Feasibility Study / Design Mission

Renewable Energy Skills Development (RESD) Indonesia

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Table of Content

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Acronyms and abbreviations

ADB	Asian Development Bank
ASEAN	Association of South East Asia Nation
BLK	*Balai Latihan Kerja* / National Industrial Training Centre
BNSP	*Badan National Sertifikasi Profesi /* Indonesia Professional Certification Authority
BPSDM (ESDM)	Human Resources Development Agency of MoEMR of Indonesia
CBT	Competency Based Training
CHF	Swiss Francs
CI	Civil engineering
CMMA	Coordinating Ministry of Marine Affairs
D2, D3, D4	Diploma 2, 3, 4 - tertiary TVET education
DANIDA	Danish International Development Agency
DIKBUD	*Kementerian Pendidikan dan Kebudayaan* / in the text MoEC
DIKTI	Directorate of Higher Education MoRTHE
DJ	General Director / *Direktor Jeneral*
DJK	Directorate General of Electricity
EBTKE	Renewable Energy and Energy Conservation Department of MoEMR
EL	Electrical engineering
FS	Feasibility Study
FS	Feasibility Study
GIZ	German Development Cooperation Agency
GoI	Government of Indonesia
HRD	Human Resource Development
ICC	Implementation Coordination Committee (to coordinate on Indonesian side)
ILO	International Labour Organization
IU	Implementation Unit (within the Indonesian Partner Institutions)
IPP	Independent Power Producer
IQF	Indonesia Qualification Framework
IRENA	International Renewable Energy Agency
JICA	Japan International Cooperation Agency
KEBTKE	Renewable Energy and Energy Conservation Department of MoEMR
KKNI	National TVET Qualifications Framework / *Kerangka Kualifikasi Nasional Indo.*
kW, MW	Kilo Watt, Mega Watt
LSK	*Lembaga Sertifikasi Kompetensi* / Competencies Certification Body
LSK-K	Competence Certification Body in Electrical Engineering
LSP	*Lembaga Sertifikasi Profesi* / Professional Certification Board
ME	Mechanical engineering
METI	*Masyarakat Energi Terbarukan Indonesia* / Renewable Energy Society Indonesia
MoEC	Ministry of Education and Culture
MoEMR	Ministry of Energy and Mineral Resources
MoI	Ministry of Industry
MoM	Ministry of Manpower

MoRTHE	Ministry of Research Technology and Higher Education
MoSOE	Ministry of State Own Enterprise
OJT	On the Job Training
PLN	*Perusahaan Listrik Negara* / State Electrical Company
PPA	Power Purchase Agreement
PPSDM	*Pusat Pengembangan Sumber Daya Manusia* of EBTKE
PSU	Project Support Unit
RE	Renewable Energy
RENAC	Renewables Academy AG, Berlin
RESD	Renewable Energy Skill Development
RISTEKDIKTI	Ministry of Research, Technology and Higher Education / in the text MoRTHE
RPJM	Rencana Pembangunan Janka Menengah Nasional / Mid-term National Development Plan
RPL	Recognition of Prior Learning
RUPTL	Rencana Usaha Penyediaan Tenaga Listrik (Power Supply Business Plan)
S1, S, S3	Serjana 1, 2, 3 – Bachelor, Master, PhD
SC	Steering Committee
SCO	Swiss Cooperation Office
SECO	State Secretariat for Economic Affairs, Switzerland
SKKNI	*Standar Kompetensi Kerja Indonesia* / Indonesia Working Competency Standard
SMK	*Sekolah Menengah Kejuruan* / Vocational High School
ToR	Terms of Reference
ToT	Training of Trainers
TVET	Technical and Vocational Education and Training
VET	Vocational Education and Training

List of Figures[1]

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[1] Figures in the Executive Summary and in the Annexes are not listed

Executive Summary

Indonesia has seen considerable economic growth over the last several decades. As elsewhere, economic growth had significant impact on Indonesia's environment and on the consumption of its natural resources. The country has therefore set ambitious goals in its National Energy Policy (Regulation No. 79/2014) to increase the share of renewable energy (RE) in power generation to 23% by 2025, and 31% by 2050.

Through its Economic Cooperation and Development Division, The Swiss State Secretariat for Economic Affairs (SECO) seeks to foster sustainable and inclusive growth in its partner countries as a way to reduce poverty and mitigate global risks such as economic and financial crises and climate change. SECO has developed a concept for a bilateral skills development program in renewable energy in Indonesia. After internal approval of this initial concept, SECO has asked external expertise to verify the feasibility of the concept, to adapt it where necessary and to provide inputs for this program.

The Feasibility Study Team (FS Team) had three main tasks:

i) To provide an analysis on skills development in the renewable energy sector in Indonesia
ii) Based on this information, to verify the feasibility of the interventions proposed in the SECO concept
iii) Conclude on and discuss necessary adjustments and provide concrete recommendations and formulations for a final project document.

By undertaking desk studies and two field missions to different parts of Indonesia, and conducting interviews, focus group discussions, workshops and a labour market scan, the FS Team came to the following conclusions:

- Current trainings in RE are mainly unstructured, non-systemic and short-term
- Different training providers provide various trainings with objectives not aligned with labour market needs and aimed at teaching low skill level competencies
- The polytechnic schools visited in Manado and Kupang have laboratories partly suitable for renewable energy exercises, in the case of Makassar and Jakarta, they even have new high quality equipment, although they do not have training programs which make full use of this equipment
- Non-formal training programs of government and non-government institutions are aligned with various qualification and certification systems, are not coordinated and not continuously offered
- Many non-formal training programs have been developed in the past, but the content and quality level is rather questionable and geared for specific companies or tasks
- A systemic approach for RE competency training serving the labour market is missing, and future developments in the sector are not considered (training institutions are not prepared for an increased demand in skilled labour)

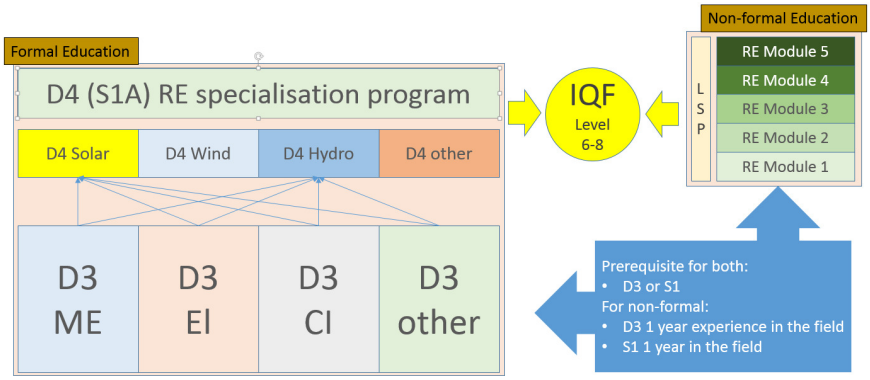
Further, the labour market scan and interviews conducted by the FS Team revealed that the RE sector is not growing as fast as predicted, and that the government's target of 23% renewable energy in Indonesia's energy mix will not be reached by 2025. Therefore, the quantitative need for skilled labour in the RE sector is more realistically estimated at 10'000 people, not at the 72'000 projected by the Government of Indonesia. The scan and interviews pointed out, that the labour market is asking for a D3/D4/S1 (bachelor, formal education) level from a multidisciplinary education setting. This is for three reasons; first, at this level a graduate can enter a company, and after an orientation period reach a supervisor level or work in RE plant design and planning; second, such graduates would have the

educational background and experience to be able to guide and train people in-company; and finally there is a much higher economic impact in the value chain of renewable energy sector by developing high skilled workers as compared to low skilled workers.

In addition, there is a demand for non-formal short-term training for people already in a job, or people who would like to improve their employability. The RE Industry would be in favour of a common accreditation standard for skills competencies, as they are currently not satisfied with the "jungle" of certifications in the sector. Companies have signalled that they would fully support a modular series of short-term (non-formal) trainings leading to an equivalent qualification level as a formal education D4 degree.

The FS team observed that there is a gap between labour market needs and available formal and non-formal training available. The main reason for this gap is a lack of meaningful cooperation between the training and education sector and the private sector. A potential future project has to actively seek cooperation with the private sector in all its activities and needs to support the establishment of systemic relations between the RE industry and the training and education sector.

The FS Team developed a new model for a multidisciplinary D4 training: a specialisation program of one year, comparable with a post graduate study program aimed at D3 or S1 graduates. The novelty of the model is that D3/S1 graduates of different general engineering fields would enter a multidisciplinary learning environment, learning to work in teams with members with various engineering background. Such multidisciplinary "post-graduation" will address one or at maximum two RE technologies. Such a program would not only better serve the labour market than the single direction training provided now, but it would also provide the graduate with wider opportunities in the labour market. MORTHE verbally confirmed that introducing such a D4 program is possible.



For non-formal education, this D4 program would be adapted into a series of modular short-term trainings. These two training programs, formal and non-formal, will build the core of the Renewable Energy Skill Development (RESD) project.

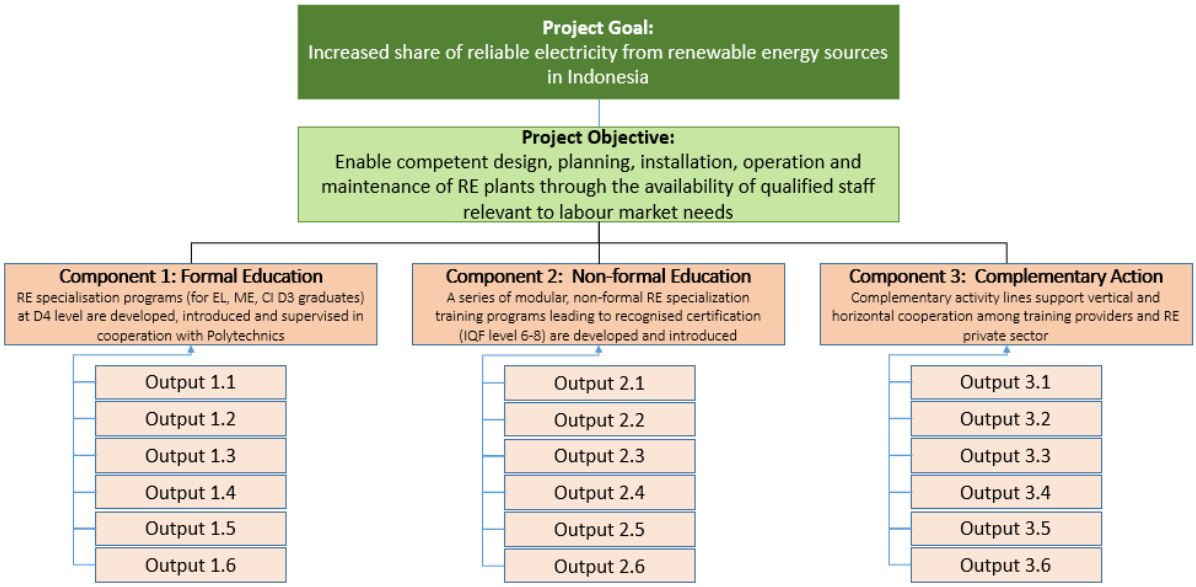
The FS believes that the objective as described in the project note, to expand access to electricity from renewable energy sources and ensure its reliability, is beyond the influence and leverage of a single project. But, the project can contribute to this objective, therefore it shall stay as the ultimate goal of the project. One aspect that is required to reach that goal is well educated and skilled staff to design, plan, install, operate and maintain RE power plants.

The project objective, to which the project significantly will contribute, therefore shall be: "***enable competent design, planning, installation, operation and maintenance of RE plants through the availability of qualified staff relevant to labour market needs***".

The project, called RESD (Renewable Energy Skill Development) in this report, shall consist of three components (which represent the outcome level). The RESD core will form the ***first (formal –VET)*** and ***second (non-formal VET) components of the project***. To further support the understanding of

technologies and to support market growth, the FS Team proposes an extended project structure that includes a ***third component*** addressing labour market issues, partnership, inclusion of and knowledge exchange with Swiss institutions, awareness and digitalisation.

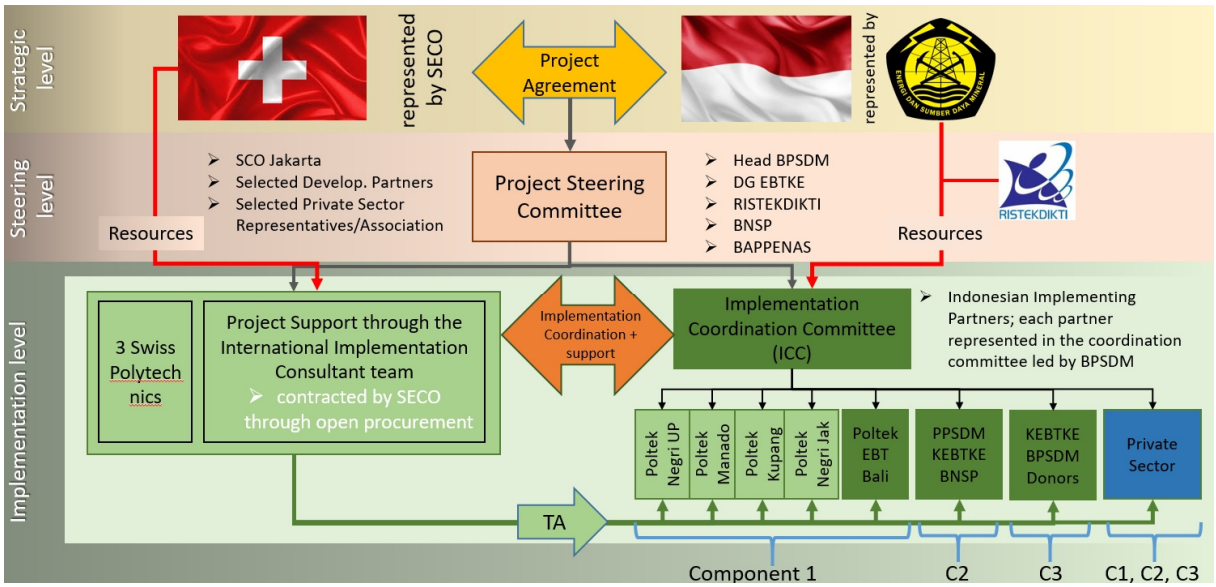
The outputs leading to the components outcomes (in below graphic only symbolic) are detailed in chapter four. The project structure would therefore be the following:



The FS Team discussed these ideas with the main stakeholders from the energy and TVET sectors and received strong (and at times even enthusiastic) support for the proposal.

Such a warm reception is a common thing if one gets free of charge support and incentives, but the delivery approach proposed by the FS Team was not “a free lunch”, it is a cooperation with similar obligations, contributions and responsibilities from both sides. For example, it was made very clear that the Swiss partners would neither pay for travel nor accommodation, nor salary topping-up and allowances. The project would only be prepared to finance small equipment in the case that it would not be possible to procure such items through regular Indonesian budgets or other on-going projects. For this reason, a *shared LogFrame* (see Annex 12), defining indicators for both the Swiss side as well as the Indonesian partners, has been drafted and discussed with proposed main partners. Taking this into consideration, the reception of the ideas at the strategic level as well as the implementation level were exceptionally good.

The FS Team also assessed and discussed the best possible partners for the RESD project at strategic, steering and implementation level, how the project would be set-up, and who should be involved in project steering. The proposed project set-up is detailed with the potential main implementing partners in the following graphic.



The PSU is not providing staff directly into partner institutions, regular visits and joint activities will be used for face to face cooperation, and ICT will be used for daily communication. Each partner institution will appoint an implementation unit for the implementation within the institution and for participation in joint activities.

This FS report contains different inputs to the SECO project concept and a proposal for how the project shall be set-up, what a project road-map would look like, and what kind of resources the Swiss side would need to prepare. The proposed project draft is based on the SECO project concept for a 4-year project. The total budget would be around CHF 6.45 million (below some details in 1000 CHF).

	year 1	year 2	year 3	year 4	**Total**
Staff costs (including housing and home leaves)	704	704	704	704	**2'816**
Project operation and administration	133	115	115	115	**478**
Activities component 1	250	405	210	70	**935**
Activities component 2	170	250	190	80	**690**
Activities component 3	120	160	170	110	**560**
Reserve	69	82	69	54	**274**
Project Overhead 12.5%	172	204	174	135	**685**
Total	**1'618**	**1'920**	**1'632**	**1'268**	**6'438**
Swiss Partner fund (included in total)	150	130	120	100	**500**

Based on assessments, interviews, focus group discussions and feed-back from the private sector, the FS Team is convinced that the proposed RESD project would be feasible, would meet the standards of Swiss development cooperation, and in addition would have the potential to bring systemic change to Indonesian TVET delivery while offering an innovative approach for Swiss Development Cooperation.

The project would serve the following Sustainable Development Goals:

Hagenwil, 26th of October 2019, H. Sager, Team Leader FS Team

1 Background

1.1 Rational[2]

Through its Economic Cooperation and Development Division, SECO seeks to foster sustainable and inclusive growth in its partner countries as a way to reduce poverty and mitigate global risks such as economic and financial crises and climate change. Indonesia is one of SECO's priority countries. As laid out in the Country Strategy Indonesia 2017-2020, Switzerland's development cooperation in Indonesia focuses on improving service delivery through efficient and sustainable use of resources and creating a more competitive and job-creating private sector with access to resources and markets.

In process of identifying new interventions within the Country Strategy Indonesia 2017-2020 under the domain of its Infrastructure Financing Division (WEIN), SECO has developed a concept for a bilateral skills development program in renewable energy in Indonesia. After internal approval of this initial concept, SECO has asked external expertise to verify the feasibility of the concept, to adapt it where necessary and to provide inputs for this program.

The Terms of Reference (ToR) for conducting this feasibility study included; i) to determine the detailed skills needs/skills gaps in renewable energy in Indonesia, ii) to assess the feasibility of the SECO concept to address those gaps; and iii) to assist SECO in adapting the current concept and developing a detailed project document. The focus shall be on the demand for introducing and expanding training and degree programs in renewable energy in the areas of hydropower and solar (including solar-diesel hybrid).

1.2 Context

Indonesia has seen considerable economic growth over the last several decades. The Gross Domestic Product per capita in Indonesia was last recorded at 4284.70 US dollars in 2018.

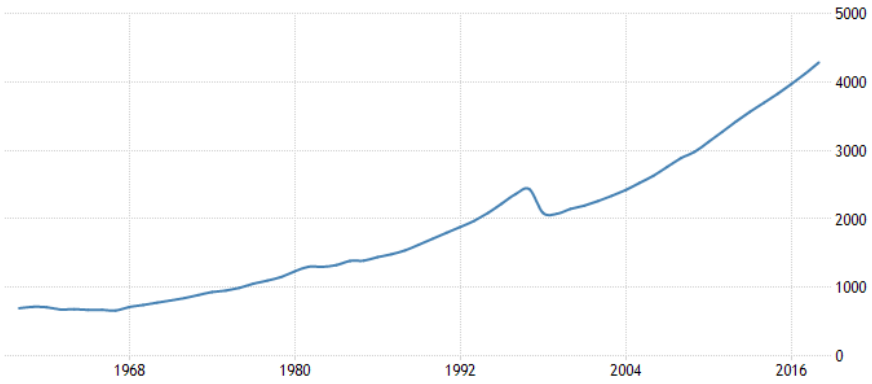


*Figure **Fehler! Textmarke nicht definiert.**: Indonesian Gross Domestic Product per capita over time[3]*

As elsewhere, Indonesia's economic growth has had an impact on the environment and on the consumption of resources. The environmental impact of the growth has mainly been manifested in de-forestation and increased waste. The massive increase of waste has had an extensive effect on water (rivers and sea), land (solid and liquid waste) and on the air quality and global warming.

A recent Nature study found that the fossil-fuel burning power plants, factories, vehicles, and buildings, if operated normally over their full lifetimes, will almost certainly warm the Earth more than the Paris Agreement climate target of 1.5 degrees Celsius[4].

[2] Extract from RESD FS ToR

[3] Source : tradeeconomics.com / World Bank, https://tradingeconomics.com/indonesia/gdp-per-capita

[4] Source : https://www.nationalgeographic.com/environment/2019/07/we-have-too-many-fossil-fuel-power-plants-to-meet-climate-goals/

One considerable factor for the increase of air pollution is power generation.

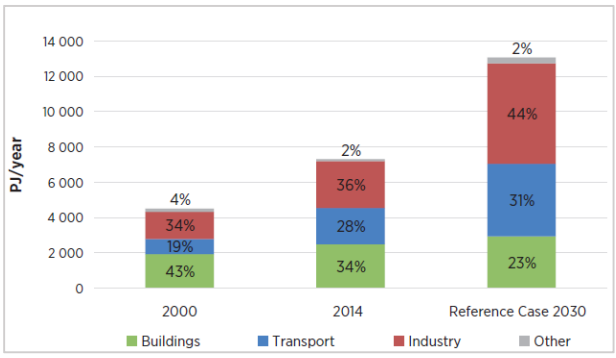


Figure 1: Energy consumption in Indonesia

Figures 2[5] and 3 show that the increase of electricity consumption by the industry is currently mainly covered by an increase of capacity of coal power plants.

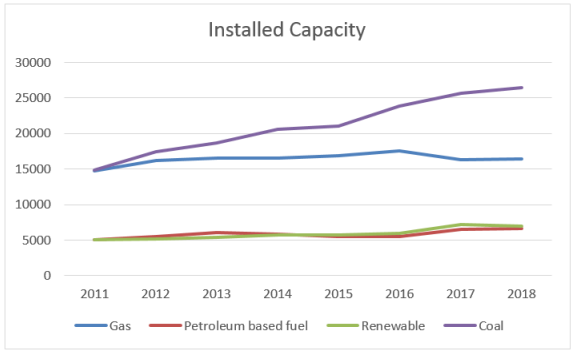


Figure 2: Production of electricity in Indonesia

One of Indonesia's main development priorities outlined in the National Mid-term Development Strategy (RPJMN) 2015-2019 is to achieve an electrification ratio of 99% by 2019. In order to reach the remaining 31 million people across the archipelago in remote areas and on smaller islands, renewable energy (RE) in the form of on-grid and off-grid solar, hydro, wind and biomass power plants will play a very important role.

Besides the importance of renewable energy for the electrification target, the government also depends on these technologies to reach its commitment to 29% greenhouse gas emissions reduction by 2030. The country has set ambitious goals in its National Energy Policy (Government Regulation No. 79/2014) followed up by its National Energy Plan (Presidential Regulation 22/2017) to increase the share of renewable energy in power generation to 23% by 2025, and 31% by 2050. As a result, the total renewable power generation capacity in Indonesia has increased by 3.2 gigawatts since 2008 (still mainly from hydropower) to a total capacity of approximately 9.1 gigawatts.

Due to the lack of local training structures, in many cases private sector IPPs as well as PLN indicate that the lack of availability of local skilled workers in the RE sector is a hindrance to developing projects. Often developers hire skilled workers in Java to be sent to the project sites during the various phases of a project implementation. As a result, salaries are substantially higher, which directly affects the cost/benefit analysis and financial performance of the projects in more remote areas and influences the reliability of remote RE plants, as most of the workers from Java will not stay permanently in these remote areas.

