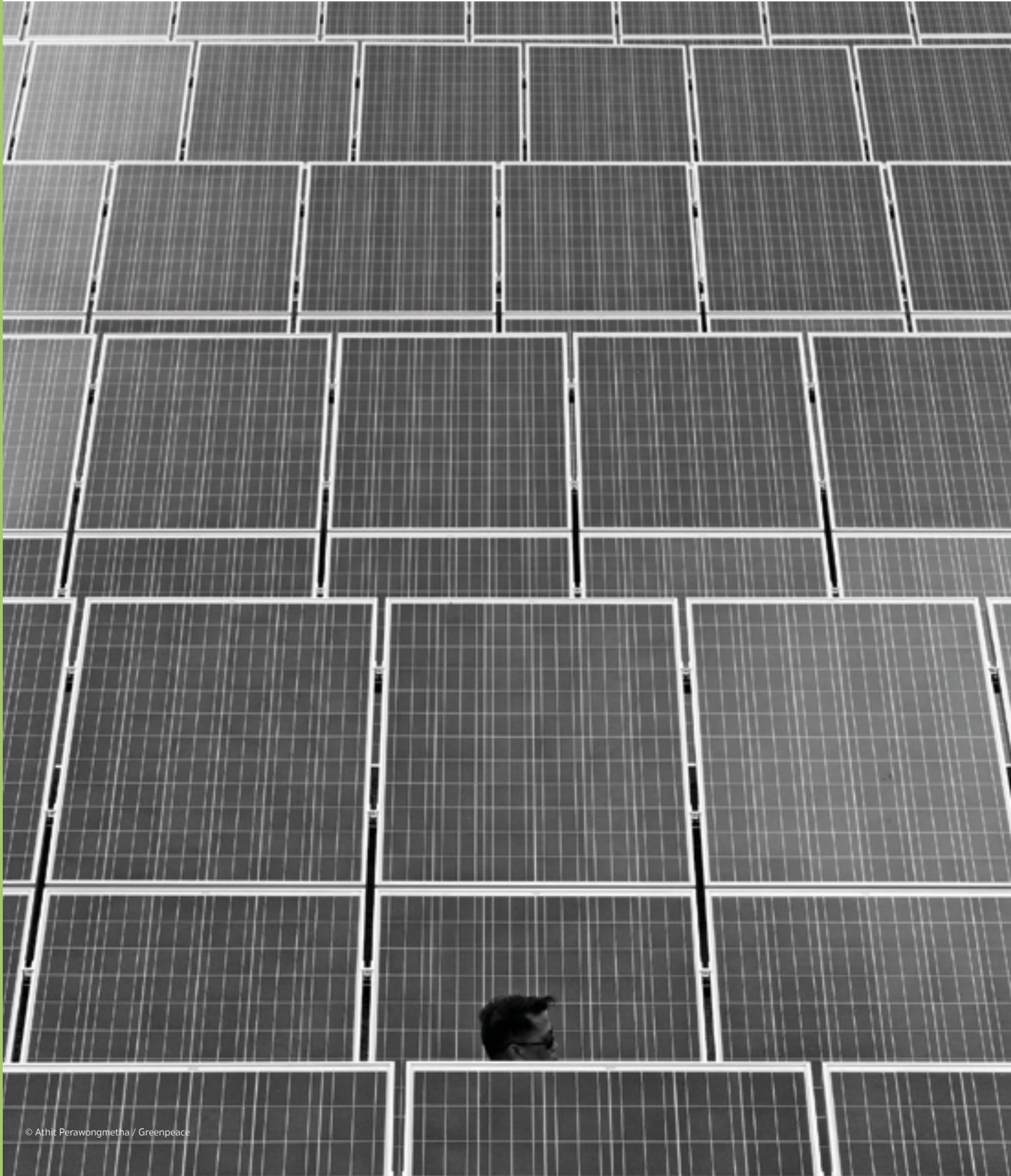


# Renewable Energy

## Job Creation in Thailand

GREENPEACE



[www.greenpeace.or.th](http://www.greenpeace.or.th)

© Athit Perawongmetha / Greenpeace

# Renewable Energy Job Creation in Thailand - Report

---

## Research Team

Dr Decharut Sukkumnoed | Faculty of Economics, Kasetsart University

•  
Assoc. Prof. Dr Chalie Charoenlarnnoppa-  
rat | Sirindhorn International  
Institute of Technology, Thammasat University

•  
Dr Somnuck Jongmeewasin | Silpakorn University International College

•  
Asst. Prof. Dr Usa Onthong | Community Biogas Demonstration  
and Research Unit, Thaksin University

•  
Somchet Chaivalap | Sustainable Energy Research Centre  
for Communities, Kalasin Province

•  
Asst. Prof. Luepong Luenam | Faculty of Agricultural  
Technology, King Mongkut's Institute of Technology Ladkrabang

•  
Asst. Prof Dr Chedsada Mingchai | Faculty of Agriculture,  
Uttaradit Rajabhat University

•  
Suphakit Nantavorakarn | Healthy Public Policy Foundation

•  
Titiwetaya Yaikratok | Healthy Public Policy Foundation

---

## Editorial Board

Tara Buakamsri

•  
Chariya Senpong

•  
Dr Decharut Sukkumnoed

---

## Editor (English Version)

Sameer Man Singh

---

## Designer

Theerat Wattanakijrunroj

June 2018

# Executive Summary

The key outcomes of the research presented in this report focus on the direct employment generated by the renewable energy industry in Thailand. Using a comparative analysis of the 'number of jobs per gigawatt-hours (GWh) of electricity generation', the research findings indicate that within the renewable energy sector, biogas and modern biomass industries have the highest direct employment rates with 1.272 and 0.871 jobs per GWh per year. The solar energy industry generates 0.766 jobs per GWh per year, followed by wind energy industry with a rate of 0.262 jobs per GWh of electricity produced.

