of positions like solar plant operator, instrumentation engineer, solar energy plants engineer, solar energy analyst, solar sales representative, project engineer, energy manager, alternative energy project engineer, solar energy consultant, solar installer, mechanical designer – solar energy, electrical engineer – solar energy and solar energy associate.

A solar energy professional may be responsible for performing one or more tasks from: supervising the solar energy units for fault-free operation; checking the quality and efficiency in energy generation; coordinating with solar operators, workers, supervisors and engineers; assisting in preparation of quality norms for energy generation and distribution; participating in maintenance work of solar plants, adhering to various safety regulations and other norms; keeping updated on various technological advancements in the area of alternative energy generation; performing quality check in absence of QC executives; making use of various equipment and performing other tasks assigned by the plant supervisor. “

#### ***EXEMPLE : DESCRIPTION OF JOBS IN WIND ENERGY INDUSTRY***

The most known wind energy positions include positions like audit engineer, wind engineer, wind energy manager, energy and sustainability manager, energy efficiency engineer, project energy engineer, associate energy engineer, wind mill operator, wind mill worker, wind energy technician and wind energy associate. The typical responsibilities of a wind energy professional include supervising the wind mill for fault-free operation; checking the quality of energy generated; coordinating with operators, workers, supervisors and engineers; assisting in preparation of quality norms; participating in maintenance work, adhering to various safety regulations and other norms; keeping updated on various technological advancements; performing quality check in absence of quality control executives; making use of various equipments and performing other tasks assigned by the plant supervisor. A wind energy professional typically reports to a wind mill supervisor.

A wind energy professional should have an associate's degree or a bachelor's degree. Excellent academic credentials are required. Prior experience in this field may be advantageous.

#### ***EXEMPLE: DESCRIPTION OF JOBS IN SOLAR ENERGY INDUSTRY***

The various most known hydraulic energy positions are those of a hydraulic test manager, hydraulic pump technician, hydraulic engineer, civil engineer, hydraulic fracturing engineer, hydraulic mechanic, hydraulic analysis engineer, hydraulic energy director, and hydraulic design engineer. A hydraulic energy professional may be responsible for providing technical support and project management leadership in the development, design, and manufacture of devices; planning, organizing, scheduling, estimating costs, assigning tests and tendering work; planning and aiding in on-going test equipment maintenance and upgrade program; and handling other tasks as required. A hydraulic energy professional typically reports to a hydraulic energy manager.

A hydraulic energy professional should have a bachelor's degree in a relevant field. A master's degree may be required for some hydraulic energy positions. Excellent academic credentials are required. Prior experience in this field may be advantageous. Strong technical knowledge in the area of hydraulic energy is essential.

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*WEBSITES : showing some of the worldwide increasing demand for renewable jobs*

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