The donor community financed different training programs developed and delivered by local training institutions in several cases. But, most of these training programs were only delivered for a short period of time and did not leave a sustainable impact in the non-formal training system. Formal education has only been supported with equipment; to the knowledge of the FS Team no formal RE training programs were developed by donor supported projects.

1.3 Energy sector background

In the annexes 3 and 4 the FS provides policy details and data on the energy sector. The below chapters will provide only an overview.

1.3.1 Current Indonesian Policies

The basis of current Indonesian energy policies is the National Energy Plan in February 2014 (***NEP14***), which was signed on 17 October 2014 as Government Regulation No. 79/2014. It introduces a number of important changes to energy policy planning. It focuses on re-establishing Indonesia's energy independence by re-directing energy resources from export to the domestic market, and aims to

[5] Renewable Energy Prospects Indonesia, IRENA, March 2017

rebalance the energy mix towards indigenous energy supplies. The plan sets out the ambition to transform the energy mix by 2025 as follows: 30% coal, 22% oil, ***23% renewable resources*** and 25% natural gas. The sheer challenge of this target becomes even more striking when translated into absolute figures. Use of gas is to more than double, use of coal is to more than triple, and renewables are to grow more than eleven-fold by 2025. Finally, the NEP14 aims to complete the electrification of the country by 2020 and to ensure full access to energy, which is a difficult undertaking considering Indonesia's immense geographical expanse.

Since 2013 feed-in tariffs and purchase for renewable energy have been regulated and partly changed again, as the tariffs and purchase regulations are not in favour of renewable energy. Local and international investors argue the current renewable energy feed-in Power Purchase Agreement tariff structure defined under MEMR Regulation 50/2017s will not generate sufficient return on their investment.

Also, purchase regulations do not seem to be encouraging the change to more renewable energy resources. Since the Decree of the Minister of Energy and Mineral Resources (MEMR) of January 2017, regulating electricity purchase from various renewable technologies by Perusahaan Listrik Negara (PLN), applied for purchase of solar, wind, biomass, biogas, geothermal and hydro power, not a single tender has been launched.

Recent conditions signal that renewable energy will become more prominent in the future with the conclusion of the tender of 2 x 25MWp of solar power plant in Bali reaching the final stages. The presidential inauguration also introduced a new cabinet with a new minister of energy who seem to immediately have positive comments on energy in rural communities and potentials for renewable energy. Additionally, companies such as Adaro and Medco, giants in the fossil fuel sector have started to provide investments in renewable energy. Medco is the lowest bidder for the 2 x 25MWp solar power tender, and Adaro has invested in renewable energy companies and projects such as solar PV and hydro.

The reasons for the stagnation in renewable energy production in Indonesia are manifold; different parties interviewed by the FS Team mentioned the following:

- A de facto monopolised electricity market with PLN in a central position
- Policy targets do not sufficiently consider existing power purchase agreements (long term, guaranteed minimal purchase)
- Low PPA tariffs and procurement methodologies not allowing sufficient return on investment
- Reputation as not reliable (due to lack of maintenance)
- Lack of skilled operation and maintenance staff

The first three points are to be dealt with by the Indonesian legislative and executive government branches, and are rather political issues and outside the scope and focus of the SECO project concept. These points represent a certain risk to the speed of growth of the RE sector, but all parties interviewed agreed that the market will grow. Therefore, the speed of growth will not change the fact that the last two points (reliability and labour force) need to be tackled and it therefore not a direct risk to the potential project, but rather provides sufficient time to prepare quality and quantity of human resources.

Although the current demand for skilled personnel in the RE sector is not very high, the assessments done by the FS team and developments forecast predict a much higher need in numbers and quality in the labour market in the near future. The FS therefore supports the SECO project note and a potential future project to focus on contributions to the preparation of qualified staff for the RE sector and the improvement of the reputation of RE technologies. This would help to provide the required future human resources to the RE sector.

1.3.2 Stakeholders

The electricity market has four main areas in which partly different stakeholders are involved; i) power production; ii) power transmission; iii) power distribution; and iv) power consumption.

The GoI is responsible for regulating the electricity market. The Ministry of Energy and Mineral Resources (MoEMR) is thereby the lead agency, but needs to coordinate with several other national bodies (see figure 4 below). The MoEMR is not only regulating the market, it is also in a supervising role of the strongest player in the sector, PLN.

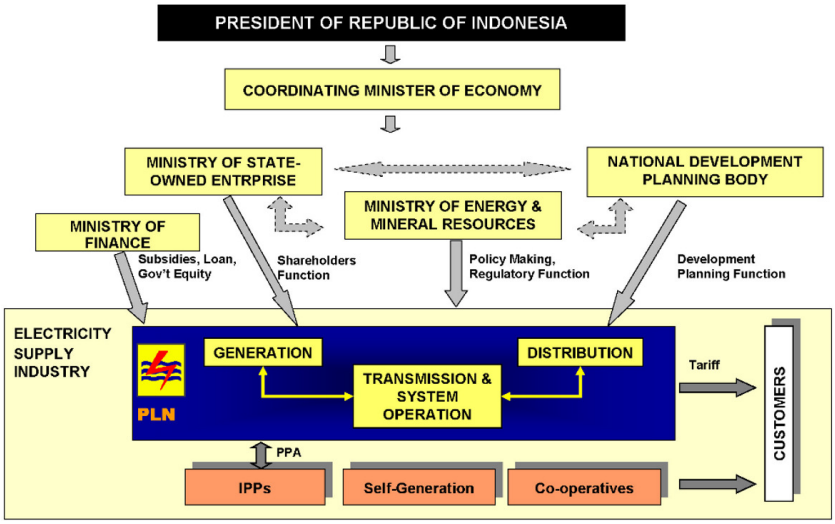


Figure 3: Electricity Market Framework

In the Indonesian electricity sector PLN plays the role, not only as the largest utility company in the country, but also as the government's primary institution to execute government obligations such as electrification. As such, PLN is the biggest power producer, tenders power from IPPs, tenders new power plants, manages and owns the transmission and distribution grids, provides power to industry (unless they do not produce their own power) and households, and is billing for power consumption.

The field of power production can be divided into three categories: 1. Design and planning of power plants; 2. construction and installation; and 3. operation. For projects above 2 MW in the RE sub-sectors, international and local investment and consultancy firms play a major role in all categories, from design to operation. In accordance with regulations, these companies should actually react to PLN tenders, but as there have been no tenders so far, companies have attempted the development of plants based on their own initiatives. The main international players in the RE sub-sector in Indonesia are UPC, VENA, Berkeley and Baywa RE[6] among others. These companies have interdisciplinary teams consisting of local and international engineers of different trades, working together with lawyers, finance specialists and environmental/social experts to design, develop, construct and operate RE power plants. Despite the somewhat unconducive conditions of the current market, these companies have maintained or even increase their planning capacities as all agree that the market will grow significantly as soon as the frame-conditions (mainly tariffs) are improved. Construction and installation are often sub-contracted to local firms.

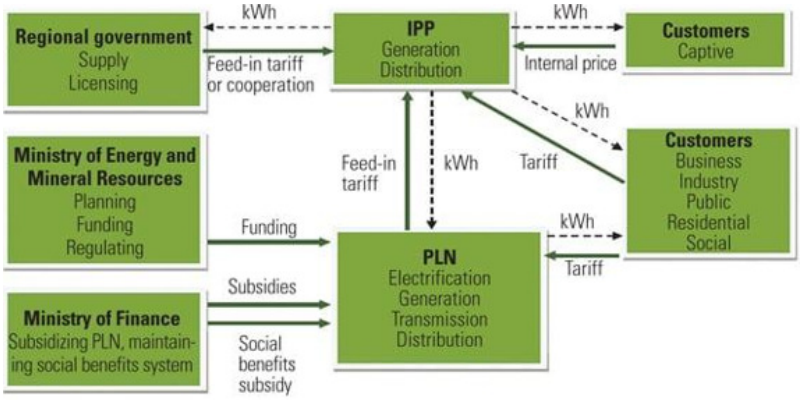


Figure 4: Electricity and financial flow in the market[1]

For a more detailed electricity market and its stakeholder please refer to the Annex 6.

[6] Contact details can be found in Annex 1

1.4 TVET / Skill Development

The SECO concept note is rather flexible regarding the level of education and depth of skill development that should be supported in the RE sector. Looking at the Indonesian Education Framework, the possible areas of support are rather scattered.

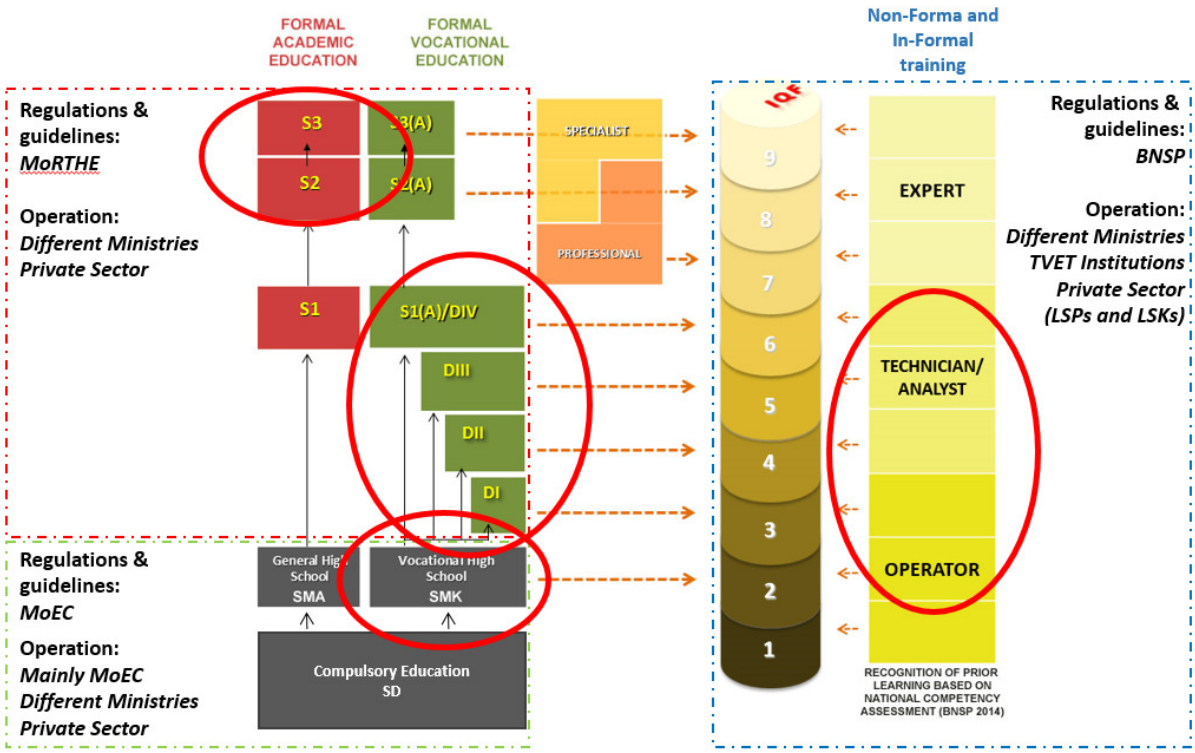


*Figure **Fehler! Textmarke nicht definiert.**: Indonesian Education Framework, and potential intervention areas according to ToR*

The FS conducted a labour market scan (30 responses), which clearly favours the S1/D4 level at tertiary education. Taking into consideration the age of students and the numbers of trade specific lessons that can be provided at higher secondary vocational level (SMK), it seems logical to the FS that the graduates of SMKs are seen as a rather "un-qualified" workforce that needs to get additional training to conduct routine tasks.

In non-formal VET a wide number of providers are operating mainly on a by-project basis. The various certification systems receive little recognition by the private sector and their link to the Indonesian Qualification Framework (IQF levels) is not clear. So far, the training programs available have not led to a systemic result, qualification levels are not harmonised, and different systems are concurrently in place. The best known qualification system is the IQF which the BNSP has built in cooperation with the private sector, but certification mechanisms are not standardised and do not cover all aspects of the IQF. National standards are only defined for low level qualification (up to level 5), higher skill levels still need to be defined.

1.5 SECO engagement in Indonesian Skill Development Sector

As laid out in the Country Strategy Indonesia 2017-2020 by the Swiss State Secretariat for Economic Affairs (SECO), Switzerland's development cooperation in Indonesia focuses on improving service delivery through efficient and sustainable use of resources and creating a more competitive and job-creating private sector with access to resources and markets.

1.5.1 Current SECO Skill Projects

Switzerland has a long-standing VET partnership with Indonesia dating back to the 1970s and is currently supporting the GoI through two projects in the education sector.

Firstly, the Skills for Competitiveness project (S4C) aims at strengthening the vocational education and training system in Indonesia by enhancing five Polytechnics in the steel, food processing and wood sectors. The project's objective is to "dualize" and to strengthen the mechanism by linking selected Polytechnics with the private sector, and as a result tackling the lack of skilled workers (skills gap).

Secondly, the Sustainable Tourism Education Development project's goal is to improve its tourism vocational education. The project aims to assist the Lombok Tourism Polytechnic in developing qualified graduates along current international standards with relevant skills for the tourism industry in Eastern Indonesia. It does so by supporting the Polytechnic in improving the curricula and teachers' qualification, and by fostering institutional relations between the school and industry.

The two VET projects work closely together and put synergies to use wherever possible. The FS team envisions that a potential can engage with these SECO projects through similar collaborations and synergies. High potential for synergies are seen in the development of a joint cooperation approach with the private sector and in the design of specialisation programs (post graduate for D3 graduates). The FS sees also a high potential in a coordinated policy dialogue, as the TVET partner institutions of the three project are below different line ministries, but all are bound to regulations of MoRTHE.

1.5.2 SECO Principles

For the envisioned project, the ToR defined the following principles as a guiding framework:

- Focus on the establishment of training and degree programs in renewable energy at SMKs and Polytechnics/Universities. *(FS comment: a key for success is focus, therefore the FS is recommending to focus on the tertiary (polytechnic) level.)*
- Private sector orientation and involvement (through functioning and committed local industry associations) to achieve better skills match and reduce training costs. This may include Swiss companies and experts but is not compulsory.
- Sectoral approach with a focus on the skills development in selected renewable energy sub-sectors such as hydropower and solar (including solar-diesel hybrid). *(FS comment: the FS labour market assessment came to the conclusion that the proposed sub-sectors provide best opportunities to start with.)*
- Focus on capacity development of training providers in order to make them more responsive to the needs of the labour market through improving the quality of their regular programs and curriculum, diversifying their course portfolio, addressing new customers, and/or entering into cooperation arrangements with the industry/private sector. *(FS comment: The FS fully agrees, sustainability and systemic change can only take place if the private sector is adequately included.)*
- Focus on potential harmonization of certification in renewable energy between BNSP and PLN. *(FS comment: PLN has no certification system and harmonisation is highly politicised, therefore the FS recommends the project to support the development of national standards for higher qualified RE staff in cooperation with the private sector, BNSP and the EBTKE that should be used by all certification systems)*
- Address gender equality and inclusion through skills-building.
- Facilitate a public-private dialogue including social partners to clarify roles and responsibilities in the definition, provision and financing of vocational training/continuous education. *(FS comment: The FS fully supports this point, but for a project of the size of the proposed RESD focussing on inclusion of private sector (labour market) is the key for sustainability and systemic change.)*

- Make information on the quality and performance of training providers publicly available and increase transparency on results achieved. *(FS comment: Please see proposed component 3.)*
- Clarify possibilities to outsource implementation of training programs to public and private companies to stimulate competition and quality. *(FS comment: Please see proposed component 3.)*

2 Methodology

The FS was organised in line with the ToR from SECO. The proposal presented by the consortium to SECO on the 24th of June 2019 also contained a seven-step general approach.

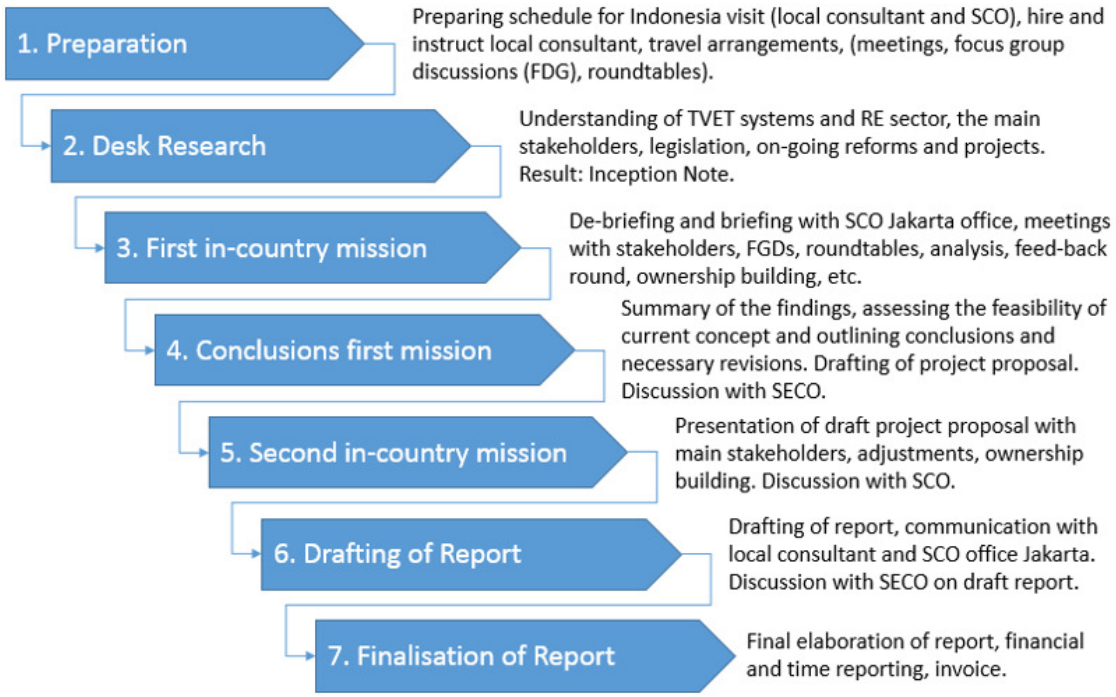


*Figure **Fehler! Textmarke nicht definiert.**: General approach for the feasibility study*

2.1 Objective of the Feasibility Study

The objectives of the feasibility study / design mission are:

iv) To provide an analysis on skills development in the renewable energy sector in Indonesia. This includes an analysis of the legal framework and government priorities, skills/labour demand in the sector, stakeholders mapping (including potential steering committee structure and members), donors mapping, and potential windows of opportunities for policy dialogue;

v) Based on this information to verify the feasibility of the interventions proposed in the SECO concept with a particular focus on establishing training and degree programs in renewable energy (hydropower and solar, including solar-diesel hybrid); and

vi) Conclude on and test the necessary adjustments, and provide concrete recommendations and formulations for a final project document. This shall include a description of the scope, modalities, methodology and budget to ensure the relevance, potential efficiency and sustainability of the intervention.

2.2 Main Tasks and Activities

1. Conduct an assessment of the skills development landscape in renewable energy, especially regarding hydropower and solar (including solar-diesel hybrid) in Indonesia. The following aspects need to be considered:
    i. Regulatory and institutional framework, alignment
    ii. Harmonization and Swissness
    iii. Demand and private sector involvement
    iv. Certification
    v. Sectoral and geographical focus
2. Opportunities for potential SECO interventions: Based on the above assessment, the Consultant shall compare its findings with the existing concept along the following lines and take conclusions:
    i. Relevance of the overall objective based on identified demand and gaps
    ii. Relevance and feasibility of the pre-selected sub-sectors
    iii. Relevance and feasibility of the pre-selected sites and respective schools
    iv. Relevance and feasibility of the main measures and the selected modalities (capacity and corporate development; technical assistance; and/or investment measures)
    v. Capacities of the involved partners against their expected role and responsibilities
    vi. Feasibility of the tentative budget and estimated project implementation period
    vii. Feasibility of preliminary expected results and related key indicators.
    viii. Detail a risk assessment and respective mitigation measures based on the adjusted concept
3. Based on the feasibility assessment, the consultant should provide concrete recommendations and suggestions/formulations on how to detail and adjust the current concept note into a full fledge proposal, including description of the context, gap analysis, and expected results. This revised proposal should also be presented to IND stakeholders for verification.

2.3 Applied Methodology

The methodology and review process included the following:

Initial briefing / kick-off meeting at the beginning of the review at SECO in Bern, to ensure common understanding of the ToRs.

Desk Study: The Consultant reviewed before carrying out the field mission:

- The legislation, strategies, action plans, and other relevant documents at national and local level related to the energy sector and skills development sector;
- Projects at the national and local levels, related institutions and other stakeholders in the energy sector; and
- Past, on-going, and planned donor supported activities related to energy.

Field Missions: The Consultant shall carry out two field missions to Indonesia. Both field missions included a briefing and a debriefing meeting with the Swiss Cooperation Office (SCO) in Jakarta. During the field mission, the consultant conducted interviews, focus group discussions, workshops, an internet survey on labour market needs, verified findings, conducted on-site visits to the pre-selected vocational trainings institutions and conduct meetings with relevant local representatives, tabled and discussed first ideas and adjustments, developed training approaches and verified feasibility, and further aligned the project idea with Indonesian plans and policies.

A detailed list of activities and visits during the missions can be seen in Annex 1.

Reporting and Capitalization: This report has been drafted and discussed based on the conclusions made after the field missions. A meeting shall be held in Berne at SECO headquarters presenting the findings to potential Swiss partners.

3 Assessment of the skills development landscape in RE

3.1 Regulatory and institutional framework

For ***formal education*** (including skill development or TVET) the Ministry of Education and Culture (MoEC) regulates the secondary level (SMK), and the Ministry of Research Technology and Higher Education MoRTHE for the tertiary level (Polytechnics and Universities). At both levels there are no specific regulations regarding the RE sector.

Please also refer to Figure 6: Indonesian Education Framework, areas of potential intervention according project note.

3.1.1 Formal Education for the RE Sector

Polytechnics are regulated by MoRTHE, and offer TVET programs of one year (Diploma 1 - D1), two years (D2), three years (D3), and four years (D4). The D4 program is considered the same level as a S1 (*serjana 1* / bachelor) in the Indonesian education framework and is also called "applied bachelor". The training programs are supposed to contain about 60% practical exercises and laboratory work, and 40% theoretical education. By regulation, the students of all programs are sent to the industry for internship. For a D3 program the structure is; 1) 3 semester in school; 2) a 2 semester internship; and 3) a final last semester in school for final work and exams.

Across Indonesia there are 51 government owned polytechnics[7] and about two hundred private ones. There are several polytechnics providing education programs in energy conversion (the ADB Polytechnic Project provided new laboratory equipment to some of these schools, including Makassar and Jakarta) and also a few providing training in RE. Current policy encourages line ministries to open their own polytechnics, but to follow the regulations set by MoRTHE. The FS has visited four polytechnics directly under RISTEKDIKTI (MoRTHE) and discussed potential approaches with the polytechnics and with RISTEKDIKTI. At both levels the approach proposed (see executive summary) has found great acceptance and support.