The direct employment rate of each of the above-mentioned renewable energy sector is higher than that of the coal industry, which is 0.094 jobs per GWh of electricity produced. Based on these findings the report also projects a future scenario of direct employment in the renewable energy sector in Thailand and in the region. The direct employment rate of Thailand's renewable energy in 2016 was approximately 17,758 jobs, 80% of which was employed in the modern biomass (14,323 jobs), followed by solar (2,588 jobs), biogas (757 jobs) and lastly wind (90 jobs). This is in stark contrast to the coal industry's projected direct employment generation of only 1,950 jobs even if it were to produce the same amount of electricity as the combined

output of all renewable energy sector. Considering the total installed capacity of all renewable energy projects in Thailand, those already installed and others awaiting approval (projects in process of obtaining a permit after completion of all legal processes), the projected direct employment number would significantly rise to 27,415 jobs in 2019. This would mean an addition of 9,657 more jobs.

Based on the vision of '100% renewable energy by 2050' for Thailand, the direct employment thus generated by the sector would create 172,164 jobs which means the average working position would gain 4,670 jobs per year. The modern biomass and solar would then employ the largest number of people with 77,964 and 76,964 jobs respectively, followed by wind and biogas. In addition to employment generated in Thailand, the vision of 100% renewable energy by 2050 in lower Mekong region (Cambodia, Lao PDR, Myanmar, and Vietnam) would dramatically increase the direct employment rate to approximately 306,704 jobs. The solar energy would hire the largest amount of workers – approximately 143,570, followed by modern biomass with 89,804 jobs. It is estimated that Vietnam would employ the greatest number of people with direct employment rates slightly higher than that of Thailand.



# 01

## The Landscape of Renewable Energy

“ The renewable energy sector in Thailand has seen massive growth in the past 20 years ”

Growing concern on the greenhouse gas emissions and the urgency to mitigate the impacts of global climate change has spurred fast progress in the renewable technology industry and increased energy efficiency at lower costs, providing a stiff competition to traditional fossil fuels.

With its rapid growth, the renewable energy industry had more new production capacity units installed compared to those of fossil fuels for the first time in 2012. Since then the renewable energy sector has experienced faster growth compared to fossil fuel.



© Antolin Avezuela / Greenpeace



© Christian Kaiser / Greenpeace



Since 1994, the renewable energy industry in Thailand has expanded its production capacity growing from 1,000 megawatt (MW) capacity for the first time in 2006, to 2,000 MW in 2010 and reaching more than 5,000 MW in 2016.

Not only Thailand, its neighbouring countries, especially those in the lower Mekong region: Cambodia, Laos, Myanmar and Vietnam, have more employment opportunities from the rapidly growing renewable energy sector. As in Thailand, they are advancing from traditional energy sources to biomass and biogas in the agricultural sector as well as wind, small-scale/mini-hydro and solar energies.

About 50 million people in Cambodia, Laos, Myanmar and Vietnam still suffer from limited access to electricity. In these countries, small-sized renewable energy industries, especially wind, biomass, hydropower and solar power projects can be developed and installed to respond to their needs expeditiously, and with more efficiency and advantages compared to developing mega-power plants.

In this regard, Thailand with its better economic position, progress, experience and well-established relationships with governments and concerned stakeholders in the region has the capacity and the vantage point in helping develop renewable energy business in its neighbouring countries.

Thus, developing the renewable energy sector and employment generation are important factors to achieve the following six of the 13 United Nations Sustainable Development Goals (UNSDGs)

- Affordable and clean energy (goal 7)
- Climate Action (goal 13)
- Responsible consumption and production (goal 12)
- Decent work and economic growth (goal 8)
- Industry, innovation and infrastructure (goal 9)
- Sustainable cities and communities (goal 11)

The present study focuses on 'goal 8' to promote 'decent work and economic growth', but will as well take into account other SDGs.

## The landscape of 'Decent Work and Economic Growth'

---

Work is an important part of human life and an important mechanism and driver of the economy. However, work in the modern world is being redefined by two key factors. First, the change of population structure with a higher proportion of senior citizens. Second, the advent of mechanisation and artificial intelligence (A.I.) to replace traditional human workforce.

A cause for concern in the new landscape of work is, therefore, the decreasing number of humans in some job areas as more of the current workforce enter the senior ages. Meanwhile, there is also a concern that some jobs will be replaced by machines and artificial intelligence which will lead to higher unemployment rates.

The Thailand Development Research Institute (TDRI), based on a set of studies, predicts that the country could lose up to 3 million jobs to replacement by machines and artificial intelligence in the next 20 years if cautionary steps are not taken in time. However, Thailand could also create more than 1 million jobs in the same time frame if appropriate and timely preparations are made towards generating decent jobs.

Preparations for the creation of decent jobs is, therefore, an important challenge for both economic and social sectors of the country. The power generating industries are production lines that are important to people's livelihoods creating quite a large number of jobs. Therefore, this report aims to estimate the number of jobs directly created by power generation industries in the renewable energy sector and projects scenarios for the present and the future. This report considers the jobs created by the renewable energy sector as decent jobs.

# 02

## Methodology

---

### 1.

Formation of the study team to carry out research on jobs created by the renewable energy sector – October 2017.

### 2.

Review study concepts on jobs directly created by electricity generation projects in the renewable energy sector – November 2017. The study on direct employment generated focused on three phases:  
a) Construction  
b) Operation and maintenance  
c) Feedstock preparation

### 3.

The categorisation of electricity produced from renewable energy projects for data review done in December 2017 is as follows:  
a) Size of the projects in each technology, to cover from small to big projects  
b) Sites of projects in each of the regions  
c) The time period to prepare and implement the project

### 4.

Appointments to get data from the entrepreneurs and the project executives during January and February 2018.

### 5.

Data review of direct employment generated by electricity production from renewable energy industries during March-May 2018, totalling 25 projects. Among these, there are nine solar energy projects, seven biomass, five biogas and four wind-power projects.

### 6.

Analysis of direct employment data by the renewable energy job creation study team during April-May 2018, starting from:  
a) Analysis of work and the number of days needed to determine employment by electricity generated in each of the renewable energy industry projects.  
b) Turn the number of days and the work needed into required number of jobs, using a ratio of '300 days-work' for each job.



© Vinai Dithajohn / Greenpeace

### 7.

Calculate and estimate the employment generation under these four scenarios:  
a) Power produced from renewable energy projects already under operation in 2017.  
b) Power produced from renewable energy projects that have been contracted and/or expected to be in full operation by 2019.  
c) Power produced from 100% renewable energy projects in 2050 in Thailand.  
d) Power produced from 100% renewable energy projects in the four Mekong countries (Cambodia, Laos, Myanmar and Vietnam) in 2050.

### 8.

Qualitative assessment of employment generated by the renewable energy industry in line with the criteria for 'decent works' along with preparation and submission of a policy proposal during April-May 2018.

### 9.

Preparation of the study report and presentation of the results during June 2018.

# 03

## Findings

Direct employment generated by power production from renewable energy industries in Thailand can be categorised into five groups.



© Vinai Dithorn / Greenpeace

## 1.

### The direct employment rate of power produced by renewable energy industries

To compare the direct employment generated by each of the renewable energy industry, we take into account the number of direct jobs created per 1 GWh per year. The findings are as follows:

- Biogas and biomass industries have the highest direct employment rates (DER) at 1.272 and 0.871 jobs per 1 GWh per year.
- The solar power industry has the third highest DER at 0.766 jobs per 1 GWh per year.
- Wind power has the lowest DER among the four renewable energy types at 0.262 jobs per 1 GWh per year.
- All of the four renewable energy types have higher DERs compared to the coal-fired power industry, which stands at 0.094 jobs per 1 GWh per year.
- The highest employment rate occurs at the operation and maintenance stages, followed by the construction and feedstock preparation stages. For biomass and biogas, there are similar DERs and higher than the construction stage.
- The DER of the renewable energy industry depends not only on the type of technology used but also on three additional factors:
  - a) Power generation capacity. In the same renewable energy technology, projects with smaller power generation capacity to generate a higher number of jobs per 1GWh.
  - b) The level of development of technology. The more modern the technology, the lower the rate of direct employment generated.
  - c) Management policy of renewable energy providers. For instance, sharing management and administration systems, focusing on supporting study visits or reducing the use of biomass as materials.

**Table 1: Average direct employment per 1 GWh per each of the renewable energy technology and work stages**

Power	Average direct employment per 1 million units of electricity produced ((jobs/ 1 million unit)			
	Construction	Operation/ maintenance	Feedstock preparation	All
Biomass	0.263	0.493	0.115	<b>0.871</b>
Biogas	0.078	0.923	0.270	<b>1.272</b>
Solar	0.281	0.486	-	<b>0.766</b>
Wind	0.040	0.222	-	<b>0.262</b>
Coal				<b>0.094</b>

Source: from surveys Remarks: Rounded numbers at the 3rd decimal numbers

When comparing the installed production capacity for each of the renewable energy industry type, the rates of direct employment generated will be as shown in Table 2. Biomass power has a DER of 4.31 jobs per 1 MW production capacity (or a 10 MW power biomass power plant will hire approximately 43 workers), biogas has a DER of 5.69 jobs per MW(or 3 MW power will create 17 jobs), solar energy has 1.19 jobs per MW rate, and wind power has 0.47 jobs per MW employment rate.

**Table 2: Average direct employment rate per 1 MW production capacity of each of the renewable energy industry**

Renewable energy	Average direct employment per 1 MW			
	Construction	Operation/ maintenance	Feedstock preparation	All
Biomass	0.61	3.06	0.63	<b>4.31</b>
Biogas	0.44	2.21	3.04	<b>5.69</b>
Solar	0.44	0.74	-	<b>1.19</b>
Wind	0.07	0.40	-	<b>0.47</b>

Source: from surveys Remarks: Rounded numbers at the 2nd decimal numbers

## 2.

### Comparison of studies on direct job employment of renewable energy industry in other countries

The study team compared the above-mentioned findings to those in other countries and found the following:

According to studies done in other countries, jobs indirectly created by renewable energy industries have been included as total jobs created by 1 million units of power generated. The rates of employment in the renewable energy sector in other countries are therefore slightly higher than in Thailand.

As an exception, the employment created by the biomass industry in Thailand is much higher than the rates in other countries. This can be attributed to the fact that the biomass power production process in Thailand involves more steps in the feedstock preparation and operation phases than in other countries.

In conclusion, the direct employment generated in power produced by the renewable energy sector in Thailand is still high, especially in the biomass and biogas industries.

**Table 3: Comparison of studies on the direct job and indirect employment of power generated by renewable energy industry at one million units (number of jobs per electricity produced at one million units)**

Study team	Findings	Carragher, V., et al. (2014)	Huntington, H. (2009)
Country of studies	Thailand	United States	United States
Employment	Direct only	Direct and indirect	Direct and indirect
Biomass	0.871	0.610	0.089 - 0.324
Solar	0.766	1.620	0.846 - 1.205
Wind	0.262	0.480	0.081 - 0.318
Biogas	1.272	-	-
Coal	0.0940	.200	0.115

Source: from surveys and from Carragher, et al. (2014) and Huntington (2009)



### 3.

#### Renewable energy industry job creation categorised by job type

This study also looks at the jobs in the renewable energy power generated industry according to type. An analysis of the job creation components will have an impact on the preparation of human resources for renewable energy development in the future.

Only the findings derived from employment generation during operation and maintenance phases as well as feedstock preparation stages are presented below. These do not include the results from the construction phase.