One weakness of the polytechnic education remains the relevance of training to labour market needs. Therefore, many polytechnics collaborate with the private sector and try to adjust their programs to specific private sector partners (sometimes individual companies). Among other collaborations, 15 polytechnic schools across Indonesia collaborate with PLN (including the four polytechnics proposed as partner in the RESD project). Graduates from these participating schools only need to pass the requirements at defined performance levels and pass a recruitment test to become PLN employees after graduation[8].

The Human Resources Development Agency of Energy and Mineral Resources Ministry of Indonesia (BPSDM) is under the umbrella of the Ministry of Energy and Mineral Resources of Indonesia as a strategic unit to assure professional reliability and competitiveness of human resources in the field of energy and mineral resources through vocational training and formal education. BPSDM operates different training centres, which are specialized in training services for the different geoscientific working fields, such as Minerals, Oil and Gas, Energy and Geology. The BPSDM currently has polytechnics in Cepu[9], training centres in Bandung and the PPSDM KEBTKE in Ciracas, Jakarta. These training institutions are under the BPSDM of MoEMR. BPSDM is also the leading institution for the planning of a new polytechnic in Bali specialised in RE, planned to be opened in 2020. The new polytechnic in Bali (called Poly EBT) will provide three-year programs in i) energy conversion, ii) automation and informatics, and iii) electrical engineering, all leading to a D3 diploma. The Poly EBT is meant to mainly cater for the government and state-owned

[7] http://pmdk.politeknik.or.id/daftar_politeknik
[8] https://rekrutmen.pln.co.id
[9] PEM AKAMIGAS, https://www.akamigas.ac.id/

companies like PLN and Pertamina, and for private sector companies directly involved with MoEMR projects. Discussions between MoEMR departments, specifically with BPSDM, have shown great acceptance and interest of the proposed approach, leading to the clear request from the Director BPSDM to be main partner for the RESD project component 1 and 2.

FS Conclusion: Based on the labour market scan (see chapter 3.3) and the discussions with the private sector, the FS Team recommends to focus the cooperation in formal education at the polytechnic level. After meetings, discussions, context and regulatory assessments, the FS Team concludes that the BPSDM of the MoEMR would be the best suitable lead partner for components 1 and 2, therefore BPSDM should be included and lead project agreement discussions on MoEMR side. Cooperation with other TVET schools (polytechnics) proposed should be clarified by agreements at time of implementation between Project and each participating polytechnic school.

The ***Sekolah Menengah Kejuruan*** **(SMK)**/ Vocational High School are at the secondary education level and are regulated by the MoEC. A student enters SMK after grade 9 and stays for 3 to 4 years. Most of the SMK graduates are between 17 and 18 years of age. In 2019 about 5 million pupils attended to SMK schools. Out of 14,247 SMKs[10], 895 SMKs providing electricity-related competencies (including renewable energy power plants and electrical grids) across Indonesia[11].

De facto these graduates have had only basic trade skills lessons; general subjects account for approximately 65% of classes in SMKs, only 35% are dedicated to trade-related subjects. Therefore, renewable energy related topics (including basic renewable energy) are taught at the expense of understanding other basic trade skills such as technical drawings, soldering, cable specifications, etc., which are far more useful for an SMK graduate looking for a job than specific knowledge of how to operate a solar/hydro/wind power plant. This approach does not seem feasible to improve the employability of SMK graduates. There is not enough time available in the SMK curriculum to train both basic trade skills and specific RE technology skills. Therefore, the current RE trainings at SMK only provide a glimpse of RE technology and will at best hopefully encourage some graduates to continue their education in a polytechnic.

FS Conclusion: Considering the sheer number of SMKs, the varying quality of education provision and school facilities, the young age of students and the low level of skill competences that can be taught, the FS Team does not recommend that the RESD project engage with SMK in the formal education (component 1). As clearly stated in the ToR, SECO support to formal education should aim to develop higher-skilled workers. The skill level, age/maturity of SMK students is too low to reach this objective, and even in the case of very high quality SMK, the FS team would not recommend any project activities that would risk duplicating results at SMK and polytechnic levels.

However, in non-formal training, there is a pathway for a potential RESD project benefits for SMKs. SMKs could acquire the training modules, teaching aids and training of trainers free of charge and either become a training centres for non-formal modular trainings offering up-grading to people already on the job, or use these modules with their students.

At the tertiary level there are also the ***universities*** (also regulated by MoRTHE). According to data from MoRTHE, there are 383 schools, at the ***polytechnic and university level***, providing electrical program studies, 21 schools providing energy program studies (including renewable energy, energy conversion, and power plants). The FS has been discussing skill development with different universities, but all of them are more interested in upstream research than in downstream applied skill development.

[10] https://lokadata.beritagar.id/chart/preview/jumlah-smk-negeri-dan-swasta-di-indonesia-2018-1563945848
[11] Source : Ministry for Education and Culture

FS Conclusion: As Indonesian universities are not prime partner for practical skills development programs, the FS is recommending to focus on the development of the polytechnics engaging in the RESD project and introduce twinning (cooperation) between research institutions for applied science from Switzerland and Indonesian polytechnics.

For more details on training programs and cooperation in the sector please refer to Annex 2 and Annex 6.

3.1.2 PLN training approach and institutions

In the Indonesian electricity sector, the Perusahaan Listrik Negara (PLN) plays a dominant role in all aspects of the energy market. This also includes the training sector and the labour market. PLN therefore has its own training facilities (including a training centre specific for renewables in Makassar), and also formal training institutions directly catering to PLN (e.g. PLN Corporate University). The PLN training centre in Makassar (Udiklat PLN Makassar) and PLN as such have a close collaboration and are supported by KfW, GIZ and the Renewables Academy Berlin (RENAC) in procurement processes, technical assistance, equipment, curricula development and training of trainers.

Within PLN, recruitment of staff is conducted at all levels from vocational secondary schools (SMKs), vocational schools (Polytechnics), and universities. PLN's recruitment process does not focus on competency and skills but rather on the candidates fulfilling the following requirements:

- administrative requirement
- test results for English language,
- academic test,
- intelligence (IQ),
- psycho test,
- physical and health check-up
- in person interview with those who have passed the previous gauntlet.

As noted above, PLN collaborates with 15 polytechnic schools across Indonesia for the recruitment of D3 level graduates, including the four polytechnics proposed by the FS. The collaboration program is set up so that graduates from participating schools only need to pass the requirements to become PLN employees after graduation. In addition, five education institutions have a collaboration program with PLN to recruit D4/S1 (bachelor's degree) level graduates, the University Ujung Pandang is the only university in the program not located in Java[12]. PLN also publishes their openings and recruitment opportunities publicly. There have been very few masters-level job openings in the last few years at PLN, most of the openings are for D3 graduates and/or D4/S1 graduates.

PLN's need for workers that are specific to their function as a utility company include maintenance staff for transmission lines, substations, power plants, and distribution lines, telecommunication and SCADA (supervisory control and data acquisition), electrical safety and occupational safety and health officers among others.

FS Conclusion: The FS Team recommends to establish close coordination with, and thereby include PLN at the local implementation level in cooperation with the polytechnics. The FS does not recommend that the RESD project engage with PLN in a formal long-term cooperation (PLN is currently a partner in German cooperation programs, and RESD shall coordinate with these). PLN should be informed about activities of the project and have the opportunity to participate, and shall receive information about the modular training and training of trainers. Component 3 of the project shall be open to collaborate with PLN in awareness campaigns and information provision and encourage twinning between PLN training institutions and Swiss institutions.

[12] Source: https://rekrutmen.pln.co.id

3.1.3 Non-Formal Education in the RE Sector

Indonesia's labour market in the energy sector, and specifically in RE related skills, is experiencing a lack of availability of skilled workers outside of Java. Many training institutions relevant to Indonesia's labour market needs are centred in Java with very limited availability in Eastern Indonesia (Makassar, Manado, Kupang, Ambon and Jayapura). In general, the FS was told that plenty training opportunities are available and that the training also satisfies expectations, but still, the quality level and level of competence of graduates seems to vary considerably, despite certification. In many cases, non-formal, short-term trainings are provided by projects, this means that most of these trainings are not always available, they are not systemic and therefore also not sustainable for the development of the RE sector.

Often the content of non-formal training is designed based of specific demand, and very specific tasks required at a specific site or by a particular employer. A likely reason for this is that the RE sector in Indonesia is rather immature and only few companies can provide in-house training for new staff, therefore external experts take over and deliver training, which in Europe or America would be delivered directly by experienced fellow workers. Over time such training are not sustainable, as the private sector does not take its obligations to train new staff. Such approach therefore is not sustainable because it is not embedded in local training institutions (such as BLK) or within permanent company structures.

To overcome Indonesia's geographical challenges of providing competent labour force even in the eastern peripheral areas, a systemic approach that provides standardised training at clear qualification levels is needed. The implementation of short-term trainings is done in-company or in training facilities by private training providers (often donor financed projects, LSPs or LSKs) or by GoI training structures (BLK or short training at SMKs or Polys). Trainees are people looking to improve employability or who want to do upskilling, specialisation or mid-career training for those already in the job. The FS team did not observe the presence of a systemic approach to satisfy labour market needs in more remote areas. As these trainings are all non-formal, there is also a lack of statistics about the number of training, the number of participants and the level of skills required.

The PPSDM KEBTKE under BPSDM (MoEMR) is one of the leading providers of short-term training in the field of electricity production and distribution. Over the last few years, various short-term training programs have been developed and provided in the field of RE technologies. Further, the PPSDM KEBTKE is registered under BNSP and has the capacity to certify as an LSP and an LSK-K.

FS Conclusion: The FS Team is recommending that the RESD project cooperate in non-formal education (component 2) with the PPSDM KEBTKE to develop standard training modules (based on national standards – see next chapter), organise training for trainers and to disseminate training materials and monitor training delivery by other institutions (e.g. BLKs, LSPs, LSKs, SMKs, etc.). The completion of all training modules, paired with work experience, shall lead to a qualification level sufficient to enable graduates to train others (e.g. IQF Level 6 to 8). The primary objective shall be the provision of a sufficient number of skilled workers, but after collecting experience in the private sector, graduates of the training series shall also be capable of delivering training in practical skills in non-formal and formal vocational training. In the medium-term, this would lead to a systemic change, away from donor and project-driven training to in-company and institution based (BLK, SMK, private sector institutions) training provision.

3.1.4 Certification

Certifications for occupational competencies in the labour market are typically provided by Occupations Certification Institutions (Lembaga Sertifikasi Profesi/LSP) under the authority of BNSP. For specific electricity-related occupations, MoEMR under its Directorate General of Electricity issues its own certificate and its own occupational competence standard. The certification bodies under MoEMR is called LSK-Ketenagalistrikan (LSK-K, LSK-Electrical).

Training institutions aligned with the LSP certifications are typically available all over the country, and many polytechnics have themselves been accredited as LSPs so that they can deliver testing to polytechnic

graduates who are required to get occupation competency certifications. This often results in a conflict of interests in which polytechnics are delivering training for students, and the same trainers assesses and certifies (in cooperation with private sector experts) the same students through their own LSP. In general it can be said that many LSPs also provide training, some even for free, and then charge for the certification (for up to CHF 500).

In contrast to LSPs, LSK-K are managed and accredited under the authority of MoEMR and only provide certifications that are issued by MoEMR for the electricity sector. Typically, electrical contractor associations such as AKLI (Asosiasi Kontraktor Listrik dan Mekanikal Indonesia), AKLINDO (Asosiasi Kontraktor Ketenagalistrikan Indonesia), APKOMATEK (Asosiasi Perusahaan Kontraktor Mekanikal dan Elektrikal Indonesia), and others provide the training for their members and are associated with specific LSK-K to issue the certificates to their members. These "electrical" certifications are required to participate in government tenders and by law to conduct electrical installations and repair.

In addition to these two national certification systems, more and more training provider provide training with so called "international" certification. The certifications are usually provided by international surveillance companies (such as TÜV) and are not based on agreed international qualification standards rather on tailor made qualifications specific for the training provided.

This means there are different certification systems in place, which serve different purposes. As the LSP certification should certify professional qualifications, the LSK certification is an authorisation to conduct certain work in the electrical field. There are no common qualification standards established to compare the two different certification mechanism. There are discussions underway on how to harmonise the systems (also with international certification schemes).

FS Conclusion: The FS Team recommends that the RESD project focus on supporting the development of national qualification standards for professionals in the RE sector for IQF level 6 and above (up to level 5 standards are defined) as part of component 2. This would mean to a support a cooperation between the project, PPSDM-EBTKE, the private sector, and BNSP in defining the qualifications required, which then can be tested and might lead to a certification. Details and approach shall be developed with the different parties during the inception phase of the proposed project.

The FS does not recommend to get involved in harmonisation of different certification systems or in certification as such.

3.2 Harmonization and Swissness

Switzerland has a long history of developing TVET institutions in Indonesia and has a very good reputation in the sector. For the Swiss development cooperation close coordination and harmonisation with other projects and donor institutions, but also with Indonesian stakeholders have always been key for a successful implementation of a project. In Annex 6 the FS Team provides an overview of past and current donor projects in the sector. In addition, the FS Team organised a donor meeting (ILO, UNDP, GIZ, New Zeeland participated) and a telephone exchange with KfW, to table first ideas and discuss these. The New Zealand project for geothermal specific capacity development, KfW with its 1000 island project and GIZ, which has developed several non-formal, short term trainings and ToT in solar, hydro and wind, are interested in a close cooperation with a future SECO project. The NZ and KfW project offer the most promising potential for synergies.

New Zealand Geothermal Development Project (2017 – 2022): NZ is currently financing the development of human resources for in geothermal fields, but has so far had challenges to get its training content delivered through formal tertiary education channels (polytechnics and universities), and the project has had to resort to delivering its own non-formal training. NZ project officers were very interested in the RESD approach and with the proposed multidisciplinary specialisation approach at D4 level with the

polytechnics. They supported a cooperation that would allow the geothermal training content they have developed to be adapted to a D4 study course at polytechnics using the RESD model.

KfW 1,000 Island Renewable Energy for Electrification Programme: this EU 600 million program aims to increase energy access by developing hydro and solar installations in remote areas. So far, the project has announced a first tender for 23 of these small power plants, with an estimated manpower need of 350 persons according to the KfW project officer Simon Erhard. KfW sees a potential cooperation mainly in the recruitment of graduates (local skilled labour) from the RESD supported polytechnics and non-formal training institutions.

The interest in Swiss expertise and knowledge transfer seems to be very high on the, Indonesian side. At the current moment twinning, expert workshops, and collaboration to get the laboratory equipment running and efficiently used seem the main issues polytechnics are interested in. But, expertise and knowledge transfer could also be leveraged for skill standard setting, awareness raising and other activities. The improvement of applied research, which is mandatory for Indonesian teaching staff at tertiary level, and also demanded for final examination of graduates ("*tugas akhir*") would be a topic the FS sees having high potential. The definition of research topics, the monitoring and mentoring by lecturers, the examination of applied research, and how to cooperate in research with the private sector are seen as areas that have potential to improve through cooperation with Swiss institutions. Joint research was the topic frequently mentioned in higher education institutions, and also in PLN training units. Areas not directly linked to the outcomes of component 1 and 2 would be covered under component 3. In component 1 and 2 training of trainers, trainer exchange, curricula development, and laboratory organisation and up-grading are the main topic mentioned at polytechnics and a PPSDM.

FS Conclusion: The FS Team recommends the RESD shall open channels to exchange with other projects in the area of skill development in RE, but also in RE sector development and to develop mechanisms for cooperation to use synergies. Also the inclusion of expertise and knowledge transfer between Swiss (or international) institutions and Indonesian institutions shall be foreseen in the RESD project. A cooperation model for cooperation between institutions and modalities how the RESD project can support the exchange shall be detailed during the inception phase of the project and approved by SECO. For the moment the FS proposes to include sufficient budget to ensure transfer can take place. Cooperation activities will take place in all components, in component 1 and 2 exchange will depend on availability for expertise on the Swiss partner side and the planning of project activities.

A list of Swiss institutions that could be interested is provided in Annex 7.

3.3 Labour Market Demand and Private Sector Involvement

To gain insight into RE sector labour market demands and trends, the FS Team interviewed various RE sector companies, institutions and government offices, and designed an online labour market survey and disseminated it through RE industry associations and individual engagements. Participants were asked multiple-choice questions about their company profile, labour demand, desired level of education and expertise, existing training practices and internships and on-the-job training. Complete survey answers are provided in Annex 11, with key results highlighted below.

The survey received 31 respondents in total, with the most coming from RE consulting companies (8), investors (4) construction contractors (4), equipment manufacturers (4) and developers (2), followed by one respondent each representing power plant operators, contractors, power plants O&M companies, multi-function companies (consultant, trading, EPC, financing), renewable energy cooperative, project

developer, independent power producers, and research institution. Respondents represented small-to medium-sized companies with total staff ranging from less than ten to over 300.

Respondents overwhelmingly desire new hires to have some tertiary education. The largest majority answered D4/S1 (42%), followed by D2/D3 (32%) and S2 (16%). Only 7% of respondents reported a demand for vocational high school (SMK) graduates.

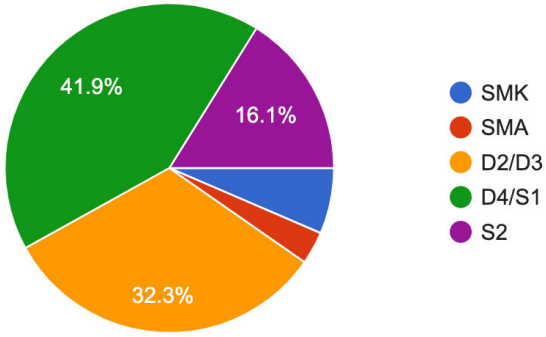


Figure 5: Demanded level of education

Industry wants incoming staff to have an engineering educational background. When asked to rank the type of basic education demanded, most respondents selected electrical engineering (87.1%), followed by mechanical engineering (64.5%) and civil engineering (45%). Fewer respondents chose finance/administration (32%), management (32%) and business (26%).

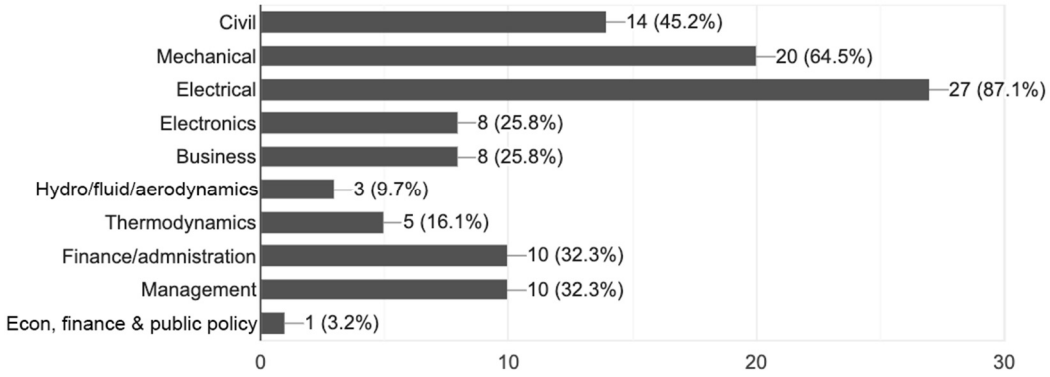


*Figure **Fehler! Textmarke nicht definiert.**: Demanded engineering fields*

The private sector wants workers capable of downstream tasks requiring multidisciplinary higher-level skills. When asked about type of work demanded, most respondents selected project development (67%) and design and planning (67%) followed closely by project management (63%). Fewer respondents selected skilled worker for daily operation (33%) or maintenance and repair (33%). But if maintenance is included in operation (as it should be) the two add also up to 67%.

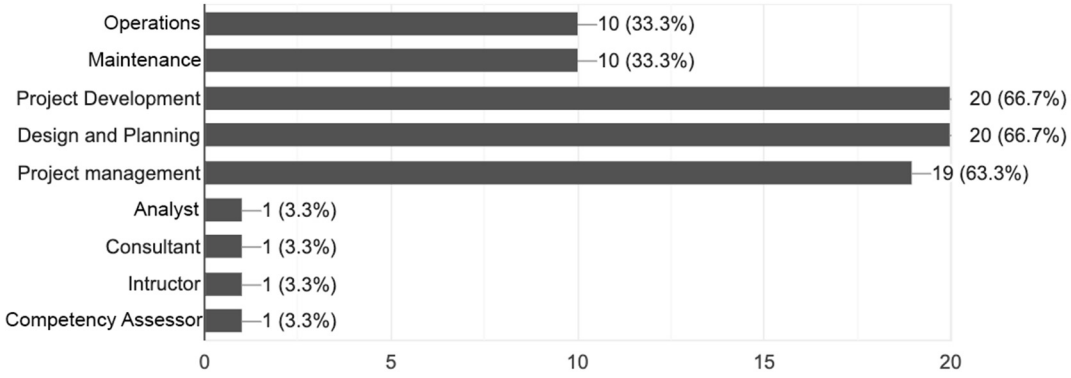


*Figure **Fehler! Textmarke nicht definiert.**: Demanded work field*

Industry reported a preference for new staff with some technical knowledge and experience, and a positive attitude. Respondents reported that the most important criteria for hiring new staff are technical knowledge (54%) and attitude (48%), with the second choices as CV and experience (51%) and experience in the field (45%). 39% of industry respondents ranked certification as the 3rd most important criteria for hiring.

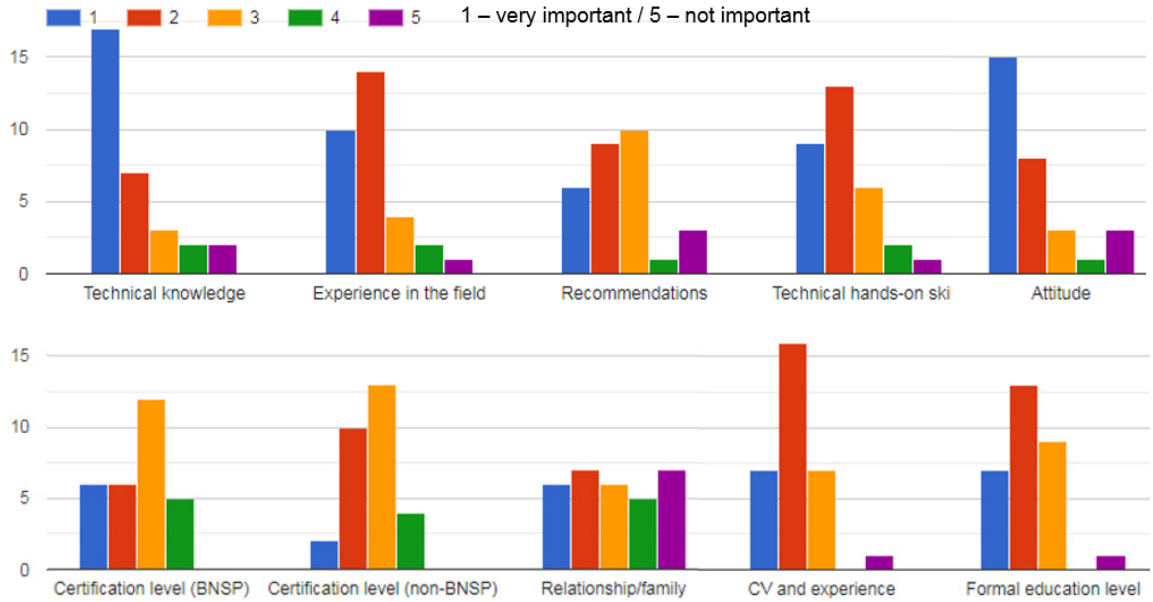


*Figure **Fehler! Textmarke nicht definiert.**: Importance of recruitment criteria*

For more information on the Labour Market Scan please refer to Annex 11.