- Engineers are expected to be hired at a rate of about 5-10 %. Biomass and wind power technologies are expected to have higher rates of hiring engineers.
- The hiring of technicians is expected to be around 21-50 %. Wind power sector is likely to have a higher employment rate.
- The hiring of management/ administration personnel is expected to be around 10 -17 % of the overall hiring in all sectors.
- The hiring of general workers is different in each sector. Wind power has the lowest rate at 23%. Bio - mass and solar energy have a 50 % hiring rate of general workers, with the biogas industry leading at 64 %.

**Table 4: Percentage of direct employment per type of jobs in each type of technology in the renewable energy industry generated power during the operation phase, exclusive of the construction period**

Renewable energy	Engineers	Technicians	Management/ administration	General workers	All
Biomass	11.55	26.90	14.69	46.86	100.00
Biogas	2.90	21.74	11.59	63.77	100.00
Solar	7.48	30.84	9.35	52.34	100.00
Wind	10.42	50.00	16.67	22.92	100.00

Source: from surveys Remarks: Rounded numbers at the 2nd decimal numbers

### 4.

#### Estimated direct jobs in the renewable energy generated power industry

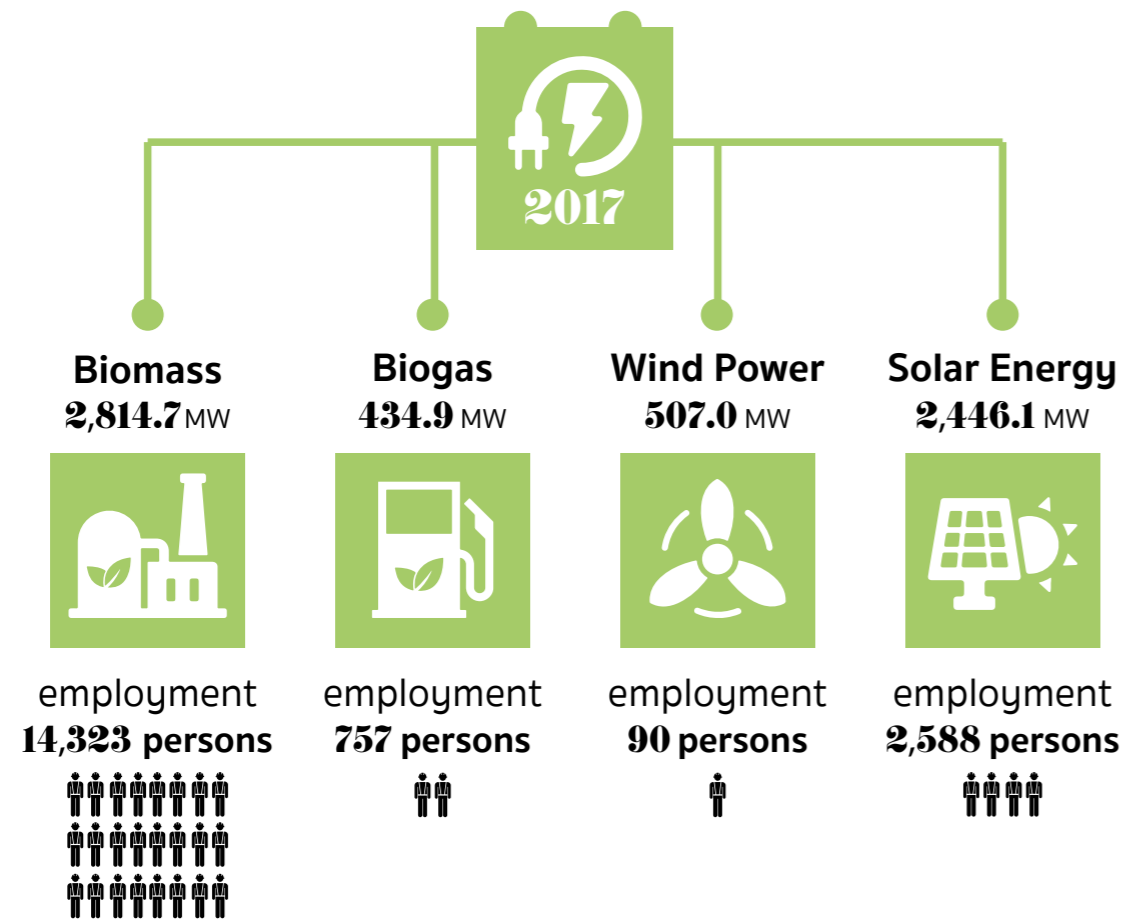
- Power produced from renewable energy projects already under operation in 2017.
- Power produced from renewable energy projects that have been contracted and/or expected to be in full operation by 2019.
- Power produced from 100% renewable energy projects in 2050 in Thailand.
- Power produced from 100% renewable energy projects in the four Mekong countries (Cambodia, Laos, Myanmar and Vietnam) in 2050. By using the direct employment numbers in the renewable energy generated power at one million units, the number of direct job creation for 2017 can be estimated. The results are as follows:
- Direct employment in Thailand's renewable energy industry generated power in 2017 has about 17,758 jobs, a large portion (14,323) of which are in biomass.
- Biomass counts for 80 % of the total jobs in the renewable energy industry, followed by solar energy with 2,588 jobs and biogas and wind energies with 757 and 90 jobs respectively.  
For the same amount of power produced, an estimated number of jobs directly generated from coal-fired power production is 1,950 jobs per year only. Developing the renewable energy industry will, therefore, help add 15,808 more jobs.

**Table 5: Estimation of direct employment in Thailand's renewable energy industry generated power in 2017**

Renewable energy industry	Estimation on direct employment in 2017			
	Construction	Operation/ Maintenance	Feedstock preparation	All
Biomass	4,322	8,104	1,897	14,323
Biogas	47	550	161	757
Solar	948	1,640	-	2,588
Wind	14	77	-	90
All	5,330	10,371	2,058	17,758

Source: calculated from Table 2 Remarks: Using rounded numbers

## Number of jobs created by Renewable Energy Sector in Thailand in 2017



We look at the number of jobs created by power produced from renewable energy by using data on the production capacities of renewable energy projects in Thailand that include projects already in operation and those awaiting completion as per power purchase agreements.