FS Conclusion: The FS team recommends that the RESD project target support at the tertiary level and/or equivalent level in non-formal education. The programs shall address trainees with different engineering background and/or experience. Formal training might include the opportunity for OJT and internships. The aim is to develop multi-disciplinary skill sets that are demanded by the labour market. This is in line with the survey respondents' preference for incoming hires to have post-secondary training in engineering, as well as some technical knowledge, experience in the field, and higher-level multidisciplinary competencies in project development, design and planning.

Indonesian policies and regulations clearly encourage the cooperation between formal TVET providers and the private sector. Non-formal education is in general very specific and tailor made to private sector needs or even specifically tailored for one company. Both training components (formal and non-formal) need to work as closely as possible with the private sector. The FS Team is aware that many formal TVET provider have been quite ineffective in terms of cooperation by the private sector. The project therefore needs to contribute to a better understanding between the education sector and the private industry; the approach of "demanding" by the education sector needs to be replaced by a cooperation approach, as only if both sides are involved in decision making processes a real cooperation can take place.

In the case of the RESD project that means that the private sector and private sector RE experts need to be involved and be part of decisions about skills and competence levels to be obtained, curricula development and training content. The private sector needs to have the opportunity to bring their expertise to the TVET schools, and to provide its most experienced experts as lecturers or at least as guest lecturers. The private sector and schools shall develop guidelines and learning outcomes of potential internships together, and roles and responsibilities for such internships need to be jointly clarified and agreed on.

FS Conclusion: The FS fully supports the cooperation with the private sector already highlighted by the SECO project note. The project will have to play a coordinating role and support both parties in defining their role in a future cooperation. Other projects, such as the Polytechnic Banda Aceh project, have shown that cooperation between a Polytechnic and the private industry is very fruitful if arranged appropriately.

3.4 Sectoral and Geographical Focus

Based on the desk studies, energy sector data, interviews conducted and a quantitative labour force estimation for Indonesia by the FS Team, the technological focus of the SECO project note has been confirmed.

The FS Team conducted an assessment to estimate the quantitative demand of skilled labour in the RE sector by 2025 (see figure 12). The team is convinced that the quantitative demand in the next 5 years will rather follow the demand described in the 4th column (Demand 2025 in case of steady market growth as now) than the demand described in the 5th column (meeting policy targets in the energy mix). The number of approximately 10'000 open jobs by 2025 (3'300 now plus 6'800 until 2025) might seem relatively small, but represents rather a chance than a limitation for the project as the education sector still has some time to prepare for a drastic increase of numbers demanded by the labour market. Once the RE sector reaches a tipping point in its growth phase, the sector will grow rapidly and Indonesian TVET system need to be ready to supply skilled workers at that time. To prepare for the estimated sector growth beyond 2025, it is necessary to start educating tomorrow's staff now.

Sub-sector	Current employees	Current demand	Demand 2025 in case market growth stagnant	Demand in 2025 if policy targets would be reached
Solar	**2'500**	**2'500**	**+ 2'500**	**+10,000 (6.5GW)**
Off grid and rooftop solar PV	2'400	2'500	+ 2'400	+3,500
On grid (utility scale above 2 MWp)	65	0	+ 100	+6,500
Solar-Diesel Hybrid	**?**	**?**	**+ 200[1]**	**+2,000 (1GW)**
Hydro	**2'250**	**+ 250**	**+ 2'000[3]**	**+20,000 (21GW)**
Wind	**100**	**0**	**+ 100[2]**	**+1,000 (1.8GW)**
Bio	**2'500**	**+ 500**	**+ 2'000**	**+22,000(5.5GW)**
Marine power[4]	**50**	**+ 10**	**+ 50**	**+1,000(500MW)**
Geothermal[4]	**na**	**na**	**na**	**na**
Total	**-**	**+ 3'300**	**+ 6'800**	**+56,000**

[1] Assuming the technology is picking-up and about 20 plants above 1MWp are installed (island solutions)
[2] Assuming that the same amount of wind power will be installed until 2025
[3] Assuming that there is a staff turn-over of 15%, and new hydro power plants are put to operation (mostly basic qualifications)
[4] Specialised university graduates and operators with general engineering subjects (geothermal is close to oil and drill)

*Figure **Fehler! Textmarke nicht definiert.**: Estimation of quantitative labour demand*

Along with solar and hydro power, bio-based power is expected to create a large numbers of jobs. The difference is that the jobs created in biomass based energy production are mainly rather low skilled (handling of bio fuel like palm oil residue, wood, bamboo, etc.) and on high skill level similar to the profiles required in fire based (coal, gas) power plants. Further, different types of bio energy technologies require vastly different fundamentals competencies:

- Biofuels such as bio ethanol and biodiesel (requiring different skills)
- Biomass burning to create steam
- Biomass gasification
- Biogas (from different feedstock such as Palm Oil Mill Effluent, municipal waste, etc.)
- Waste to energy (methane capture, incinerator, etc.)

FS Conclusion: The FS Team confirms that the project shall start its activities by focussing on solar (photovoltaic, including solar hybrid systems) and hydro power generation (at least to start with). Training the future workforce should start before the RE labour market is showing signs of rapid growth, otherwise the sector will face significant challenges and the sustainability of investments might be endangered.

Geographical Focus

Taking into consideration that the current administration is focussing on the development of eastern Indonesia, that many other donor-supported RE activities are located in eastern Indonesia and that Bali (and other tourism areas in the east) are pushing to become "green", the FS Team is supporting the SECO project draft to focus on schools at the periphery and in particular in eastern Indonesia. During the second field mission the Director General of RISTEKDIKTI requested that the project should also consider a Java-based institution as the demand in Java will be the highest in the country. In addition, having a cooperation partner on Java would increase project visibility significantly and would also provide opportunities for cooperation between the different project components without creating high transportation costs, e.g. between the PPSDM and the formal education sector. In cooperation with the Director General the FS Team proposes the Polytechnic Negri Jakarta (PNJ) as the Java Partner in component 1. PNJ has an energy conversion department and has received similar RE laboratory equipment as Polytechnic Negri Ujung Pandang (PNUP, Makassar) and is therefore an ideal partner with synergies to PNUP.

Next to Swiss partner institutions, PPSDM in Jakarta could be the primary partner for the ToT for the participating polytechnics and other training institutions. Trainer trainings should be done in Jakarta and Bandung with PPSDM where there is already good infrastructure or at the participating polytechnics. A platform for the RESD trained trainers and other beneficiaries to share experiences, best practices, and potential collaboration shall be developed and survive RESD's project duration. PPSDM shall continue providing ToT for the training programs developed under the RESD, adapt the materials as necessary, and provide short course trainings for the industry beyond the duration of the RESD program.

FS Conclusion: The FS Team supports the SECO concept note's suggestion to focus on eastern Indonesia, but also proposes to include the Polytechnic Negri Jakarta in component 1 as proposed by the Director General of RISTEKDIKTI. PPSDM shall be foreseen as a main TOT hub during, and beyond the RESD program.

Please also refer to Annex 10.

3.5 Assessment Conclusions

The FS Team would like to summarise its insights and learnings from the policy studies, regulation studies, interviews, workshops, energy market assessment, RE market studies, labour market scan, and education provision assessment in the RE sector in this chapter.

1. ***Sustainability*** through systemic relevance and focus: To achieve desired impact it is necessary to concentrate the resources. It will be of high importance to address the accurate level of formal and non-formal VET. Therefore, a future project shall not address several education level, but concentrate on the one most relevant for the labour market, which at the same time provides future trainers. For FS Team this is assistance to develop knowledge and skills at ***IQF level 6 to 8***, or ***polytechnic level D4*** in formal education.

2. ***Systemic impact***: Systemic impact is usually achieved by working in formalised systems. Therefore, next to its first priority, enabling the provision of skilled labour force, the project shall also take future needs of skill development and TVET into consideration to ensure continuation and systemic sustainability. For a potential RESD this would mean to develop programs relevant to the labour market needs, train trainers, and ensure that graduates of these programs have skills required by the labour market. The graduates' certification level should be sufficient to provide graduates the opportunity to become themselves trainers at polytechnic skill level, provided they do some (defined) additional training and having collected sufficient work experience in the industry.

3. ***Partner***: To achieve systemic impact, a project has to partner with institutions and groups that have the leverage for and are interested in systemic change. In the RE sector this is mainly the private

sector and the regulator (MoEMR). In the field of skills development and VET it will be institutions setting standards (BNSP and/or BPSDM/DJK) and training institutions (like polytechnics) which are tasked to deliver relevant human resources to the sector. In the non-formal education sector it would be again BPSDM and the private sector (including all training institutions interested to provide meaningful training).

4. ***Leverage*** and cooperation: A potential RESD project with the given resources will not be in the position to change policies and market settings (e.g. due to its limited size and the monopolistic position of PLN). Therefore, it needs to partner with like-minded institutions on eye level. A cooperation with PLN is necessary, but not at national level. PLN has a strong cooperation with Germany, which covers policy, investment, and training. A potential Swiss project shall therefore cooperate and coordinate with the PLN partners at national level (GIZ, KfW programs) and at local level directly through the local partners (polytechnics, PPSDM, PLN training institutions).

5. ***Relevance***: The labour market is requesting skilled people with general engineering background, specialised knowledge in RE technology and the right attitude. Being able to work in multidisciplinary teams is one skill that has been highlighted by nearly all private sector institutions the FS met. Working in multidisciplinary teams also provide an experience that mirror the industry processes and develop the right attitude for the world of work. The project therefore shall apply an "out of the box" training model that allows general engineering graduates in a multidisciplinary manner to specialise in RE.

6. ***Step by step***: At present, the labour market demand for personnel skilled in solar and hydro technologies is highest compared to other RE technologies, and it is likely that this will increase in the short term. Therefore, the project shall start with these two technologies by applying a cautious step-by-step approach. This means to first assess demand in quality and quantity, develop relevant programs and trainer competences, conduct trials (first batch of D4 program) with a limited numbers of students, and expand in numbers only if an adequate quality level is reached. As a consequence student numbers will only start increasing significantly after 3 to 4 years of project start.

7. ***Digitalisation and communication***: The best program will not be successful if no one knows about them and if it is not following up-to-date communication mechanisms and information delivery systems. A potential RESD project therefore shall include complementary activities ensuring the involvement of Swiss and International institutions, support expert dialogue, and digitalisation of market information in the RE sector.

8. ***Project Structure***: To align structures with partner institutions' roles and their obligations, with both the formal and non-formal sectors of the Indonesian education framework, and to accommodate the required flanking measures and requirements of the digital age, the FS Team concludes that a three-component structure would be better suitable than a two-component structure.

3.6 Relevance and Feasibility of proposed SECO Intervention

The FS Team supports the content of the SECO project note. Based on the above findings and assessments, the FS Team finds the proposed SECO intervention very ***relevant*** and is convinced that a project as proposed by the SECO project note is ***feasible*** as long as some adjustments are made. In a nut-shell these adjustments are: i) addressing only one level of education with formal training (D4) and a series of non-formal modular training leading to the same professional level; ii) support the development of national qualification standards and not the harmonisation of different certification systems; and iii) the introduction of complementary activities (like knowledge exchange, information digitalisation, awareness).

The SECO project note is ***in line with the SECO Country Strategy*** objective 2; "*A more competitive and job-creating private sector with access to sustainable resources and markets*". The first priority of this objective is to support; "*Dynamic entrepreneurship, strengthened skills and flexible labour market*". As the strategy mentions, "*the promotion of entrepreneurship and skills together with improved framework conditions for the labour market and the social partnership help to create new jobs and retain existing, decent quality jobs"*.

To further support the strategic direction, the FS Team proposes a different project structure including a ***third component*** addressing labour market issues, partnership, knowledge exchange, awareness and digitalisation.

4 Inputs to Project Design and Structure

4.1 Project Structure

4.1.1 Project Goal and Objective

The SECO project note describes the overall objective (goal, desired impact) of the potential RESD project as follows:

*The **overall objective of the program** is to expand access to electricity from renewable energy sources and ensure its reliability through competent operation and maintenance. This will be achieved through the availability of qualified personal with higher-level skills competencies taught at Polytechnics/Universities, vocational high schools (SMKs) and the PLN RE training center in Makassar with well-equipped laboratories.*

Based on above assessments and conclusion, the FS Team proposes to focus on the skill development aspect, as the overall objective as described in the project note, is beyond the influence and leverage of a single project. But, ***the project will contribute to that overall objective of expanded access to electricity from RE sources, therefore it shall stay as the ultimate goal of the project***.

One important aspect that is required to reach that goal is well educated and skilled staff to design, plan, install, operate and maintain RE power plants.

The project objective, to which the project significantly will contribute, therefore shall be: ***Enable competent design, planning, installation, operation and maintenance of RE plants through the availability of qualified staff relevant to labour market needs****. This will be achieved through the availability of qualified personal with higher-level skills competencies graduating from relevant formal and non-formal tertiary level education and training programs.*[13]

The above new formulation is still covering all content proposed and all principles applied in the project note, but would make implementation clearer and more relevant to labour market needs.

4.1.2 Overall Project Structure and Project Outcomes

The FS Team proposes a new project structure with three components, which would align with Indonesian education structures, ensure system and sector development by applying a systemic approach and introduce complementary action lines required for communication and digitalisation in the RE sector.

As proposed by the SECO project note the first component shall focus on ***formal education*** aiming to fulfil current labour market demand and address youth or adults with formal education programs. Such program shall be formed and developed in close cooperation with the private sector ensuring current and

[13] multidisciplinary specialization programs in formal TVET (D4, polytechnics) and from non-formal training programs leading to IQF level 6 to 8

future labour market demands are addressed. ***Outcome 1: Formal, multidisciplinary RE specialisation programs at D4 level are in place and produce labour market-relevant graduates for the RE sector.***

The proposed ***second component*** shall focus on ***non-formal training***. The primary aim shall be to cover labour market demands. The non-formal training shall use a modular training approach and shall base on the materials developed in component 1 (training modules, training of trainers, instructions and teaching materials). It will address people already in a job, not willing to take a one year break, but rather to do up-grading through short-term trainings. To do so the project shall support the development of higher national qualification standards along the lines of the established procedures in Indonesia. ***Outcome 2: Different training providers offer non-formal modular trainings in accordance with higher national skill standards providing skill and knowledge up-grading in Eastern Indonesia relevant to the RE labour market.***

The ***third component*** shall focus on (but not be limited to) aspects such as on knowledge exchange, awareness and provision of information. This component shall complement the training development and implementation by stimulating exchange and providing accurate data and information. One aspect will be the establishment (or further development) of a digital platform to support exchange of expertise, awareness building and guided communication between all stakeholders. All information on RE aspects available or linked to one web-page. ***Outcome 3: Exchange and understanding within the RE sector and with the education sector has led to a higher acceptance and use of RE.***

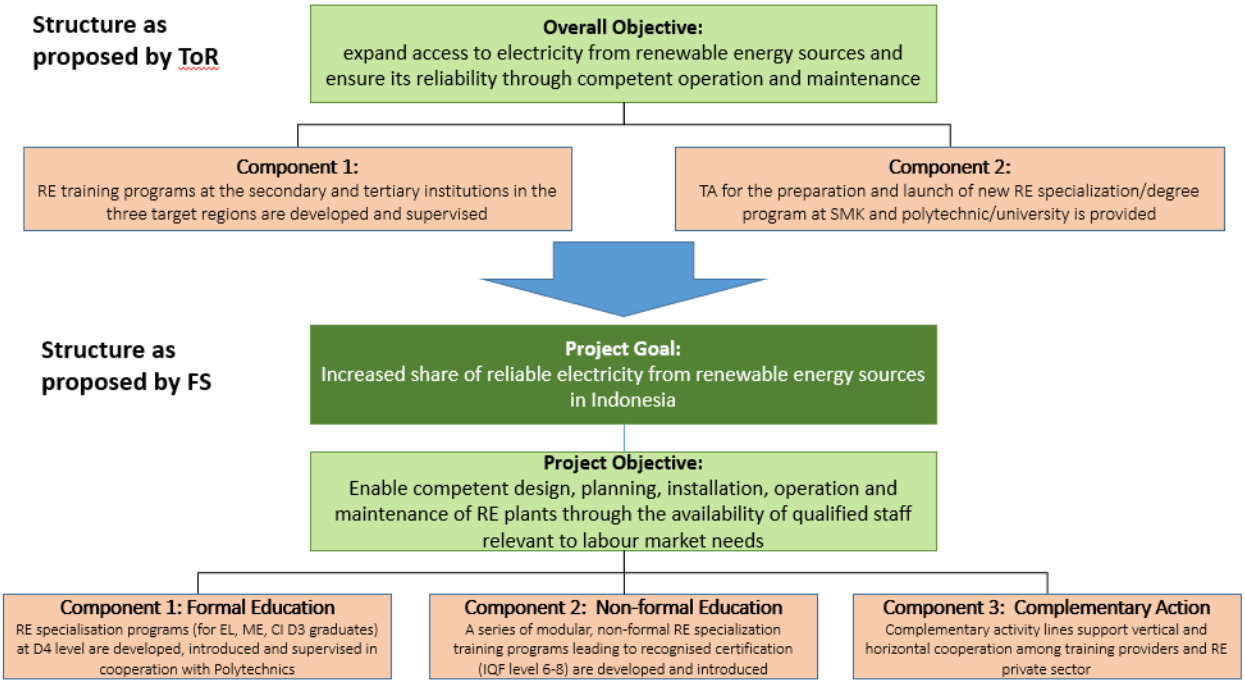


*Figure **Fehler! Textmarke nicht definiert.**: Adjusted Project structure*

4.1.3 Component 1: Formal Education

Narrative: RE specialisation programs (for EL, ME, CI graduates from D3/S1) at D4 level are developed and introduced, and implementation is supervised in cooperation with Polytechnics and private sector

Outcome 1: Formal, multidisciplinary RE specialisation programs at D4 level are in place and produce labour market relevant graduates for the RE sector.

Outputs: There are at least eight outputs the project has to create in cooperation with its partners to sufficiently contribute to the achievement of outcome 1.

Output	Lead	Partners involved
Output 1.1: Learning outcomes, structure and preconditions for a one year "post graduate" D4 program specialised in solar, solar hybrid and hydro RE production defined	Project PSU	Polytechnics, private sector, BNSP, DIKTI
Output 1.2: Road-map for the development, and clarifying of roles and responsibilities established and approved	Project PSU, private sector	Polytechnics, BPSDM
Output 1.3: Curricula for at least two D4 specialisation programs developed and accredited	Polytechnics / BPSDM	Private sector, project PSU, DIKTI
Output 1.4: Required equipment, testing procedures (testing facilities) and training for instructors/lecturers defined and available	Polytechnics / BPSDM	Private sector, project PSU
Output 1.5: Teaching aids and internship programs developed	Polytechnics / private sector	Project PSU, BPSDM
Output 1.6: ToT with at least 4 instructors/lecturers per institution conducted and participants certified	Project PSU / private sector	Polytechnics, BPSDM
Output 1.7: D4 "post graduate" RE programs launched at participating polytechnics	Polytechnics	Private sector, project PSU
Output 1.8: Program implementation monitored in cooperation with private sector	Polytechnics	Private sector, project PSU

Expected Result: All participating polytechnics should be able to enrol at least 30 students per program and year starting 2023. This would mean that by 2025 about 900 specialised graduates with D4 degree in solar and hydro that fit labour market requirements will be produced by the participating polytechnics.

4.1.4 Component 2: Non-formal Education

Narrative: Based on the D4 program developed in component 1, a series of modular, non-formal RE specialization training programs are developed, introduced and implemented by private or governmental training institutions in accordance with national standards leading to recognised certification (IQF 6-8).

Outcome 2: Different training provider offer non-formal modular trainings in accordance with higher national skill standards providing skill and knowledge up-grading in eastern Indonesia relevant to the RE labour market.

Outputs: The project in cooperation with its partners has to deliver at least 9 outputs to sufficiently support the establishment of the component 2 outcome.

Output	Lead	Partners involved
Output 2.1: Learning outcomes, structure and preconditions for modular short-term training based on D4 specialisation program defined	Project PSU	Private sector, PPSDM
Output 2.2: Road-map for the development, clear roles and responsibilities are established and approved	Project PSU	PPSDM, private sector
Output 2.3: Series of modular trainings developed	PPSDM	Private sector, project PSU
Output 2.4: Teaching aids developed and required equipment and training for instructors/lecturers defined (D4 adjusted)	PPSDM	Private sector, project PSU
Output 2.5: Needs for ToT assessed and training to fill gaps conducted and trainer certified	PPSDM	Project PSU, private sector
Output 2.6: New modular training programs introduced at public and private training provider	Private sector	Project PSU, PPSDM
Output 2.7: Program implementation monitored by Indonesian partner in cooperation with private sector	BPSDM	Private sector, project PSU
Output 2.8: Training results and required adjustments assessed and reported	PPSDM, private sector	Project PSU

Output 2.9: National standards (IQF level 6 to 8) developed and approved and training programs of component 1 and component 2 adjusted if required	Private sector, BNSP, EBTKE	Project PSU, polytechnics, PPSDM

Expected Result: By 2025 at least 5 training institutions in eastern Indonesia provide non-formal training modules developed with the support of the project, 300 trainees have joined at least one module and 10 trainees graduated from all modules.

4.1.5 Component 3: Complementary Activities

Narrative: Complementary activities have supported structures for cooperation between training providers and the private sector in RE, and supported a good reputation of RE technologies and availability of services

Outcome 2: Exchange and understanding within the RE sector and with the education sector has led to a higher acceptance and use of RE.

Outputs: The FS proposes 4 outputs to support the establishment of the component 3 outcome.

Output	Lead	Partners involved
Output 3.1: Web-platform on Indonesian RE sector (technologies, policies, regulations, government institutions, training options, private sector companies, services, experts, etc.) established and launched	Project PSU	Private sector, EBTKE
Output 3.2: Awareness campaigns for wider introduction of RE technologies supported with expertise	Project PSU	EBTKE, private sector, polys, BPSDM, PLN
Output 3.3: Three yearly Indonesian RE sector conference organised and conducted (donors, government, private sector, national and international training institutions, certification bodies, etc.)	Project PSU	Private sector, EBTKE
Output 3.4: National and international training institutions linked	Project PSU	Polytechnics, Universities, training provider

Expected Result: Three national RE conferences with participation of all main stakeholders and international RE community have taken place, the public awareness of RE potentials has improved, customers find available RE services easily, and Indonesian research is more downstream and practice oriented. In addition, the digitalisation of information will help interested parties (including students) to learn about policies, regulations, technologies, best practice and the service delivery landscape. It will help to market training programs, match job seekers with potential employees and provide information about job openings.