According to the study, we find that if all projects are implemented as contracted, i.e., to be completed by 2019, an estimated DER from the renewable energy industry will amount to 27,415 jobs, with an increase of 9,657 jobs.

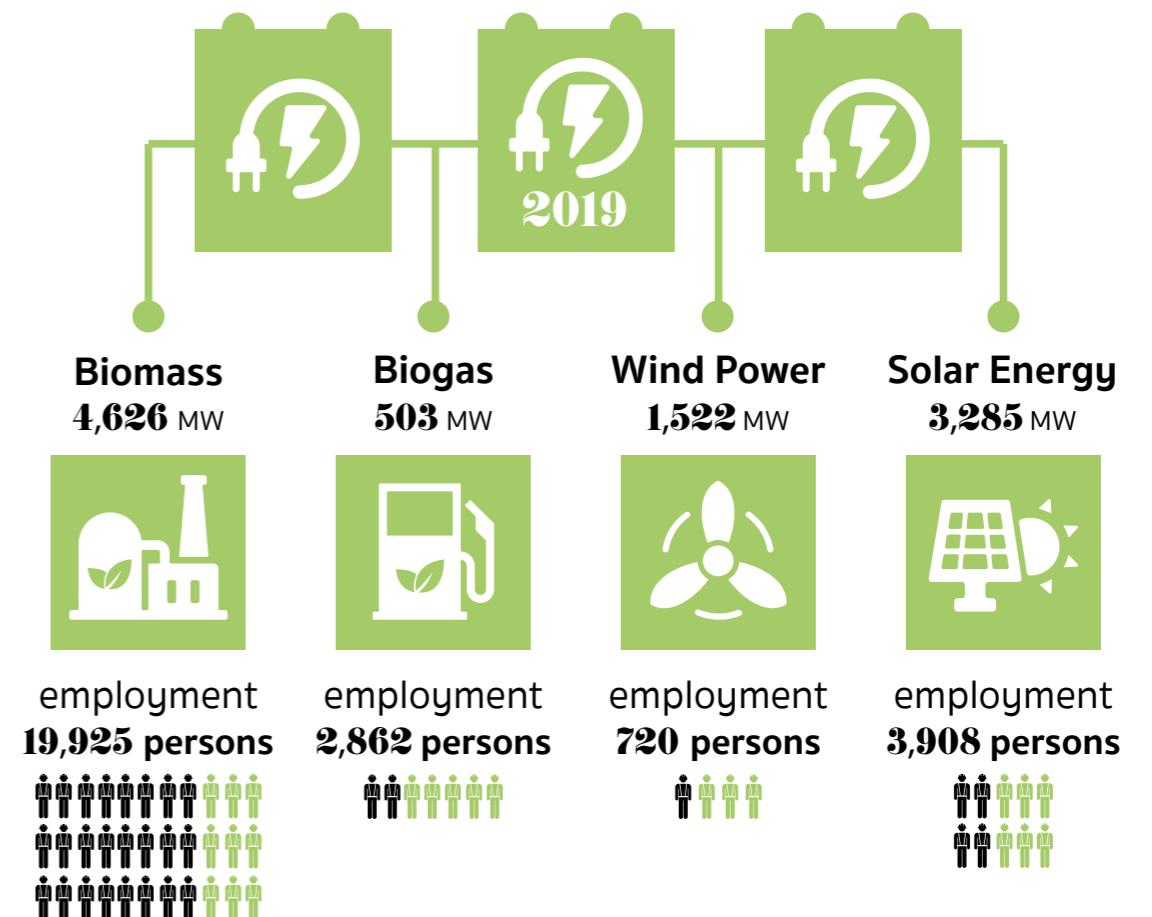
- The biomass sector remains the leader with the highest employment rate at 19,925 jobs, but at a reduced ratio (72 % of all jobs created in the renewable energy) because there is a higher distribution of jobs in other renewable energy sectors.
- Biogas has the fastest expected employment growth at 2,105 jobs, followed by solar and wind energies at 1,320 and 629 jobs respectively.

Table 6: Predicted direct employment generated by power produced from renewable energy in the case that all projects are built and in operation as contracted to be completed by 2019

Renewable energy	Prediction on direct employment in 2019			
	Construction	Operation/Maintenance	Feedstock preparation	All
Biomass	2,830	14,169	2,926	19,925
Biogas	220	1,112	1,530	2,862
Solar	1,462	2,446	-	3,908
Wind	111	609	-	720
All	4,623	18,335	4,456	27,415

Source: calculated from Table 2 Remarks: Using rounded numbers

## Number of jobs created by Renewable Energy Sector in Thailand in 2019



## 5.

### Predicted direct jobs created in the renewable energy generated power industry in a 100% renewable energy scenario in Thailand and Mekong countries

The last part of the analysis is based on the scenario that Thailand along with four other Mekong River basin countries: Cambodia, Lao PDR, Myanmar and Vietnam have developed and are using 100% renewable energy in the year 2050 as per the 'Thailand Power Sector Vision 2050 Toward 100% Renewable Energy by 2050' report (WWF, 2016.)

From the estimation results, the direct employment generated from renewable energy industry in Thailand will amount to 172,164 jobs in 2050 (with an average increase of 4,670 jobs per year), of which 77,964 jobs will be from the biomass industry and 76,620 from solar power, followed by wind power and biogas industries respectively.

In addition to the employment generation in Thailand, renewable energy industry development in the Mekong basin countries can also directly create around 306,704 jobs (with an average increase in 9,893 jobs per year), with solar energy contributing the most at around 143,570 jobs (double that of Thailand) and biomass coming second at 89,804 jobs (slightly more than Thailand).