Please refer to Annex 11 (*shared LogFrame*) for more details how the tentative outputs will be reached.

4.2 Delivery Approach

The FS Team sees a potential project as a real cooperation between Indonesia and Switzerland. Ownership should be on the Indonesian side rather than on the Swiss side. Hence, cooperation implies that both parties will have benefits, will contribute and will take responsibilities. Only with such joint efforts can the project deliver its planned outputs, safeguard outcomes (results) and over time achieve the intended impact.

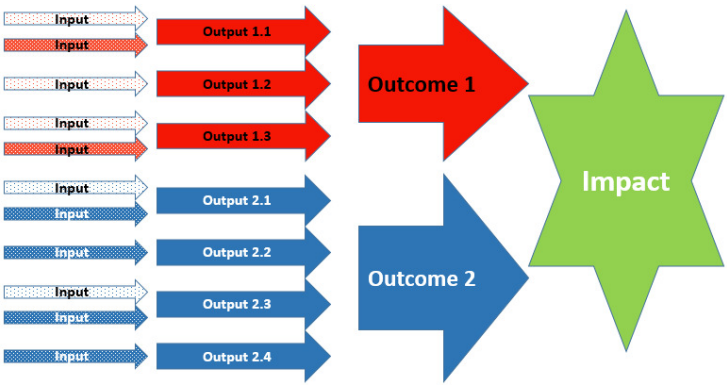


Figure 6: Cooperation approach with shared input/output responsibilities

Therefore, the FS Team would like to propose an approach that defines the roles and responsibilities of both cooperation sides from the very outset. The instrument proposed to clarify inputs and responsibilities of the different parties is a *Shared LogFrame*[14]. The FS Team has developed a draft *Shared LogFrame* with tentative indicators. This *Shared LogFrame* has been discussed and adjusted with some of the partners. During a project inception phase the project implementing agency on the Swiss side will need to further develop the *Shared LogFrame* in cooperation with the different partners.

In Annex 12 the draft *Shared LogFrame* can be consulted. That shared LogFrame has been tentatively discussed and agreed on with potential partners, it therefore can serve as a basis for project negotiations and agreements.

4.3 Private Sector Involvement

Private sector involvement is a principle of Swiss development cooperation in TVET. Indonesian policies and regulations also clearly demand the cooperation between formal TVET providers and the private sector. Non-formal education in general should be tailor-made to private sector needs or often even specifically tailored for one company. Both training components (formal and non-formal) need to work as closely as possible with the private sector. The FS Team is aware that many formal TVET provider have tried, but have not been very effective in cooperation with the private sector. The project therefore needs to contribute to a better understanding between the education sector and the private industry; the approach of "demanding" cooperation of the private sector needs to be replaced by a cooperation approach, as only if both sides are involved in decision making processes can a real cooperation take place.

In the case of the RESD project that means that the private sector and private sector RE experts need to cooperate not only in the elaboration of curricula, the definition and development of teaching aids and equipment, the promotion and implementation of training, and the monitoring process, they also need to be involved and be part of decisions about skills and competence levels to be obtained, curricula structures, training duration and management, and in the certification process.

The RESD project has to ensure the private sector has the opportunity to bring their expertise to the TVET schools, and to provide its most experienced experts as lecturers or at least as guest lecturers. Partners (schools and government) need to be supported in finding ways that this can happen. Jointly with the private sector, schools and authorities shall develop guidelines for private sector cooperation, set learning outcomes of potential internships together, and define and agreed on roles and responsibilities for such internships.

Private sector companies related to renewable energy in Indonesia have already accepted interns within their workforce, although without a formalised cooperation nor well-integrated, clear internship programs. Interns typically approach the companies informally to request internship opportunities without solicitation from the private sector companies. This process is often difficult, and the students do not receive systemic nor effective assistance from the schools. Some of the private sector companies do announce the need for interns for specific short term projects through personal and professional networks. Companies such as Baywa RE, Vena Energy, UPC, Engie, and others have expressed interest to the FS team in collaborating closely to develop regular internship programs and to have the internship program well-integrated into the workflow of the company.

Within limits, the private sector companies have also expressed interest in participating in curriculum development, providing subject matter experts and industry experiences to the polytechnics, and providing opportunities for the teachers and lecturers to potentially collaborate on industry relevant projects with the help of the students.

[14] The shared LogFrame has been developed by PCS GmbH and can only be used with its consent and mentioning the copyright of PCS GmbH

The private sector shall be invited to cooperate in all activities of the project. The project has to ensure information on activities is provided to private sector representatives in time. Further, the project will have to ensure a balance between national and international private sector participation as the interests vary and coordination between national and international companies, especially on HRD, is not developed so far.

4.4 Main Partners

4.4.1 Component 1: Formal Education

In component 1 the implementing partners would be decentralised. In each participating polytechnic an implementation unit (IU) should be established (a "*unit pelaksanaan*" in line with Indonesian regulations), taking responsibility for the implementation on the Indonesian side. As the Polytechnic EBT in Bali is not yet established the BPSDM will appoint the implementation unit for the Poly EBT.

The BPSDM implementation unit will play a central role for the project, as it is expected to provide crucial content inputs and is the only one not directly under RISTEKDIKTI. BPSDM will have to establish a project implementing unit, and appoint a coordinator in charge for resource planning, acquisition of required equipment, the implementation of the project activities in BPSDM institutions, and for the coordination with other implementing partners under RISTEKDIKTI. The BPSDM is proposed to lead the coordination of all Indonesian partners by chairing the Implementation Coordination Committee (ICC, see figure 18).

Polytechnics: The FS team conducted site visits to the three polytechnics identified in the SECO ToR – Polytechnic Negri Manado, Polytechnic Negeri Ujung Pandang (UPG) and Polytechnic Negeri Kupang – as well as an additional polytechnic recommended by the Ministry of Higher Education, the Polytechnic Negeri Jakarta. The FS team proposes a potential RESD project to work with all these polytechnics. An assessment of these polytechnics is provided in Annex 13, a summary is provided below.

1. ***Polytechnic Negeri Jakarta, Depok, West Java***
   A well-resourced poly with new engineering labs (new Lucas Nuelle training systems for RE training), motivated teachers and management, and recommended for cooperation by DIKTI. This polytechnic currently operates D3 and D4 study programs in the main engineering disciplines. Due to its location close to Jakarta, this polytechnic would likely receive more attention from national and international partners than the others. The proposed cooperation was very well received at the Polytechnic, in a meeting with the director and all potentially involved management staff the Polytechnic clearly signalled their interest and willingness to contribute.
2. ***Polytechnic Negeri Ujung Pandang, Makassar, South Sulawesi***
   Highly motivated teachers and management, equipped with an engineering laboratory with new Lucas Nuelle training systems, although teachers have not yet been sufficiently trained on its use. Newly commissioned solar and wind plants are nearby, as well as several hydro plants. D3 and D4 programs in engineering disciplines. The FS team had two meetings with the Poly. The interest raised in the first meeting was overwhelming, the Poly organised as a consequence the stakeholder meeting on its own costs and seems very committed to participate.
3. ***Polytechnic Negeri Manado, Manado City, North Sulawesi***
   Motivated teachers and supportive management. This polytechnic currently offers D3 and D4 programs in the main engineering disciplines, as well as a cooperation program with PLN. Newly commission solar plants nearby, as well as geothermal and hydro. Laboratory equipment is at least 30 years old and would require some updating. The Poly has recently set up a grid-tied solar panel system. The FS team had two meetings with the Poly. The interest raised in the first meeting was very strong, the Poly organised as a consequence the stakeholder meeting on its own costs and is very committed to participate, even without the cooperation of DIKTI (which is given).

4. ***Polytechnic Negeri Kupang, Kupang City, East Nusa Tenggara***
   Very motivated teachers, management supportive but wants to ensure DIKTI approves. Laboratory equipment in poor shape. Engineering programs are offered at the D3 level, but not D4. East Indonesia is the hot spot for future solar investment, so this poly is well positioned geographically. Overall, a motivated partner but will likely require more attention/support from the RESD project than the other polytechnics. The FS team met only once with Poly Kupang. The management was rather reserved, but teachers were very welcoming the project idea and a future cooperation with Switzerland.

4.4.2 Component 2: Non-formal Education

The main partner in component 2 shall be the PPSDM-EBTKE. This institution has a good reputation for the delivery of short trainings in the energy and RE sector. The PPSDM will be supported to develop the series of modular trainings based on the D4 program of component 1. The PPSDM will lead the development of the modular, non-formal training, promote the training programs to training providers in eastern Indonesia, provide training for trainers (at PPSDM but also in other locations) and will coordinate activities on the Indonesian side.

With regard to qualification standard setting the project will closely work together with the private sector, KEBTKE, BNSP and PPSDM. As foreseen in the Indonesian regulations the private sector will have to take the lead in the development of the national qualification standards. Compensations and arrangements will follow the BNSP regulations and shall be the responsibilities of the Indonesian partners.

4.4.3 Component 3: Complementary Activities

As in the other components, in this the PSU would have to work with different implementing partners on the Swiss and the Indonesian side. On the Swiss side the implementing agency shall cooperate with interested parties from the Swiss TVET and RE sector. SECO will inform interested institutions and will determine the cooperation modalities. The Swiss institutions will cooperate in the establishment of the outputs defined where interested.

The cooperation and collaboration with Indonesian partner in this component will much depend on the development of policies and the RE market forces. As in other components the main partner on the Indonesian side shall be the private sector, but also government institutions (EBTKE, MoEMR, PLN) and educational institutions can play a crucial role, especially if the private sector is not able to put sector interests above individual interests.

For the establishment of the web-platform the PSU will have to sub-contract local an expert company or have to go into cooperation with an Indonesian company.

4.5 Result-Chain of potential RESD Project

The draft of the *shared LogFrame* (see Annex 12) already shows results the different project components shall produce, but it does not yet detail the activities and developments not directly influenced and outcomes/impacts that not directly serve the RE sector, therefore the below result-chains have been developed.

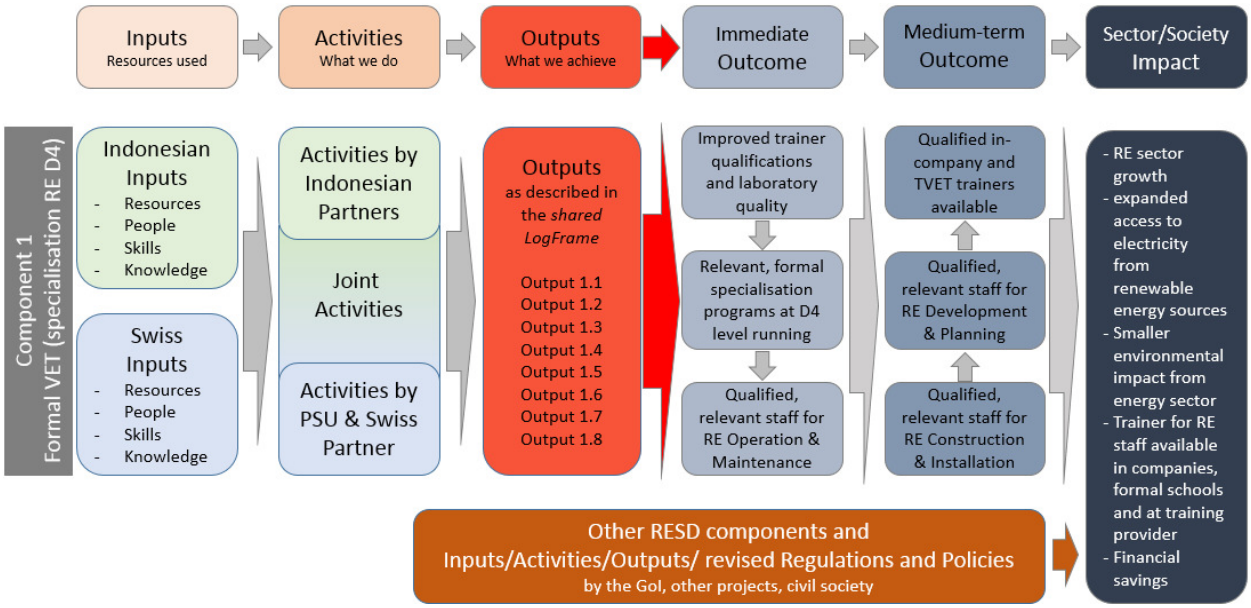


*Figure **Fehler! Textmarke nicht definiert.**: Draft result-chain component 1*

Component 2 shall lead to similar medium-term outcomes and a very similar impact as component 1.

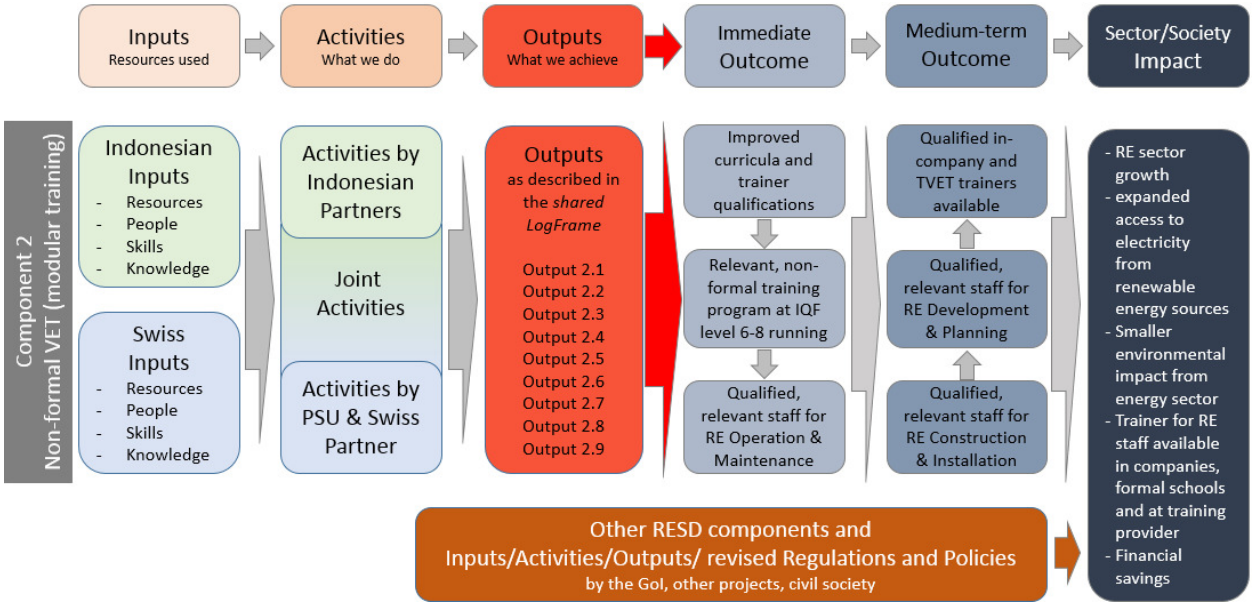


*Figure **Fehler! Textmarke nicht definiert.**: Draft result-chain component 2*

The result chain of the third component also leads to the same impact, but as component 3 is closely interlinked with developments the project cannot directly influence, the activities involve more stakeholders and the PSU management will need to closely monitor developments and – in accordance with regulation or policy changes – redraft the result-chain.

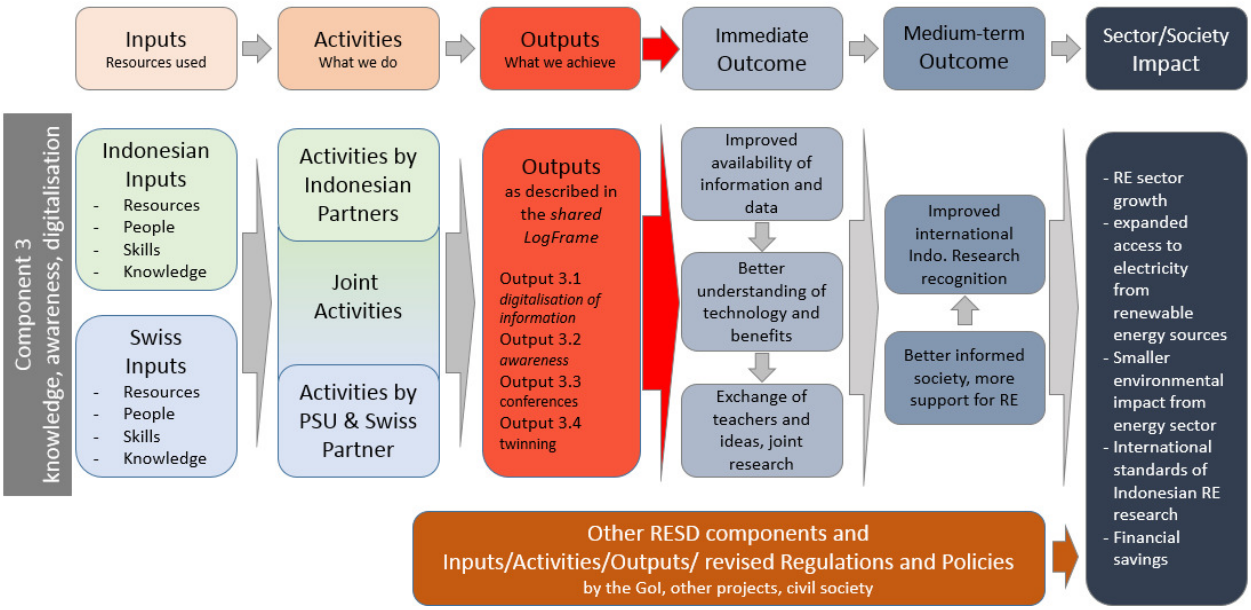


*Figure **Fehler! Textmarke nicht definiert.**: Draft result-chain component 3*

For more details, please refer to the *shared LogFrame* in Annex 12. It must be underlined that the above result-chains are based on the ideas the FS Team developed in cooperation with potential Indonesian partners. The FS Team would like to stress that all ideas and inputs, approaches, roles and responsibilities, presented tools and arrangements need to be revisited during a potential project inception phase.

4.6 Project Set-Up and Steering

4.6.1 Strategic and steering level

Taking the assessments and conclusions into consideration, the FS Team would opt for a project model including the following main partners and stakeholders:

At project agreement level: The Swiss Federal Department of Economic Affairs, Education and Research and the Indonesian Ministry for Energy and Mineral Resources.

At project steering level: The Swiss Coordination Office in Jakarta, the director BPSDM, the director general EBTKE, a representative of RISTEKDIKTI, the chairman of BNSP, a representation of BAPPENAS, a representation of the national private sector, a representation of the international private sector. For more information please refer to Annex 7.

Technical coordination: The FS team does not recommend to set-up a technical coordination committee, but would recommend to keep the possibility open in case it deems necessary to establish such a committee in the course of project implementation.

4.6.2 Implementation management

Project Support Unit (PSU): The PSU will be responsible for the planning, organisation, resource management and implementation of the project activities by the Swiss partners. An international project manager (PM) shall lead a team of 5 to 7 experts and a number of support staff. The PM will be responsible for the organisation of the PSU (recommended in accordance to project structure), budget and resource planning, establishment of implementation level agreements, joint activity planning, communication, administration, and all arrangements required for project implementation from the Swiss side. The implementing agency will also be responsible to prepare Swiss partners for their missions to Indonesia and ensuring that the Swiss and Indonesian parties meet on equal terms. The PSU plans, budgets and

reports need to be approved by SECO. Monitoring is considered an integral management function which has to be included in all job descriptions, no separate monitoring officer shall be employed.

The PSU will interact with the Indonesian partners as a group (planning, establishment of common implementation level agreements, joint activity planning, agreement on code of conduct, etc.) and on individual level (specific TA for individual partners). To address issues all partners are concerned with, the PSU will address the Implementation Coordination Committee in regular meetings.

In **component 1** the implementing partners (taking responsibility for the Indonesian side) will be decentralised, there is no lead agency taking responsibility for all component 1 partners. Each partner will have a project implementation unit with a coordinator responsible for the implementation of project activities within the institution, its location and the coordination and cooperation with PSU and other project partners. Each unit is responsible for resource management and implementation of project activities and coordination with other partners. This includes the planning, acquisition and disbursement of required resources through budget with the line ministry or projects.

The RESD PSU will conduct joint project planning workshops on a bi-annual basis (later probably on a yearly base). Project plans, project budgets and reports need to be approved by SECO after consent by the project steering committee. All partners and especially the PSU will have to ensure relevance to private sector needs and therefore must integrate the private sector wherever possible, including in decision making and planning.

By having several independent partners the project creates a competitive environment and has the opportunity to apply cooperation and performance standards. In addition, with this set-up the project follows Indonesian regulations on project implementation and sets clear responsibilities from the start, and it does not interfere with partner structures and authority. All partners shall be supported by project experts and experts from Swiss partner institutions. The private sector will be invited to participate in all activities of the component, its participation in curricula development will be mandatory.

The main partner in ***component 2*** would be the PPSDM-EBTKE. They will have to establish a project implementation unit with a coordinator responsible to jointly plan with the PSU all activities of the component 2. In addition, they will have to plan, acquire, and manage required resources (GoI budget through MoEMR).

With regard to qualification standard setting the project shall closely work together with the private sector, KEBTKE, BNSP and PPSDM. In accordance with Indonesian regulations the private sector will have to take the lead. It is foreseen that project PSU experts as well as Swiss Experts are supporting all aspects of component 2. The private sector will be strongly involved with the design, dissemination and implementation of the training programs.

In ***component 3*** the PSU would have to work with different implementing partners on the Swiss and the Indonesian side. The PSU will be clearly in a regulating and coordination position, but will also take the lead for the tendering of services. On the Swiss side the partners will be from the private and the education sector. On the Indonesian side mainly private sector partners, government institutions, universities and TVET institutions will be involved.

The implementing agency has to develop detailed cooperation mechanisms, cooperation proceedings and code of conducts, and will need to ensure a close collaboration with Swiss institutions, coordinate mandates and missions, and align them with the Indonesian side. Modi and mechanisms for the involvement of Swiss partner institutions are not yet defined and need to be developed during the inception phase and approved by SECO.

Implementation Coordination Committee (ICC): To ensure coordination on the Indonesian side a coordination committee or unit under the lead of BPSDM shall be established. The Director of BPSDM will appoint the committee chair, whereas SECO will have to provide consent. All Indonesian partner institutions shall have one two representations in the ICC, only the private sector shall be represented by

two international representatives and two Indonesian representatives. It is recommended that the representatives are members of the partner internal implementation unit (IU). For ICC meetings each partner has to send at least one representatives. Each meeting shall provide a minutes of meeting addressed to the Project Steering Committee members with copy to PSU.

The ICC will be the direct address for the PSU in matters concerning all partners. Usually the chair of ICC invites for meetings and workshops, but if required the PSU can also invited if two members of the Project Steering Committee provide their consent.

4.6.3 Project set-up overview

On the Indonesian side, the private sector and KEBTKE are taking the lead in identifying the right partners for activity implementation.

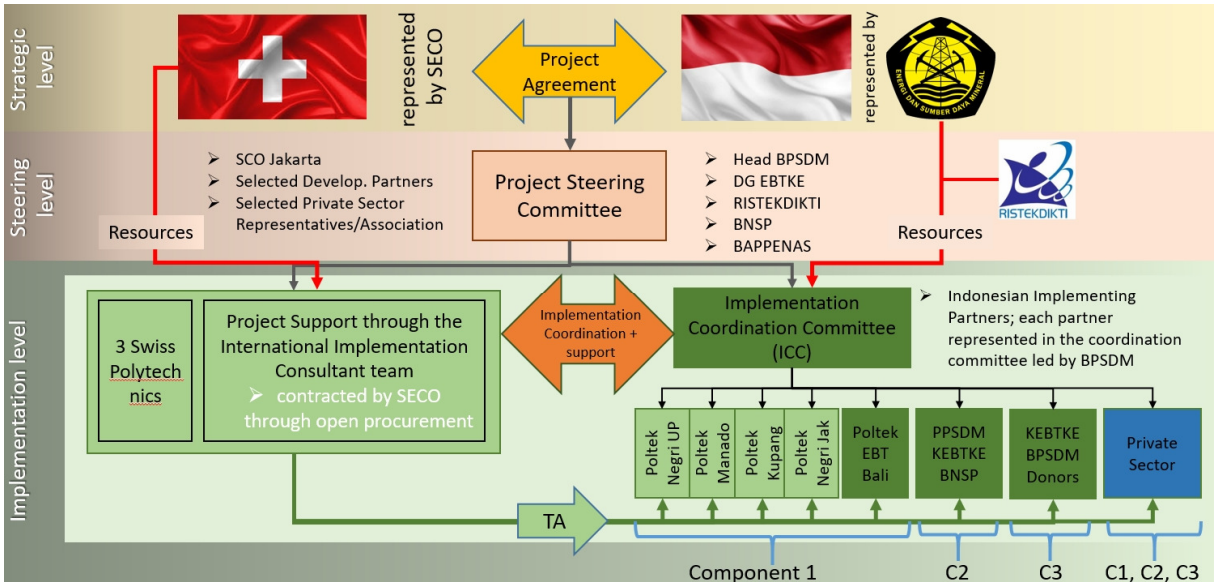


*Figure **Fehler! Textmarke nicht definiert.**: Overview of project set-up*

The above figure shows the set-up of the potential RESD project. On the left side are the Swiss parties involved, on the right side the Indonesian parties.

To keep the graphic clear, at the implementation level on the Swiss side only the Implementing Agency is mentioned (the Swiss partners not). The agency winning the SECO tender will be in charge for administration and coordination with potential Swiss and Indonesian partners at the implementation level. This also includes the negotiation and elaboration of MoUs with the implementing partners.

On the Indonesian side at the strategic level the partner shall be the MoEMR, but as seen in the graphic resources will also be provided by other line ministries, mainly the MoRTHE (RESTEKDIKTI) which is responsible for the resources of the polytechnics in Jakarta, Makassar, Manado and Kupang. In kind contribution, as e.g. from the private sector, are not mentioned in the graphic.

5 Inputs to Project Framework

The SECO project note has defined a project duration of four years. Based on this time frame and the activities and set-up described above a general framework was developed, defining a project road-map, staff resources, opportunities and risks, exit scenarios and a budget draft.

5.1 Opportunities and Risks

The FS Team made an assessment of the opportunities and risks the RESD project would entail. The risk and opportunity assessment uses a two-criteria scoring system that shows the likelihood and the impact.

Opportunity Likelihood (OL) +++ symbolises high, ++ means likely, + means probably, and – means unlikely.

Opportunity Impact (OI) +++ symbolises significant (project will have systemic change), ++ means high impact (project will introduce local change), + means light (some aspects will be taken over), and – means no significant impact.

Opportunities	OL	OI	Potential Impact
Expansion to other RE technology	+++	++	Training approach is applied for other RE technologies
Formal training model will be adopted by DIKTI	+	+++	Training model is used by other schools to provide horizontal paths in TVET, better suited for the labour market
Additional Poly will take over training model	++	++	Polytechnics will adopt training model in other specialisation fields (e.g. food processing), other polytechnics will copy the approach
Modular training taken over by BLKs and other local TP	++	++	Standard modules (with standard qualification level) are introduced in different VET schools
RE technology demand will increase due to civil society demand	++	+++	Awareness measures and digital information motivate more private and corporate individuals to invest in RE technology
Information on RE technology knowledge in society will increase	++	++	A wide spectrum of the society understands the mid-term and long-term benefits of RE technologies

*Figure **Fehler! Textmarke nicht definiert.**: Opportunity assessment*

Risk Likelihood (RL) +++ symbolises high, ++ means likely, + means probably, and – means unlikely.

Risk Impact (RI) +++ symbolises grave (project has to close), ++ means high impact (project will not be able to deliver all outcome), + means light (some outputs will be affected), and – means no significant impact if correctly reacted).

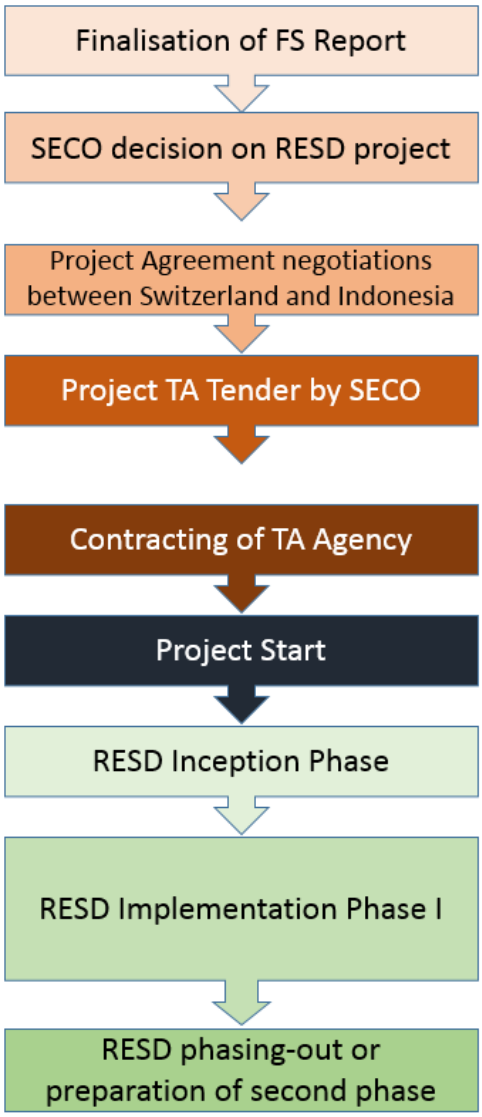
Risk	RL	RI	Mitigation plan
Political unrest	+	+	Project is active at different location, activities can be moved
Community protests	-	++	Project is active at different location, activities can be moved
Low interest on strategic level	-	+++	Terms and conditions of project cooperation must be clarified before tender of TA
Low interest at steering level	+	++	Project steering committee needs code of conduct, if not obeyed, member needs to be changed
Low motivation of partners in component 1	+	+	Project has several partners, cooperation agreements must be clear and have to be callable
Low motivation of partners in component 2	-	++	Project relies very much on PPSDM, cooperation conditions must be agreed on from the start
Low motivation of partners in component 3	+	-	Project has to select several partners to start with and learn over time who is genuinely interested
No interest by private sector	-	+++	In case national companies are not interested, the project has to work with international ones and vice versa
No interest in training program by trainees	+	+++	Show opportunities in the ASEAN labour market, change training modus to make it more interesting, ensure social and gender inclusion
Low interest by trainers/instructors	+	++	Project has to work with different institutions and select trainers carefully, in case of disinterest collaboration needs to be terminated

Swiss partners not interested	+	++	Show long-term benefits, in case of low interest incentive system needs to be adjusted

*Figure **Fehler! Textmarke nicht definiert.**: Risk assessment table*

5.2 Project Road Map

The FS Team has discussed the required SECO internal procedures and the negotiation needs between Switzerland and Indonesia. Bi-lateral negotiations, in particular, can be time consuming, especially if SECO follows the proposed *shared LogFrame* approach. Still, while this would make the elaboration of the project agreement more time consuming, it would clarify expectations prior to the signing of the agreement and therefore make implementation significantly more effective and efficient.



- October 2019 – Final FS Report is discussed by SECO November 7th – SECO discusses approach with potential Swiss partners
- End November 2019 – SECO internal decision on project
- December 2019 to March 2020 – negotiations with Indonesian strategic level partners, elaboration of TA tender documentation
- End March 2020 – signing of project agreement between Switzerland and Indonesia, launching of TA tender by SECO
- July 2020 – Signing of TA contract by SECO and Implementing Agency
- Preparation of project
- October 2020 – Project launch
- October 2020 – Project Inception phase (3 month)
- January 2021 – Inception report, implementation agreements, general implementation plan and budget, detailed half-year planning
- Until March 2024 – Project implementation
- March 2024 – External project evaluation, "way forward" report
- April 2024 until September 2024 – Project phasing out, and/or preparation of follow-up

*Figure **Fehler! Textmarke nicht definiert.**: Tentative road-map for RESD*

5.3 Exit Scenarios

Exit scenarios are defined by defining the cooperation modalities. The FS is in favour of using a "business approach", which clearly defines roles and responsibilities before one of the parties has signed in obligations with third parties (this would in case of RESD mean before TA is signed). Therefore, the project agreement should already clarify expectations and contributions by the Indonesian and the Swiss side. It also should contain procedures describing what will happen in case of breach of agreement.

If a project agreement between Switzerland and Indonesia is regulating roles and contributions, there are basically three exit scenarios:

1. ***Termination due to end of project***
   This is the scenario all partners should aim for. It would mean that the project fulfils its obligation and delivers the expected results. Continuous monitoring and reporting as well as the external evaluation are positive and a planned and regulated exit can take place.

2. ***Termination due to "non-performance"***
   This scenario would take place in the case that the project would operate as planned, but it would be very unlikely that the expected outcomes would be achieved. In such a case the main partners (Switzerland and Indonesia) should seek external support to assess the situation and provide recommendations for continuation or termination.

3. ***Termination due to breach of agreement***
   In the case that one partner does not fulfil its obligation, the other party should have the right to terminate the cooperation after providing the opportunity to correct wrongdoings. In such a case the PSU shall provide exit plans for the Swiss partners and BPSDM for the Indonesian partners.

5.4 Required Resources

While exact determinations for project resources are not yet possible at this early stage, the FS can make estimations based on experience with similar project and country contexts for the Swiss and Indonesian inputs, with the limitation that the Indonesian inputs will be subject of negotiations and therefore are not calculated in the budget. The human resources (HR) are only calculated for cooperation and development purposes, not for training to trainees.

The project will have to employ an ***experienced TVET Project Manager*** for the operations in Indonesia. The activities will mainly take place in Indonesia, but it is expected that the project implementing agency also conducts certain activities in Switzerland, including preparation of Experts for their missions, information events, partner workshops and press releases. For sustainability reasons a ***Junior Swiss Expert*** should also be included in the project.

The Swiss project management will be supported by the back-office of the project implementation agency and by ***5 Indonesian expert staff*** in their office in Jakarta. To complete the team in Jakarta ***3 office support staff*** (accounting, logistics and communication) will be added.

The Indonesian partners will also have to invest in the project. There will be the need of project management and implementation on the partner side (HR).

Human Resources over 4 years:

	Number of internat. staff	Internat. person years	Number of Indonesian staff	Indonesia person years
PSU Manager and Swiss Coordinator	***1***	***4***		
Junior Swiss Expert	***1***	***4***		
PSU expert staff			***5***	***20***
PSU support staff			***3***	***12***
Project management team at BPSDM			2 x 0.25	2
Project management at PPSDM			1 x 0.25	1
Expert staff at PPSDM and EBTKE			6 x 0.25	6
Project management at each Poly (5 Poly)			1 x 0.25 x 5	5

Expert staff and trainers at Polys			3 x 0.25 x 5	15

*Figure **Fehler! Textmarke nicht definiert.**: Tentative HR needs*

Only the bold printed HR will be paid with Swiss budget, the ***Indonesian*** management and expert staff is considered as ***in-kind contribution***. In addition the Indonesian side will have to fund other in-kind contributions like laboratory equipment and regular budget for the implementation of activities. Travel and accommodation of its staff and facilities to conduct workshops.

In addition to human resources the project will require ***facilities (office) and operational funds*** to work. The local office operation and administration in Jakarta is estimated to total approximately ***CHF 480'000***.

The RESD project shall also work in cooperation with Swiss partners. These partners will need to visit Indonesia on a regular basis. Tentatively, we estimate 5 person visits of 2 weeks per year. Such a visit is calculated as such (per visit): 1. Air ticket - CHF 2'400; 2. Accommodation, taxi, railways and allowances (12 x CHF 250.-) – CHF 3'000; 3. Local flights – CHF 900.-; and 4. Honorary (15 x CHF 1200) – CHF 18'000. That leads to a yearly budget for Swiss partner organisations of approximately CHF 120'000. Adding some reserve a total ***"Swiss Partner Fund" of CHF 500'000*** will be calculated. This "Swiss Partner Fund" should be managed by the implementing agency directly. For all partner missions the ToR need to be established and performance has to be monitored.

5.5 Budget

Considering the above resources needs and the project activities required to achieve the project outcomes and objective a total budget of CHF 6.45 million will be required to run the project over 4 years.

After consultations with SECO the costs for back-office, administration and management of the project, hiring staff and project implementation supervision has been set at 12.5%.

Below budget (in 1'000 CHF) is based on above calculations and estimations. A detailed budget can be found in Annex 14.

	year 1	year 2	year 3	year 4	**Total**
Staff costs (including housing and home leaves)	704	704	704	704	**2'816**
Project operation and administration	133	115	115	115	**478**
Activities component 1	250	405	210	70	**935**
Activities component 2	170	250	190	80	**690**
Activities component 3	120	160	170	110	**560**
Reserve	69	82	69	54	**274**
Project Overhead (PLE) 12.5%	172	204	174	135	**685**
Total	**1'618**	**1'920**	**1'632**	**1'268**	**6'438**
Swiss Partner Fund (included in total)	150	130	120	100	**500**

*Figure **Fehler! Textmarke nicht definiert.**: Tentative overall budget*

As mentioned above, the project implementing agency will also be responsible for the management of the "Swiss Partner Fund".

Hagenwil, 26th of October 2019 / SA

Annex 1: Organisations/People met

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Annex 2: TVET Regulatory Framework

Source: https://unevoc.unesco.org/wtdb/worldtvetdatabase_idn_en.pdf

The overall structure of the Indonesian education system including TVET is stated out in the National Education System Law, enacted in 2003. It describes all levels of education and the structure attached to each of them.

The act on manpower no. 13 of 2003 regulates the national training system (preparation for work). Further, the Teacher Law of 2005 and its respective regulations provide for the organisation of teacher profession and its quality.

Technical and vocational education consists of 47 programmes in the following fields: technology and engineering; health; arts; craft and tourism; information and communication technologies; agro-business and agro-technology; and business management. A certificate is awarded upon completion of senior secondary school. Students also sit a national examination, and, if successful, they are awarded a national certificate which grants access to higher education.

Higher education in Indonesia is provided by institutions falling under one of the following 5 types:

- Single-faculty academies, that provide instruction in only one field and mostly offer either applied science, engineering, or art studies and grant Diplomas and Certificates for technical-level courses at both public and private levels;
- Advanced schools, that offer academic and professional university-level education in one particular discipline;
- Polytechnics, that are attached to Universities and provide sub-degree junior technician training;
- Institutes, that provide education programmes in several fields of study by qualified faculty and are ranked at the same level as universities with the right to grant a degree; and
- Universities that offer training and higher education in different disciplines.

According to the Law on National Education System of 2003 “non-formal education is provided for community members who need education services which functions as a replacement, complement, and/or supplement to formal education in the frame of supporting life-long education” (Law on National Education System, 2003).

Non-formal and informal TVET systems aim to develop the potential of learners with the emphasis on the acquisition of knowledge and functional skills.

Non-formal education comprises life-skills education, early childhood education, youth education, women empowerment education, literacy education, vocational training and internship, equivalency program, and other kinds of education aimed at developing learners’ ability’ (Law on National Education System, 2003).

In addition to equivalency programmes, both private and public institutions offer short-term non-formal vocational training. This training focuses on preparing workers and trainees to enter the job market with specific, upgraded skills. Public non-formal vocational training providers (known as BLKs), that are under the responsibility of district governments, provide programmes for poor individuals who dropped out of primary or secondary school.

Annex 3: Renewable Energy Policies

Sources: https://www.nortonrosefulbright.com/en/knowledge/publications/0552a1f0/renewable-energy-snapshot-indonesia

Indonesia is targeting that 23 per cent of electricity will be generated from renewable energy sources by 2025.

In early 2019 hydro, geothermal, solar PV, wind, biomass, biogas and waste-to-energy. Hydro accounts for 7.17 per cent of the total electricity generation (approximately 4,010 MW), with geothermal responsible for another 3.48 per cent (1,948.5 MW).

PT PLN (Perero) (Perusahaan Listrik Negara or state electricity company) (PLN) is the state-owned vertically integrated utility company who acts as the primary offtaker of electricity generated by independent power producers (IPPs). Consumers are allowed to own and operate power generation facilities for their own use and may sell any excess power to PLN. Consumers wishing to do this need to comply with prevailing regulation and will need approval from PLN. See below for a discussion of rooftop solar and net metering.

Private parties are also allowed to set up IPPs and to sell the electricity generated directly to end-users within a stipulated area. Key requirements of such projects include an electricity supply business permit, an operational license (izin operasi), a designated operating area (wilayah usaha) and approval of the tariff by the relevant authority. In case PLN is connecting the area to its power supply, the operational licence will be withdrawn and the IPP has to deliver to PLN in accordance with tariff regulations.

Indonesia favours an auction process with a tariff ceiling. Projects are procured under differing methods, according to the renewable energy source/technology. These are explained below.

With the exception of geothermal and waste-to-energy projects, all renewable projects must be procured by PLN through a “Direct Selection” process, which is a limited tender process involving at least two bidders drawn from a pre-qualified list. During the pre-qualification phase, developers are invited to join a “List of Selected Providers” (Daftar Penyedia Terseleksi or DPT). According to PLN, the List of Selected Providers is valid for a period of three years.

PLN has concluded two pre-qualification processes so far. The first was launched in October 2017 for developers of solar PV, hybrid energy, wind, biomass and biogas, municipal waste and tidal projects. The results were announced in November 2018 and the pre-qualification is valid for three years. The second pre-qualification process was launched in April 2018 for hydro projects (above 10 MW).

PLN commenced a third pre-qualification process for developers of solar PV, hybrid energy, wind, biomass, biogas, tidal, biofuel and “new energy” projects about 10 MW in 2019. “New Energy” is defined under Law No. 30 of 2007 on Energy to cover nuclear, hydrogen, coal bed methane, liquefied coal and gasified coal. The deadline for submission of applications was on 15 March 2019 and the pre-qualification status granted by this process will be valid for three years.

Pre-qualification processes have also been carried out by PLN at a regional level for renewable projects below 10 MW.

Specifically for solar PV and wind power, the direct selection process must be based on a “capacity quota” – being the maximum generation capacity offered to business entities within a certain period of time for a determined purchase price.