When comparing the projections of direct jobs created by the renewable energy industry in the five Mekong river basin countries (including Thailand) in 2050, the highest jobs created will be in Vietnam (176,658), followed by Thailand (172,164), Myanmar (72,066), Laos (43,236) and lastly Cambodia (23,744).

If Thailand were to be involved in around 10 % of jobs created in its neighbouring countries, it will have more than 30,000 jobs (or an average increase of 1,000 jobs per year). As such, there is a high potential for job creation in the renewable energy sector if Thailand were to transition to 100% renewable energy by 2050 – developing renewable energy industry to its full potential and contributing to the renewable energy industry development in the Mekong region.

Table 7: Predicted employment in different scenarios, current and future

Scenario	In operation	Contracted (to buy electricity produced)	Renewable energy 100%	
	Thailand		Thailand	4 other Mekong countries
	Year 2018	Year 2019	Year 2050	
<b>Prediction on employment (jobs)</b>				
Biomass	14,323	19,925	77,964	89,804
Biogas	757	2,862	4,321	48,397
Solar energy	2,588	3,908	76,620	143,570
Wind energy	90	720	13,260	24,932
<b>All</b>	<b>17,758</b>	<b>27,415</b>	<b>172,164</b>	<b>306,704</b>
<b>Production capacity (MW)</b>				
Biomass	2,814.7	4,626.0	11,246.0	15,136.0
Biogas	434.9	503.0	427.0	5,471.0
Solar energy	2,446.1	3,285.0	58,546.0	100,674.0
Wind energy	507.0	1,522.0	22,202.0	40,086.0
<b>All</b>	<b>6,202.7</b>	<b>9,936.0</b>	<b>92,421.0</b>	<b>161,367.0</b>

Source: from a calculation

Table 8: Predicted employment in the case of renewable energy 100% in 4 Mekong countries in 2050

Country	Predicted employment in the case of renewable energy 100% in 2050 (jobs)				
	Solar	Biomass	Biogas	Wind	All
Myanmar	41,107	23,677	-	7,283	72,066
Lao PDR	13,098	7,468	9,817	3,853	34,236
Cambodia	13,480	9,797	-	466	23,744
Vietnam	75,885	48,862	38,580	13,331	176,658
<b>All</b>	<b>143,570</b>	<b>89,804</b>	<b>48,397</b>	<b>24,932</b>	<b>306,704</b>

Source: from a calculation

# Indirect employment created in the production and services of solar cells in Thailand

---

In addition to the direct employment generation scenario presented, renewable energy industry also has the potential to create indirect jobs which have not been calculated or included in this study. However, this section will note six key indirect job areas related to the renewable energy industry.



©Tadchakorn Kitchaiphon / Greenpeace

## 1 Employment in solar cell and panels production

A survey conducted by The Ministry of Energy (MoE) in 2015 shows that a majority of solar cell producers import raw materials such as cells, waferboard and raw materials for aluminium frames. The survey references the database of the Department of Industrial Works (DoIW) which considers only the production and assemblage of the solar cells involved in the installation of electrical systems. It was found that there are 12 solar cell panel producers whose combined cell production capacity is 924 MW per year and a solar cell panel production capacity of 4,000 MW per year, generating a total of 2,506 jobs.

## 2 Employment in “Solar Rooftop” project

The Thai government has promoted installations of solar panels on the roofs through its ‘Solar Rooftop’ pilot project. It is expected to contribute 100 MW electricity with 50 MW in the service areas of the Metropolitan Electricity Authority (MEA) and an additional 50 MW in the Provincial Electricity Authorities (PEAs). Of these, the set ratio of installation of solar systems on the roofs is 20 MW for household roofs and 80 MW on commercial buildings. The participation totals 32.72 MW and is in the process of setting up the system and connecting to the power distribution system and expected to be completed by 31 March 2017 (source: Department of Alternative Energy Development and Efficiency, Ministry of Energy).

A study done in April 2018 found that, in an average, installation of a 5 Kilowatt (KW) solar rooftop system in households and businesses will require 5 persons to work for 2 days each, or a ‘10-person-day’. For maintenance work, 2 persons will be required to work 1 day twice a year, or a ‘4 person - day’ per year. And if a district has 600 households and businesses with 5 KW or 3 MW solar rooftops installed, the installation will generate ‘6,000-persons - day’ and hiring of ‘2,400-persons-day’ per year, or 8-person-day per year (calculating at 300 work days per year). And, if there is a purchase of electricity produced from solar rooftops amounting to 3,000 MW nationwide, there will be a need to hire ‘6,000,000-persons-day’ (or 20,000 jobs) for the system installations. Additionally, 8,000 jobs would need to be hired for the maintenance work of the system.

## 3

### Employment in solar cell panel recycling industry

The used solar photovoltaic panels can be recycled by employing chemical processes to recover raw materials such as aluminum, glass, copper etc. At present, this is done in India and is expected to spread to other countries in the future. The process of extracting and reusing materials will require additional manpower, thus creating a need for more jobs. However, there is no projection of additional employment generated by this sector yet.

## 4

### Employment in combustion steam boiler industry for biomass power plants in Thailand

According to the study done in April 2018, there are five manufacturers from three business owners who produce, assemble, and distribute (complete cycle) combustion steam boilers to the biomass power plants in Thailand. These have contributed to the hiring of 668 posts in the combustion steam boiler industry for biomass power plants. This sector has three key types of jobs: Management positions (34 persons, 5% of total positions), Engineer and Technician positions (94 jobs, 14% of total positions) and Workers (540 persons, 81% of total positions).

## 5

### Employment in development of power transmission and distribution system

Renewable energy is 'distributive generation' by nature because the source of energy is often small in size and spread out, adding to the complexity of its power transmission and distribution systems. Therefore, to deal with the fluctuation and complexities of power transmission it is normally managed and controlled at the power substation with the help of a remote control. Each station has a different size, starting from 50 MVA. The manpower/ employment needed in the setting up and operation of such power substations will involve the following:

- Construction of the power substation. This process takes around 18 months, with about 60 construction workers during the first 12 months. The last six months will require about 20 construction workers and 30 technicians and engineers.
- Operation of the power substation. Although most power substations are controlled remotely, there is a need for at least one substation controller to monitor and respond to any special events.
- Smart grid power management system. Indirect employment is generated in the management of smart grid systems which consists of design, research, equipment production and operations in different parts and stages. Additionally, activities like the set-up, operation and maintenance of energy storage systems e.g. pump energy storage, grid battery for the fluctuation of electricity demand also require dedicated manpower leading to the indirect creation of jobs.
- A gigafactory like Tesla battery factory employs at least 600 construction workers working daily for a 50,000 MW per hour per year battery producing capacity. Although the factory uses a lot of machines and robots, it also hires at least 850 permanent positions.

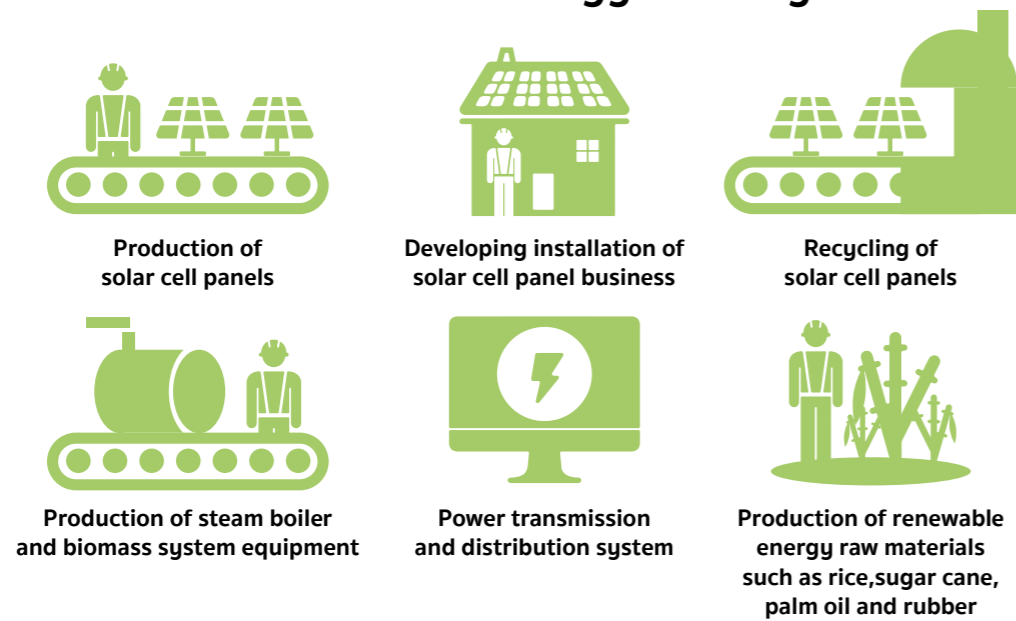
## 6

### Employment in the producing of raw materials for biomass energy

The production of raw materials for the biomass energy industry is an important phase that requires a substantial labour workforce and also significantly involves the agricultural sector. Since the production of raw materials for biomass energy is often encapsulated within the process of agricultural production, it is difficult to segregate or specifically quantify the labour used therein. This report will therefore not analyse direct employment in the production of raw materials for biomass energy.

The data of the Office of Agricultural Economics of Thailand (OAE) indicates that in 2017 a total of 5,826,000 farmers' households planted four key crops viz. rice, rubber, palm oil and sugar cane that yielded raw materials for biomass energy with a combined value of THB 688,580 million. According to the Energy Policy and Planning Office, in 2019, biomass energy production will help add up to THB 41,813 million in value, and has the potential to help increase the added value of agricultural products at the rate of 6.1 % which is equivalent to adding an income of THB 7,176 per household for 5.8 million households.

## Indirect employment from the development of renewable energy industry



**Table 9: Are jobs generated by the renewable energy sector decent works?**

		
It is an industry with continued demand, secure Power Purchase Agreements (PPA), no high competition and labour costs are not the key costs.	<b>Security</b>	Jobs that do not require specific skills may easily be replaced by machines, e.g. cleaning of solar cell panels, conveying (or transportation) of biomass.
In an overall context, renewable energy sector jobs are neither high-risk nor too challenging.	<b>Work conditions</b>	Some work processes involve environmental risks and health hazards such as dust, noise, smell and lack of ventilation.
Renewable energy sector provides opportunities for aspiring business owners/ entrepreneurs in local areas.	<b>Career advancement</b>	No developed clear career path.
It provides entrepreneurs with an opportunity to work near one's home and neighbourhoods with an image of doing 'eco-friendly' business and being innovative.	<b>Meaningful work-life balance</b>	Some renewable energy entrepreneurs have pending disputes with local communities and carry a questionable image.
Renewable energy industry presents opportunities for good income.	<b>Income</b>	
	<b>Labour rights</b>	The renewable energy employment sector still lacks labour unions.

## Are renewable energy decent works?

Besides presenting a quantitative projection of direct jobs created by the renewable energy industry, this report also attempts to address the issue of whether renewable energy jobs should be considered as 'decent works'. Aspects like security, work conditions, career advancement, meaningful work-life balance, social life, income and labour rights are therefore considered. We find both positive and negative aspects of 'decent works' in the renewable energy industry.

On the positive side, the products of renewable energy industries are always in high demand. The industry has security in terms of power purchase agreements and low competition. It has good income potential (approximately THB 500-900 per day) and labour is not the key cost of the industry, which means that it has a low-risk factor. Overall, work in the renewable energy has less risk and challenges. Renewable energy jobs also benefit from a positive social image of environmental stewardship and being innovative. It also has career advancement opportunities to become entrepreneurs in their local areas.