Annex 4: RE Regulations Indonesia

#	Title	Year	Policy Status	Policy Type	Policy Target
1	Renewable Energy Purchase Policy 2017	2017	Ended	Economic Instruments, Economic Instruments>Fiscal/financial incentives, Economic Instruments>Fiscal/financial incentives>Feed-in tariffs/premiums	Multiple RE Sources, Multiple RE Sources>Power
2	Electricity Supply Business Plan (Rencana Umum Penyediaan Tenaga Listrik – "RUPTL") 2016-2025	2016	In Force	Policy Support, Policy Support>Strategic planning	Multiple RE Sources
3	Solar Feed-In Tariff of Indonesia (2016)	2016	In Force	Economic Instruments, Economic Instruments>Fiscal/financial incentives, Economic Instruments>Fiscal/financial incentives>Feed-in tariffs/premiums	Solar, Solar>Solar photovoltaic
4	Indonesia geothermal auctions 2016	2016	In Force	Regulatory Instruments, Economic Instruments>Market-based instruments	Geothermal
5	Accellerated Depreciation in certain business fields and/or certain regions of Indonesia	2015	In Force	Economic Instruments, Economic Instruments>Fiscal/financial incentives, Economic Instruments>Fiscal/financial incentives>Tax relief	Multiple RE Sources, Multiple RE Sources>All
6	Feed-in-Tariffs for Biomass and Municipal Waste (Ministerial Regulation No. 27/2014 and No. 44/2015)	2014 and 2015	In Force	Economic Instruments>Fiscal/financial incentives>Feed-in tariffs/premiums	Bioenergy>Biomass for power
7	New Geothermal Law (No. 21/2014)	2014	In Force	Regulatory Instruments	Geothermal
8	National Energy Policy (Government Regulation No. 79/2014)	2014	In Force	Policy Support, Policy Support>Strategic planning	Multiple RE Sources
9	Ceiling Price for Geothermal (Ministerial Regulation No. 17/2014)	2014	In Force	Economic Instruments>Fiscal/financial incentives>Feed-in tariffs/premiums	Geothermal>Power

#	Title	Year	Policy Status	Policy Type	Policy Target
10	Power purchase from solar photovoltaic plants (No. 17/2013)	2013	In Force	Economic Instruments>Fiscal/financial incentives>Feed-in tariffs/premiums	Solar, Solar>Solar photovoltaic
11	Biofuel Blending (Ministry Regulation No. 25/2013)	2013	In Force	Regulatory Instruments>Codes and standards>Product standards	Bioenergy>Biofuels for transport, Bioenergy>Biofuels for transport>Biodiesel, Bioenergy>Biofuels for transport>Bioethanol
12	Feed-in-Tariffs for Biomass (Ministerial Regulation No. 19/2013)	2013	Superseded	Economic Instruments>Fiscal/financial incentives>Feed-in tariffs/premiums	Bioenergy>Biomass for power, Bioenergy>Biomass for heat, Bioenergy
13	Electricity Purchase from Small and Medium Scale Renewable Energy and Excess Power (No. 4/2012)	2012	In Force	Economic Instruments>Fiscal/financial incentives>Feed-in tariffs/premiums	Multiple RE Sources, Multiple RE Sources>Power, Bioenergy, Hydropower
14	Clean Technology Fund	2012	In Force	Economic Instruments>Fiscal/financial incentives>Grants and subsidies, Policy Support>Institutional creation, Policy Support	Multiple RE Sources
15	Geothermal Fund (Ministry of Finance Regulation No. 3/2012)	2012	In Force	Policy Support, Economic Instruments>Fiscal/financial incentives	Geothermal
16	Purchase of electricity from geothermal plants (20/2011; 22/2012)	2011	In Force	Economic Instruments>Fiscal/financial incentives>Feed-in tariffs/premiums	Geothermal>Power
17	Purchase of Electricity from Geothermal Plants (Regulation No. 02/2011)	2011	In Force	Economic Instruments>Fiscal/financial incentives>Feed-in tariffs/premiums	Geothermal
18	Tax exemption on goods for geothermal exploration (No. 22/PMK.011/2011)	2011	Ended	Economic Instruments>Fiscal/financial incentives>Tax relief	Geothermal
19	Indonesia Value-Added Tax and Import Duty Exemption For Renewable Energy Property	2010	In Force	Economic Instruments>Fiscal/financial incentives, Economic	Multiple RE Sources, Multiple RE Sources>All

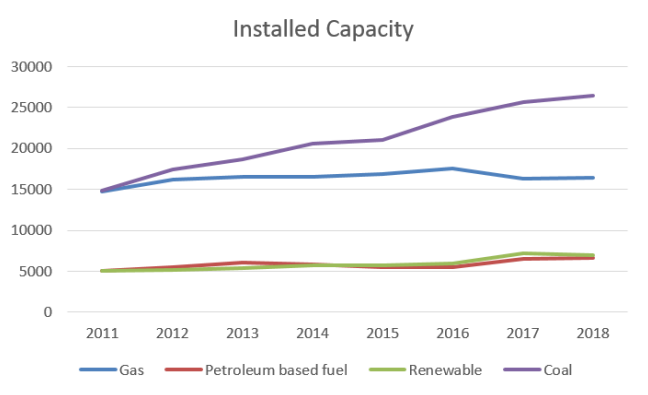
#	Title	Year	Policy Status	Policy Type	Policy Target
				Instruments>Fiscal/financial incentives>Tax relief	
20	Income tax reduction for energy development projects (MoF Regulation No. 21/2010)	2010	In Force	Economic Instruments>Fiscal/financial incentives>Tax relief	Multiple RE Sources
21	Non-Building Tangible Assets for Tax Depreciation Purposes	2009	In Force	Economic Instruments, Economic Instruments>Fiscal/financial incentives, Economic Instruments>Fiscal/financial incentives>Tax relief	Multiple RE Sources, Multiple RE Sources>All
22	Tariffs for Small and Medium Scale Power Generation using Renewable Energy (No. 31/2009)	2009	Superseded	Economic Instruments>Fiscal/financial incentives>Feed-in tariffs/premiums	Multiple RE Sources>Power, Multiple RE Sources, Bioenergy, Hydropower
23	Electricity Law (No. 30/2009)	2009	In Force	Policy Support	Multiple RE Sources
24	Biofuel Supply, Utilization and Trading (Ministerial Regulation No. 32/2008)	2009	Superseded	Regulatory Instruments>Codes and standards	Bioenergy>Biomass for power
25	Geothermal Business Activities (Government Regulation No. 59/2007; 70/2010)	2007	In Force	Economic Instruments>Fiscal/financial incentives>Grants and subsidies	Geothermal
26	Energy Law No. 30/2007	2007	In Force	Policy Support>Strategic planning, Policy Support>Institutional creation, Policy Support	Multiple RE Sources
27	Development credits for biofuels and plantation revitalisation (MoF Regulations No. 117/2006; No. 79/2007)	2007	In Force		Bioenergy>Biofuels for transport>Biodiesel, Bioenergy>Biofuels for transport>Bioethanol, Bioenergy>Biofuels for transport
28	Provision and Utilization of Biofuel (Presidential Instruction No. 1/2006)	2006	In Force	Policy Support	Bioenergy>Biofuels for transport, Bioenergy>Biofuels for transport>Biodiesel, Bioenergy>Biofuels for transport>Bioethanol

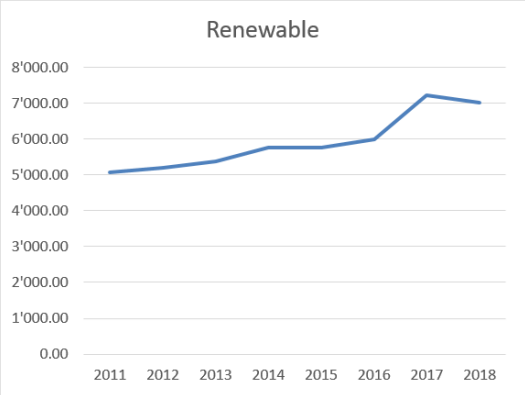
#	Title	Year	Policy Status	Policy Type	Policy Target
29	Medium-Scale Power Generation using Renewable Energy (Ministerial Regulation No. 2/2006)	2006	In Force	Economic Instruments>Fiscal/financial incentives>Feed-in tariffs/premiums	Multiple RE Sources
30	National Team for Biofuel Development and Biofuel Roadmap (Decree No. 10/2006)	2006	In Force	Policy Support>Strategic planning	Bioenergy, Bioenergy>Biofuels for transport
31	Presidential Regulation on National Energy Policy (No. 5/2006)	2006	Superseded	Policy Support>Strategic planning	Bioenergy, Multiple RE Sources
32	Blueprint of National Energy Management (2005-2025)	2005	In Force	Policy Support>Strategic planning	Multiple RE Sources>Power
33	Green Energy Policy (Ministerial Decree No. 2/2004)	2004	In Force	Policy Support, Economic Instruments>Fiscal/financial incentives, Information and Education>Information provision	Multiple RE Sources
34	Old Geothermal Law (No. 27/2003)	2003	Superseded	Regulatory Instruments	Geothermal>Power
35	Small Distributed Power Generation Using Renewable Energy (Ministerial Regulation No. 1122 K/30/MEM/2002)	2002	In Force	Policy Support, Economic Instruments>Fiscal/financial incentives	Multiple RE Sources

Annex 5: Indonesian Electricity Market

Installed Capacity (in MW):

Description / Energy source	2011	2012	2013	2014	2015	2016	2017	2018
Hydro/Mini hydro	3'917	3'937	4'086	4'156	4'289	4'401	4'860	4'939
Pumped storage hydro	0	0	0	0	0	0	0	0
Geothermal	1'147	1'260	1'280	1'340	1'348	1'443	2'197	1'814
Biomass	0	0	0	26	44	44	146	168
Municipal Waste	0	0	0	0	0	0	0	0
Solar PV	1	6	8	9	9	11	20	25
Biofuel	0	0	0	220	76	78	0	0
Other Renewable	1	0	2	0	1	1	1	71
Gas turbine	3'121	3'448	3'604	3'730	3'717	4'172	4'541	4'328
Gas steam	9'850	10'997	11'115	11'093	11'347	11'347	10'016	10'830
Gas/diesel dual fuel	0	0	0	0	0	286	98	0
Diesel	5'054	5'543	6'076	5'863	5'458	5'462	6'548	6'658
Coal gasification	0	0	0	0	0	0	0	0
Coal steam	14'819	17'486	18'657	20'542	21'077	23'837	25'689	26'411
Gas/oil steam	1'798	1'798	1'785	1'760	1'760	1'760	1'610	1'266
TOTAL	39'708	44'475	46'613	48'739	49'126	52'842	55'726	56'510

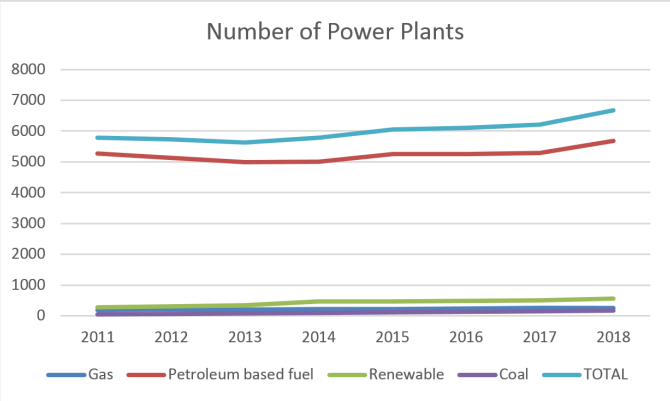


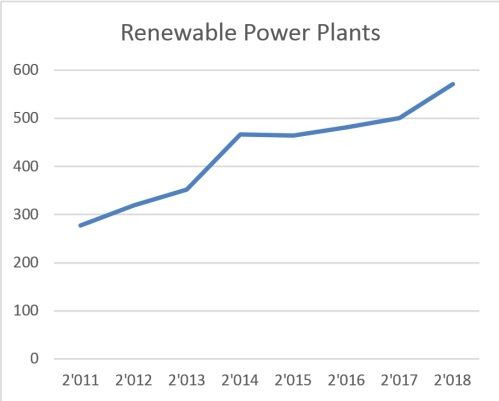


Above graphic shows that the installed capacity is mainly growing in coal power plants. The installed capacity of RE plants is even decreasing due to reduction of geothermal capacity.

Number of Power Plants in Indonesia:

Types	2'011	2'012	2'013	2'014	2'015	2'016	2'017	2'018
Hyrdo/Mini hydro	239	257	271	293	309	322	344	378
Geothermal	18	21	21	22	22	25	34	42
Biomass	0	0	0	16	28	28	46	53
Municipal Waste	0	0	0	0	0	0	0	0
Solar PV	13	33	53	59	60	61	71	90
Biofuel	0	0	0	71	38	38	0	0
Other Renewable	8	8	7	6	7	7	6	8
Gas turbine	83	95	106	113	106	117	158	159
Gas steam	76	80	79	89	92	92	77	81
Gas/diesel dual fuel	0	0	0	0	0	2	12	0
Diesel	5'276	5'137	4'996	5'003	5'253	5'255	5'299	5'678
Coal gasification	0	0	0	0	0	0	0	0
Coal steam	58	71	83	97	118	138	151	165
Gas/oil steam	24	24	22	25	24	24	21	17
TOTAL	5'795	5'726	5'638	5'794	6'057	6'109	6'219	6'671



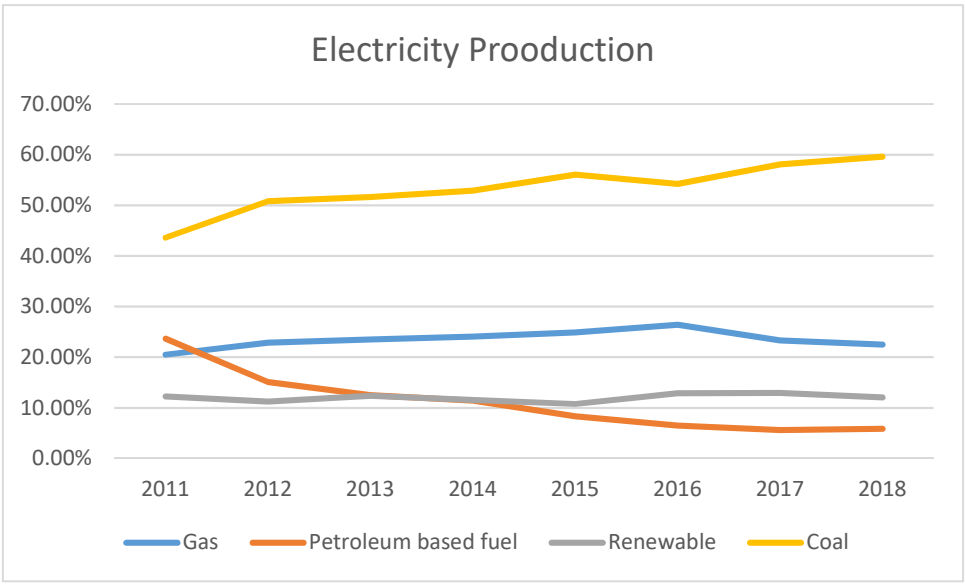


The number of RE power plants nearly doubled from 278 in 2011 to 467 in 2014. After the introduction of the new RE policy the increase – expected to be steep – slowed down, only to pick up slightly later. As most of the RE plants are rather small, the number of plants does not show the entire picture, rather the electricity production by RE plants is meaningful.

Electricity production (in TWh) over time:

Types	2011	2012	2013	2014	2015	2016	2017	2018*
Hydro	12'419	12'801	16'923	15'156	13'740	19'370	18'632	13'676
Geothermal	9'371	9'417	9'410	10'036	10'048	10'656	12'672	11'598
Biodiesel/Biofuel	0	0	148	718	653	1'211	1'007	700
Biomass	0	0	0	208	437	584	590	516
Solar PV	0	0	0	38	19	21	29	15
Wind	0	0	0	0	0	6	0	165
Other Renewable	0	0	0	0	4	0	0	0
Gas	36'551	45'278	50'257	54'465	57'649	65'316	59'376	49'650
Petroleum based fuel	42'186	29'870	26'691	25'909	19'213	16'057	14'271	12'884
Coal	77'737	100'710	110'421	119'605	129'807	134'069	147'825	131'612
TOTAL	178'264	198'076	213'850	226'135	231'570	247'290	254'402	220'816

* only until October 2018



Despite higher production of electricity by RE, the graphic shows that RE is not growing shares in total electricity production. Electricity production by coal power plants is gaining.

All data has been collected by the FS team from various resources.

Annex 6: Renewable Energy and Skill Development Context Assessments

By Andre Susanto

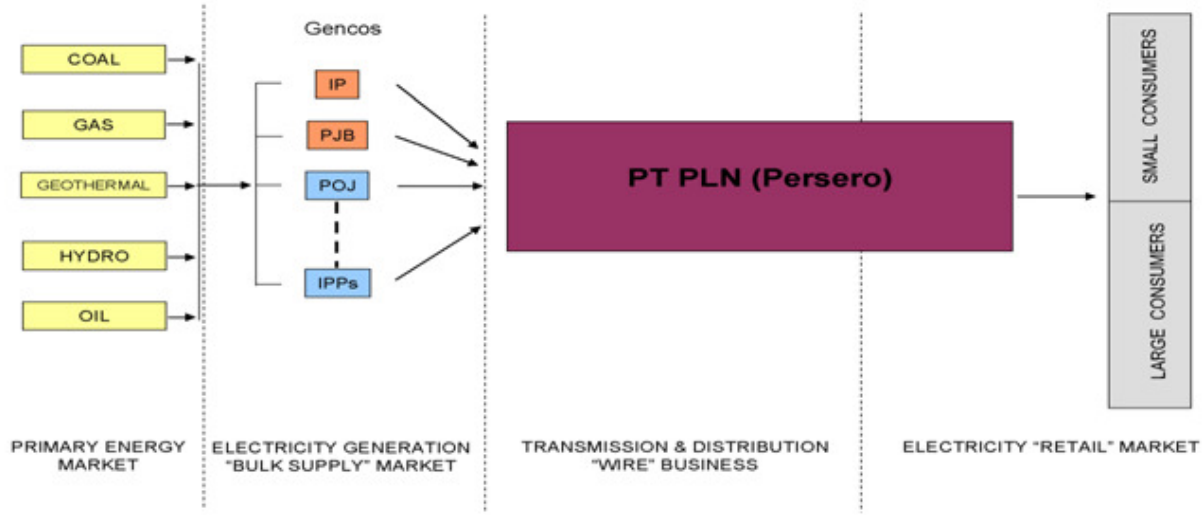
In the Indonesian electricity sector, PLN plays a big role not only as the largest utility company in the nation, but also as the government's primary institution to execute government obligations such as electrification. Despite its monopolistic tendencies, PLN does so not because of greed or high profit margins. Rather PLN's structure and its place in the stakeholder map puts it in the centre.

PLN's limitations on consumer tariff setting is its largest setback in being able to run as a profitable company. There is no clear and transparent mechanism by which PLN can propose consumer tariff increases, but rather this is a political decision overseen by the national parliament (DPR). Unable to recover its costs through consumer tariffs, PLN's operations require large annual subsidies by the Indonesian government that need annual approvals.

PLN's limitation also includes having three ministries controlling its various structure and operations. The Ministry of Finance needs to approve the state budget for PLN's subsidies, and the state budget need further approval by DPR. The Ministry of State-Owned Enterprises oversees PLN's operations and its regulations apply to PLN directly. And lastly the Ministry of Energy and Mineral Resources regulates much of PLN's technical requirements, licensing, and permits in the electricity sector. This include labour force occupational competence certification requirements.

Within the electricity sector, independent power producers (IPPs) are increasingly becoming more important with more and more Power Purchase Agreements (PPA) being signed. IPPs and project developers require semi-skilled and skilled workforce for the development activities of power plant projects, project financing, construction, inspection and commissioning, and finally the operation and maintenance. Below chart shows the electricity supply value chain including the various government institutions related to electricity and/or PLN's role to supply electricity to the nation. (see figure 4: Electricity Market Framework)

The following chart shows PLN's role as a utility company in the electricity supply value chain where it handles all of the transmission and distribution roles as well as retail. PLN also operates generation assets both through its subsidiaries such as Indonesia Power (IP), Pembangkitan Jawa Bali (PJB), and through its own assets including diesel generators, coal power plants, and others. For certain jobs within PLN, many of the workers are outsourced including some customer facing workers (meter readers, technical services, administrative and secretarial services, power plant and substation operators, customer service, distribution line operators, and others).



Source: https://www-pub.iaea.org/MTCD/Publications/PDF/cnpp2018/countryprofiles/Indonesia/Indonesia.htm

Within PLN, recruitment of staff is needed at all levels from vocational secondary school graduates (SMKs), vocational schools (polytechnics), and universities. Through research and interviews, PLN's recruitment process does not put a high value on competency and skills but rather on the candidates fulfilling the following requirements:

- administrative requirement
- test results for English language,
- academic test,
- intelligence (IQ),
- psycho test,
- physical and health check-up
- face to face interview with those who have passed the previous gauntlet.

There are some collaborations with 15 polytechnic schools across Indonesia including ones in Papua and Maluku for D3 level graduates. The collaboration program is set up so that graduates from participating schools only need to pass the requirements to become PLN employees after graduation. Five schools also have collaboration programs for D4/S1 bachelor's degree level graduates with University Ujung Pandang the only university in the program not located in Java. (source: https://rekrutmen.pln.co.id/)

Referring to PLN's role in the value chain, and how much operating assets owned and managed by PLN, there is a large requirement of employees by PLN. Besides the abovementioned collaboration with the educational institutions, PLN also publishes their openings and recruitment opportunities openly. There are very few masters level job opening in the last few years by PLN with most of the open recruitment calls being for DIII graduates and/or DIV/S1 graduates.

PLN's needs for workers that are specific to their function as a utility company include maintenance staff for transmission lines, substations, power plants, and distribution lines, telecommunication and SCADA (supervisory control and data acquisition), electrical safety and occupational safety and health officers among others. Very few renewable energy specific or grid planning and management are ever published. These are typically filled from within PLN's existing employees rather than new recruits.

PLN's own training centres operated under PLN Corporate University serve to provide short course trainings for upskilling and mid-career capacity development of PLN employees. This does not include STT PLN which is an educational institution set up to prepare its graduates to be ready for hire by PLN but is not in itself part of PLN's internal institution.

A flow chart of the Indonesian electricity sector (see Figure 5: Electricity and financial flow in the market) shows where in the value chain of the various high-level stakeholders are sitting. It is clearly showing the needs of skills and labour force are mainly for those of IPPs and their supporting industries (EPC contractors, financial institutions, operators, O&M contractors, and others), PLN and their supporting industries (same as IPPs plus retail sales, transmission and distribution line operators and maintenance technicians, and others), and the government sector for policy making and regulatory issues.

Based on data from MoEC, there are 895 SMKs providing electricity related (including renewable energy power plants and electrical grids) competencies across Indonesia. If each school is able to graduate an average of 30 students per year, that means there are 26,850 SMK graduates per year (typically 17 to 18-year old) deemed ready to work in the electricity sector.

On the other hand, at the polytechnic and university level, according to data from MoRTHE, there are 383 schools providing electrical program studies, 21 schools providing energy program studies (including renewable energy, energy conversion, and power plants). If each school can graduate an average of 30 students per year that means there are 12,120 graduates mostly at bachelor level and some masters deemed ready to work in the electricity sector.

Certification for occupational competencies in the labour market are typically served by Professional Occupations Certification Institutions (Lembaga Sertifikasi Profesi/LSP) under the authority of BNSP. For specific electricity related occupations, MEMR under its Directorate General of Electricity issues its own certificate and its own occupational competence standard. The certification bodies under MEMR is called LSK-Ketenagalistrikan.

Training institutions aligned with the LSK-K and LSP certifications are typically available and many polytechnics set up their own LSPs to meet the MoRTHE's requirement of Polytechnic graduates also needing industry competency certifications. This results in the polytechnics providing training for its students through their academic career and at the same time assesses and certifies the same students through their own LSPs.

In contrast to LSPs, LSK-K are managed and accredited under the authority of MEMR and only provide certifications that are issued by MEMR for the electricity sector. Typically, electrical contractor associations such as AKLI (Asosiasi Kontraktor Listrik dan Mekanikal Indonesia), AKLINDO (Asosiasi Kontraktor Ketenagalistrikan Indonesia), APKOMATEK (Asosiasi Perusahaan Kontraktor Mekanikal dan Elektrikal Indonesia, and others provide the training for their members and are associated with specific LSK-K to issue the certificates to their members.

A certification institution can be both LSPs and LSK-K in order to provide services for various sectors including electricity. One such institution that could be of specific interest is PPSDM-EBTKE (Pusat Pelatihan Sumber Daya Manusia) under MEMR's BPSDM (Badan Pengembangan Sumber Daya Manusia). BPSDM is also setting up their own polytechnic specifically for renewable energy technologies in Bali.

Geographical challenges

Indonesia's labour market in the electricity sector is further complicated by lack of availability of skilled workers outside of Java. Many of the training institutions relevant to Indonesia's labour market needs are cantered in Java with very limited availability in Makassar, Manado, Kupang, Ambon and Jayapura.

In many cases, previous interviews by Inovasi and Sinergi of the private sector IPPs as well as PLN indicate that lack of availability of local skilled workers is a hindrance to developing projects. In practices, many Javanese skilled workers are needed to be sent outside of Java during the various phases of a project implementation. Starting from construction, commissioning/inspection, operation, and repair/maintenance, many Javanese workers are sent to the project location. As a result, they request substantially higher salaries as a compensation for leaving their friends and family. This directly affects the cost/benefit analysis and financial performance of the projects in more remote areas.

Experiences by Inovasi and Sinergi's staff on training and capacity development indicate that it is not enough to have training institutions available locally, but also incentives for the locals to stay. In the past, short course trainings performed by Inovasi on behalf of various donor agencies were only effective when there is follow up and collaboration with PLN and/or private sector who hired the trainees.

As an example, Inovasi trained batches of trainees in West Nusa Tenggara to become utility scale solar PV installers and operators. The content was designed to be demand-driven based on the tasks required by the occupations being trained. Furthermore, specific private sector companies were involved during the project and as a result more than 90% of the trainees passed the competence test at the end of the training and most of them were hired by both PLN and the private sector companies as installers and operators of utility scale solar PV systems.