On the negative side, around 40 % of all jobs in the renewable energy production sector is unskilled labour which could easily be replaced by machines. Examples of these works are cleaning of solar cell panels and transporting biomass fuels. Moreover, there is a lack of clarity or standards for a career path in the sector. Work in some areas may involve environmental risks and hazards such as dust, noise, smell and lack of ventilation. The labour communities themselves also lack unity and solidarity. Some renewable energy producers also have disputes/ conflicts with the communities and may not be seen as carrying a good image by the local communities.

# 04

## Policy recommendations

---

The current study shows the potential of the renewable energy industry in generating 'decent works' in its various aspects. However, in order to develop the renewable energy industry sector in a way that translates into job market expansion, problems and challenges within the industry need to be addressed and resolved as presented in the three policy recommendations.



© Antolin Avezuela / Greenpeace

## 1.

### Energy planning

The direct employment generation potential of the renewable energy industry should be prioritised and analysed as part of the nation's development plans for power generation capacity and energy planning.

1. There is a big difference in employment rates of power generation from the renewable energy industry to that of the fossil fuel industry, and it greatly affects the overall employment in the present and in the future. Therefore, the making of the development plans for power generation capacity should consider, analyse and incorporate each of the renewable energy types' direct employment rates.

2. By including employment rates from the renewable energy, the industry will help make electrical power planning more comprehensive because there is a connection between economic investment in the electricity security energy sector and the social benefits from the jobs it creates. Such an analysis will help the education and human development for site/area specific development plans as well.

3. Planning of future renewable energy industry expansion should be done in collaboration with countries in the Mekong river basin. This will enable us to see bigger regional markets and can help us plan on human resource development in the renewable energy industry.

## 2.

### Human resource development in the renewable energy industry Policy

Employment opportunities in the renewable energy industry in Thailand is expected to keep increasing in the future. Therefore, an enhanced education policy to promote and develop labour skills in support of a growing renewable energy industry is critical. The development of education policies in order to address and fulfil the skill-sets required in the renewable energy industry can be categorised as follows:

1. The development of a Health, Safety and Environment (HSE) policy for the renewable energy industry to create a safe work environment for all.

2. The development of Total Preventive Maintenance (TPM) policy for renewable energy industries in order to enhance the ability to monitor the overall renewable energy operating system and ensure non-stop operations. This requires development of skilled manpower to accurately predict system deterioration for timely maintenance which is crucial for the efficient operation of renewable energy production systems.

3. The development of an renewable energy industry curriculum that enables everyone to have an opportunity to work in the renewable energy industry sector that is productive, has fair compensation, provides freedom, equality, safety and dignity to all humans regardless of gender.

4. The development of short-term training courses to upgrade the level of existing human resources in the renewable energy industry to gain more knowledge on technology, management, safety and other areas.

5. The development of skilled human resources must be prioritised in the Research and Development areas of the renewable energy industry in Thailand for career advancement. Research activities focusing on developing high potential entrepreneurs in the renewable energy sector, high efficiency in renewable energy factories and for developing high skilled labour must be intensified.

6. Fostering collaborative activities between educational institutions and the Federation of Thai industries to develop human resources and skilled manpower in the renewable energy industry Such collaborations can help develop courses for renewable energy personnel from the Mekong River basin countries (Cambodia, Lao PDR, Myanmar and Vietnam).





### 3.

## Education policy

From the above-mentioned findings related to job creation in Thailand's renewable energy industry, the study team has put forward important recommendations for uptake in the education policy for human resource development in the renewable energy industry to help deliver highest benefits for the public.

The study finds that in order to manage undergraduate education in Thailand's universities and institutes of higher learning, there need to be concerted efforts to bring in renewable energy industry-related knowledge from different dimensions and incorporate them into the curriculum as part of major electives or basic subjects. This would help build accurate views as well as the ability to systematically analyse renewable energy related situations.

At the same time, the faculties, departments or institutes, etc., who make renewable energy or renewable energy related curriculums need to include learning and skill building on safety management as well as environmental management so that the students can be a part of the drive to push forth renewable energy development in the country. The skills gained will also help equip the students with more vocational skills that can be integrated with other skills giving them competitive advantages and employment opportunities.

In addition to existing curriculums, the study findings also emphasise additional capacity development courses to encourage thorough understanding of smart grids using digital technology, which will be a turning point for renewable energy industry in the near future. This report also stresses the importance of training engineers, technicians as well as academics to be skilled in designing renewable energy systems (or plant design) that are based on renewable energy while being financially feasible.

An important element of education policy is the development of entrepreneurial skills for the undergraduates,

leading them to be capable new entrepreneurs. Research findings indicate that the renewable energy business generates good income for individuals with a good return on investment (RoI) in the industry. The renewable energy market is, therefore, an attractive avenue for the undergraduates interested in entrepreneurship. This would require continuity in managing curriculum with Cooperative Education or Work Integrated Learning (WIL) systems in order to build confidence and clarity before entering the real business system.

The recommendations for education policy derived from the findings in this study are not limited to Thailand but have a wider relevance to countries with similar potential, context and development such as the Mekong basin countries: Cambodia, Laos, Myanmar and Vietnam (CLMV), who also have a great opportunity to develop human resources in the renewable energy industry sector. Higher education institutions in Thailand have the capacity to be the centre for development of human resources in the CLMV countries.



© Kate Davison / Greenpeace

## Conclusion on policy recommendations

---

The development of the renewable energy industry in Thailand and the region has many positive aspects for the development of local areas using local resources for job creation and income generation for local people while being an important agent for change and providing an impetus for more knowledge and innovation in the long run.

[ Local people should look at developing renewable energy industry as a way to comprehensively distribute opportunities and power ]

by using local resources and local knowledge as a base and focus on developing opportunities, economy, and human resources.



## References

- Carragher, V. et al., 2014. Job Creation and Prospects of Renewable and Sustainable Energy Technologies.
- Huntington, H., 2009. Creating Jobs with 'Green' Power Sources. Stanford University, USA.

**GREENPEACE**