What's needed to ensure Indonesia's geographical challenges of providing competent labour force are demand-driven competency-based curriculum in formalized educational system of the schools (Polytechnics especially) and short courses for upskilling and mid-career training for those already in the job. Only then can the trainings be effective to provide local competent skilled workers who will stay because there are enough lucrative jobs in the area.

Available training institutions

As mentioned above, there are 15 polytechnic schools across Indonesia who have a working collaboration with PLN that their D3 graduates will be hired by PLN if they meet PLN's requirements. For D4 graduates, PLN has the same arrangement with only 5 polytechnic schools. This is despite that there are almost 400

polytechnics across Indonesia providing curriculum and study program directly related to electricity and energy from civil, electrical, mechanical, and energy faculties. 23 polytechnics provide specific study programs on energy such as energy conversion and power plants. (source: https://rekrutmen.pln.co.id/)

At the vocational secondary education level, there over 895 SMKs across Indonesia providing training programs that are specifically electrical and renewable energy related. Through previous interviews and site visits, Inovasi's team members have identified that at the SMK level, there is an urgent need to provide teachers who are competent and have industry experience and knowledge.

There are also occupational certification institutions (LSPs) providing official certifications from National Occupational Certification Agency (BNSP) for short courses. Currently 75 companies have programs specifically aimed at the electricity labour market. This include transmission and distribution line operators, power plant operators, control systems, and installation planning among many others. Some of them are open to the public, and others are open only to the association members that the LSPs were developed under.

Another type of training institution is the private sector driven without endorsed BNSP certification. One recent example is TUV certification on Solar PV Designer training sponsored by the Indonesian Association of Solar Energy. Schneider Electric, REC Solar are examples of manufacturers who are providing trainings related to their products. Schneider Electric is interested in developing capacity of technicians who are not only familiar with their products but also able to troubleshoot and repair their equipment.

Government institutions also provide short course trainings on various topics related to electricity. Human Resource Development Agency for Renewable Energy for New and Renewable Energy and Energy Conservation (PPSDM KEBTKE) have provided various trainings on electricity related topics. They are also registered as an LSP and LSK-K so they're able to issue BNSP endorsed certificates on many topics. Other government institutions include Center for Training and Education, Agency for the Assessment and Application of Technology (Pusdiklat BPPT), Ministry of Labour of Republic Indonesia in cooperation with various local organizations, Ministry of Education and Culture in cooperation with Schneider Electric Foundation, and others.

Academic institutions such as SMKs, Polytechnics and Universities may also provide short course trainings to the public. These are useful for upskilling and mid-career development of those who are already working in the industry. Typically the short course trainings are done in conjunction with another certifying agency (such as LSPs, LSK-K, or others). The academic institutions serve as the training centres while the certifying agencies provide the assessors and the certification. Additionally, within the BNSP scheme, academic institutions are typically already LSP Type 1 accredited by BNSP to provide certifications to those it has trained. Therefore, they're also able to provide the trainings and certify the training participants for certification schemes accredited by BNSP.

BLK, the Ministry of Manpower's regional vocational training centres are also good potential training institutions to work with. They are funded by the MoM to provide training for free and increase the labour force skills. Many of them have close collaboration with the industry and private sector companies where the companies provide the requirements for the competencies of the participants and often even the equipment and training materials. According to the Ministry of Manpower, there are 284 BLKs funded through the provincial and district government's budget and 19 through central government's Ministry of Manpower budget. Toyota, Nissan and Mistubishi are examples of such companies who have collaborations with MoM's BLKs.

SMK Renewable Energy Curriculum

According to MoEC, one academic year consists of between 34 to 38 effective weeks. Within each week, there are 48 academic classroom hours. This means that there are 1,632 to 1,824 academic hours per year and for the duration of the 3-year education, the students will have attended 4,896 to 5,472 academic hours. In 2018, MoEC issued two competency lists for new expertise programs (program keahlian) in SMKs. They are for biomass and solar/hydro/wind competencies.

For the solar/hydro/wind, a total of 2,922 academic hours are listed in the required competencies for this expertise program, not including other classes such as language, mathematics, and others. From 2,922 academic hours, there are 1,7143academic hours that are specific to renewable energy topics. Others include physics, chemistry, technical drawing, each at 108 to 144 hours. This means that from 5.472 maximum academic hours, only 35% are dedicated to renewable energy related topics (including basic renewable energy) at the expense of basic knowledge at a high school level of physics, chemistry, mathematics and others. It can also be argued that a thorough understanding other basic topics such as technical drawings are far more useful for an SMK graduate than specific knowledge of how to operate solar/hydro/wind power plant. Each of the technologies are taught as a small percentage of the total academic hours required for graduation. There is not enough time allocated for each technology to allow an understanding of each technology beyond the graduates being able to follow directions. As an example, for the hydro subject matter there are 61 competencies that must be taught leaving an average of 9.8 academic hours of instructions per competence (equivalent to 7.3 hours @ 60 minutes).

Fundamentals of Renewable Energy	216 hours	3.9% from total
Solar PV	490 hours	8.9% from total
Wind	420 hours	7.7% from total
Hydro	596 hours	10.9% from total
Hybrid	208 hours	3.8% from total
Required Graduating Hours	5,472 hours	

For the biomass, a total of 3,031 academic hours are listed in the required competencies for this expertise program. From this, specific to bio energy topics are allocated 1,714 academic hours. Others include physics, chemistry, technical drawing, each at 108 to 144 hours. Similarly, each of the specific topics/technologies of bio energy is not sufficiently taught to allow the graduates to have adequate understanding beyond following directions. Biomass subject matter as an example require 50 competencies to be taught. This leaves an average of 7.68 academic hours of instructions per competence (equivalent to 5.8 hours @ 60 minutes).

Fundamentals of Renewable Energy	216 hours	3.9% from total
Biogas technology	490 hours	8.9% from total
Biofuels	456 hours	8.3%from total
Gasification technology	384 hours	7.0% from total
Biomass technology	384 hours	7.0% from total
Required Graduating Hours	5,472 hours	

According to the labour market survey form that was distributed by the project, most participants do not employ SMK level graduates. D4/S1 and D2/D3 graduates are overwhelmingly desired for various occupations within the renewable energy sector. It is expected that SMK graduate employees are to be trained internally by their supervisors or within the company's upskilling programs. The trainers for such programs are typically D4/S1 graduates or higher with specific knowledge and training in their subsector.

Developing the curriculum for SMKs is one thing, but developing the teachers for the curriculum is a much more demanding process for sustainability. It has been proven through many existing ToT programs in Indonesia, SE Asia and globally that without a sustained motivation, the trainers do not continue with the program. In Indonesia specifically, ToT programs have been developed and implemented by USAID funded ICED (Indonesia Clean Energy Development) program, various GIZ programs (EnDev Indonesia, LCORE, ELREN), and various others. Very few if any of the programs and the materials taught have survived beyond the duration of the program. Some success stories exist such as Sinergi assistance to University of Mataram and SMKN 1 Kuripang in Lombok. They both are still using the equipment purchased by the program and even developed new curriculum and program studies. The technical assistance and the equipment purchase at the beginning accelerated their renewable energy training program. The common thread in

both of the success stories are the specific people within each institution that became champions of the program and are in a position to make decisions.

Developing a training program that addresses these issues in a systemic change has to start from the D4/S1 graduates. They are at the middle of the ecosystem and act as a bridge between the SMK level education system, SMK graduates hired by the companies, and able to be trainers/instructors as well as upgrade their own skills and knowledge. Having a solid D4/S1 graduate or the labour market equivalent that possess the relevant skills and knowledge in the renewable energy is key to grow the SMK level graduates who are likely to become system operators. It is also key to develop a labour market for the private sector and government that can learn and grow into the specific skills and knowledge their occupations require.

There is an argument that building the labour market pyramid by focusing on the bottom level where there is the largest number of employees is a better strategy. This may be true for sectors that already have a mature ecosystem including the availability of skilled labours and training institutions to produce the labour force. For Indonesia's renewable energy sector, however, building only the capacity of the operators as semi-skilled labour is only a short term solution to address the immediate need. Without a solid mid-level skilled labour force available as instructors, trainers, and mentors, the supply will quickly outstrip the demand for the operators. Without a skilled labour force capable of developing new projects and creating an environment where the renewable energy industry is thriving, the need for semi-skilled operators will grow too slowly.

Complementary Services

An online platform for renewable energy information already exists in Indonesia, currently managed by MEMR's DGNREEC. The platform was developed through grants from DANIDA and the Danish government. Lintas EBTKE was developed as an information and investment service platform for Indonesia's clean energy sector. It has links and information about renewable energy policies and regulations as well as a list of companies providing services and several feasibility studies of projects.

Since this platform already exists and managed by MEMR, it is important to build upon this platform and improve it through SECO's RESD program component 3. Additional resources can be deployed to improve its image and to have the resources required to collect and publish relevant information about renewable energy in Indonesia. A searchable database of training institutions, academic institutions, certifications available can be developed to enable those seeking academic degrees or upskilling trainings to easily find them. Availability of labour force across Indonesia's provinces can be mapped out and the trained individuals can be listed based on their certifications, skills, knowledge and experiences.

International examples of such www.americansolarworkforce.org can be used as a template and to learn from its best practices on developing such a platform. Another option would be to pair up with other organizations such as International Renewable Energy Agency and synergize the Lintas EBTKE platform with various IRENA's platforms (http://marketplace.irena.org/).

For an annual conference, there is already an existing renewable energy conference with MEMR's DGNREEC lending its name to the conference called EBTKE Connex (http://www.indoebtkeconex.com). It is managed by METI in full and it is a combination of a conference, exhibition, and workshops. It is aimed at renewable energy in general and does not focus on capacity development or labour market. One of the easiest ways to achieve this part of component 3 is to add a labour market focused component to the event. However, it is more impactful to work with MEMR's bureau of information and develop a new annual conference focused on capacity development and labour market in the renewable energy sector. This will allow the Swiss government through SECO to have a more prominent role and credibility and be able to ensure Swiss companies and institutions have an opportunity to participate.

Annex 7: Potential partners for Project Agreement and Steering Committee

Potential Partner and role in RESD	Pro	Cons
MoEMR (ESDM): The Ministry for Energy and Mineral Resources is the line ministry responsible for the planning of the future energy supply in the country. It is setting policies and has one departments directly involved in the development of RE, the EBTKE. Responsibility for training in the sector covered by MoEMR is the Human Resource Development Department (BPSDM), which is planning to establish a new Polytechnic for RE in Bali. The MoEMR already runs four Polytechnics providing education in energy provision and distribution. **RESD role:** The FS is considering the MoEMR as the most potential main partner for a RESD project. The MoEMR would be most suitable to sign the project agreement, where as its departments (EBTKE and BPSDM and even PPSDM institute) would be knowledgeable partners at implementation level.	• Line-ministry which creates the environment for the RE market • Improve RE market share in energy market is clear policy of MoEMR • Most knowledgeable and motivated staff at national level • EBTKE department is involved in standard setting and certification level definition • BPSDM is planning RE Poly in Bali • PPSDM is LSP and LSK and provides short term training • MoEMR is regulator of energy market and therefore has influence on tariffs and monopoly settings of PLN • Clear aspiration to be in the lead in all concerning energy (including training)	• Current minister is seen as rather weak (it is expected that he is changed soon) • RE Poly Bali seems to have sparked land dispute • Programs (curricula structures) for RE Poly Bali seem already go into a wrong direction (needs to be further clarified in second mission) • Little experience in cooperating with the private sector • No training facilities in eastern Indonesia
MoRTHE (RISTEKDIKTI): One Directorate within the Ministry is regulating and guiding tertiary education in Indonesia. In addition it is the superior institutions to the existing Polytechnics in Manado, Makassar and Kupang and is also providing their budgets. Accreditation and quality control for higher education is provided by (Badan Akreditasi Nasional Pendidikan Tinggi – BAN-PT) which is formally an independent institutions but in fact heavily influenced by RISTEKDIKTI. **RESD role:** The FS is considering MoRTHE an important institution and potential SC partner for the RESD project.	• DIKTI is in-line superior of some potential implementation partners (Polys) • DIKTI has cooperation projects that could finance laboratory equipment • Accreditation of D3 and D4 level programs are depending on DIKTI regulations and approval • Clarification of DIKTI position and their consent will be important for implementation with Polytechnics • The cooperation with a potential Swiss project will improve DIKTI reputation and support their revitalisation program • The revitalisation program of DIKTI could provide funding for DIKTI polytechnics	• Directorate of Higher Education (DIKTI) has a mixed performance track record when it comes to TVET • Some Poly do have very good equipment for RE training, but teachers are not trained • RE is listed as program study D4

BNSP: The National Professional Certification Agency (BNSP) is an independent, professional institution whose mission is to develop, monitor and evaluate the implementation of national education standards. It is supported by and works in coordination with the Kemdikbud. The KKNI system has been introduced by BNSP to ensure the quality of competencies and the recognition of workers in all sectors through a process of certification of work competencies for workers, both from formal training and work experience. **RESD role:** The FS sees BNSP as a valuable member for the Steering Committee. With its participation the SC has required expertise for efforts in certification harmonisation.	• Lead agency in the implementation of the IQF (KKNI) standardisation and certification scheme • Understanding of the different certification schemes in Indonesia • Interested in defining qualification levels above IQF level 5 • Experience in cooperation with private sector • Agency to certify assessors and LSPs (certifying entities)	• The certification system (KKNI) set in place a few years ago seems not be uniform and differs from sector to sector • Reputation of the KKNI system in the private sector is at a low level • KKNI system is seen as an easy income source
Selected Private Sector Representatives: The private sector is best aware of needs and requirements in the RE labour market. To steer a future project it is of high value to have the private sector bringing in the knowledge of the market and required labour market information. Further, it will help to develop ownership and relevance of the project. The FS recommends to invite one representative of int. companies operating in Indonesia and one larger Indonesian company.	• Relevance of programs • Labour market knowledge • Ownership and recognition	• Business interest • Selection of representative might spark controversy
Selected Development Partners: The FS conducted a meeting with different development partners. The NZ government is supporting the development of the RE market from geothermal power, and GIZ has developed some short term trainings and supported the quality improvements at PLN training units. The FS recommends to invite the NZ government, KfW and GIZ to participate in the SC as guests.	• Better donor cooperation and coordination • Knowledge and experience sharing among projects • Fostering of SECO position in the RE sector	• Selection of representative might spark controversy

Annex 8: Donors and Projects in VET and the RE sector in Indonesia

Donor	Projects involved	Local Partners	Target Groups	Description / Objective	Duration / Budget	Cooperation / Potential Synergies
USA / MCC	MCA - Indonesia	BAPPENAS, MOEC, MEMR	Pro-poor via grants to EPCs and organizations developing remote RE infrastructure	US-Indonesia Partnerships to Promote Economic Growth, Better Health, Strengthened Government Services, Renewable Energy for Indonesians in NTB A second contract between USA-Indonesia is upcoming, will prioritize RE again.	2015 - 2018 (compact I) / 650m US$	Coordination, exchange of experience /
USAID	The Indonesia Clean Energy Development II (ICED II)	MEMR BAPPENAS MoF PLN	Policy makers PLN staff Regional government private sector	ICED II works with national and regional government agencies, the national utility (PLN), private sector project developers and suppliers, banks and financial institutions, and other stakeholders in opening the market for renewable energy projects and technologies in Indonesia.	2016-2020	Exchange of experience, coordination
SECO	S4C	MoI, DIKTI	4 Polytechnics in metal and wood sector	Development of sector specific programs relevant to the labour market needs and promotion of cooperation with the private sector	2018 – 2026 (first phase until 2021) CHF 31m (including partner contributions)	Coordination, exchange of experience / DACUM
SECO	STED	MoT, DIKTI	Poltekpar Lombok	Support the development of relevant training programs at D3 level and establish cooperation with the private sector	2018 -2022 (first phase) CHF 3.9m	Coordination, exchange of experience / DACUM
	PIDG			Focus on RE, PPP in RE	4m US$	Identification of private sector players, labour market studies
KfW	1000 island REEP	GoI, PLN	Villages	Electrification of villages by using RE. 93 remote mini grid with solar-battery hybrid systems should be tendered installed and operated. By the end of 2019 the first batch of 23 systems should be tendered.	Since 2015 65m €	Identification of target areas, synchronising support to PLN / Targeted training for specific regions in Indonesia, labour market studies / OjT, internships, NTT region

GIZ	LCORE-INDO	Directorate General of New, Renewable Energy and Energy Conservation (EBTKE)	EBTKE	The DG-NREEC is strengthened. Economic solutions are developed and tested in order to replace fossil fuels with renewables. Efficient technologies are being introduced as a result of partnerships with German companies.	2012 to 2017/2018	Exchange, coordination GIZ is working on a follow-up project, the so-called ExploRE
GIZ	TVET System Reform (TSR)	Coordinating Ministry for Economic Affairs	Private sector and SMK level schools	Relevant private and public actors at national level have implemented key elements of the Indonesian government's reform agenda on technical and vocational education and training.	2018 to 2021	Exchange, coordination in case SMK level is included in project
GIZ	Electrification through Renewable Energy (ELREN)	Directorate General of New, Renewable Energy and Energy Conservation (EBTKE)	GoI institutions	Knowledge on off-grid electrification using renewable energy is institutionalised in Indonesia.	2017 to 2019	Coordination, learning
GIZ	1,000 Islands – Renewable Energy for Electrification Programme (REEP)	EBTKE of MoEMR	PLN & EBTKE	Selection of two typical island grids with good replication potential to demonstrate 23 percent of renewable energy integration into the State Electricity Company (PLN) grids. REEP will install a monitoring system to prove the technological and economic feasibility of the renewable energy grid integration in these two grids.	2017 to 2020	Exchange, coordination, addressing of same beneficiaries. Synergies in joint and complementing activities. tjut.devi@giz.de
GIZ	ASEAN-German energy programme (AGEP)	ASEAN Centre for Energy (ACE)	ACE, GoI institutions	Preparing recommendations for action. Improving the regional exchange of expertise. Strengthening the ASEAN Centre for Energy (ACE).	2016 to 2019	Coordination, exchange
ADB	Polytechnic Project	DIKTI	Existing Polytechnics	Infrastructure and equipment improvement	100m US$	Coordination, lab-equipment to Poly Makassar and Jakarta

CIDA				The Canadian government is about to establish a new program in the sector. However, details are not yet clear.		
UK	GLOBAL SKILLS PROGRAMME		Brazil, Egypt, Indonesia, Kenya, Malaysia, Mexico, Nigeria, Philippines, South Africa, Indonesia	UK is supporting Indonesia in enhancing TVET policy, regulations and practices in the maritime sector to improve employment opportunities	2019-2023 £75m	Study results: https://www.britishcouncil.org/sites/default/files/the_role_of_tvet_governance_at_sub-national_levels_-_june_2017.pdf
USAID				USAID is about to establish a bigger facility of USD 50 million to assist vocational, business and/or life skills training, targeting to reach 200'000 vulnerable and poor through a variety of projects.	50m US$	
WB	Research and Innovation in Science and Technology Project P121842	Ministry of Finance;Ministry of Research Technology and Higher Education	Indonesia	The development objectives are: to create an enabling policy environment for research and development in science and technology, to improve the public services.	2013 - ?? 95m US$	Experience with Masters and graduates receiving jobs and have their skills aligned with the industry requirements
WB	ID-Geothermal Energy Upstream Development	MINISTRY OF FINANCE PT Sarana Multi Infrastruktur (Persero);	Indonesia	The development objective of Geothermal Energy Upstream Development Project for Indonesia is to facilitate investment in geothermal power generation and reduce greenhouse gas emissions.	2017 -2020 98m US$	Capacity development experiences
Australia	Applications Open for the 2019 Renewable Energy Technologies in Eastern Indonesia	N/A	Indonesia	This short course aims to support the Indonesian government's plan to ensure that at least 23 percent of Indonesia's electricity comes from renewable sources in 2025, and is designed for 25 representatives from private companies, BUMN/D or NGOs that are engaged in renewable energy in Eastern Indonesia.	2019	Experience sharing about the participants of the energy short term award participants https://www.australiaawardsindonesia.org/content/61/13/current-short-term-awards?sub=true

JICA	Program for Enhancing Quality of Junior secondary Education (Pelita SMP/MTs)	Ministry of National Education (MONE), Ministry of Religious Affairs (MORA)	Jakarta, Banten Province, West Java Province, Yogyakarta, Province, East Java Province, West Sumatra Province, South Kalimantan Province, North Sulawesi Province	Quality of junior secondary education is enhanced through participatory school-based management (PSBM) and Lesson Study (LS) extensively in the nation.	2010-2013	Some exchange, perhaps experience with the ministries. https://www.jica.go.jp/project/english/indonesia/0800042/index.html
New Zealand	NZMates https://www.nzmates.org/	PLN, ESDM, national and international EPCs	Seram and surrounding islands	NZMATES's goal is to increase the uptake of affordable, reliable, and renewable energy to improve social well-being and economic development on Seram and surrounding islands, Maluku Province, Indonesia. NZMATES will partner and collabourate closely with State Electricity Company (PLN) and the Ministry of Energy and Minerals (ESDM) Directorate General for New Renewable Energy and Energy Conservation (EBTKE) to increase the use of renewables and improve energy access.	2019 - 2023, 5-year program, budget not available	Coordination, exchange. Valuable to know their considerations for training/capacity building for the new and renovated RE sites
Korea	Korea International Cooperation Agency https://www.koica.go.kr/koica_en/index.do#n	MEMR	Indonesia in general	Improve universal access to modern energy Respond to climate change by Increasing the renewable energy Improve energy efficiency and power quality through technological cooperation	Ongoing program	Coordination, exchange. Experiences in finding experts and training needs for renewable energy
UNDP	MTRE3 https://dev.mtre3.id/about.php?lang=en	MEMR	Jambi Riau East Nusa Tenggara West Sulawesi	Removing the Barriers to the Widespread Application of Renewable Energy and Energy Efficiency in the Indonesia	Ongoing program	Coordination, exchange

ASEAN Centre for Energy	ASEAN Renewable Energy Support Programme (ASEAN-RESP)	MEMR	Indonesia	"the relevant stakeholders in ASEAN region use the regional and technical policy exchange to improve the framework conditions for renewable energies"	Ongoing program	Experience with policy
Green Climate Fund / Ministry of Finance	Direct Access Entity Climate Change Related Programs	Ministry of Finance	Country-wide	The GCF supports countries such as Indonesia on a paradigm shift towards a low-emission and climate-resilient development.	Currently at RFP stage, 4-5 year timeline	Exchange of experience -- GCF/MoF may provide value as they outline their targets for this fund relating to developing RE in Indonesia
World Bank	Indonesia Sustainable Least Cost Electrification Program	PLN	Eastern Indonesia region	support Indonesia to leverage private sector investments and expertise while developing renewable energy, increase access to modern energy services and support its energy transition. The proposed TA plans to support PLN in targeting specific investments in grid dispatch and transmission upgrades that are crucial to integrate VRE generation, and in developing business models that would leverage private sector investments for generation	2019-2020 US$700k	Exchange of experience when WB brought in trainers for specific grid planning and interconnection analysis (PLEXOS) for PLN staff to learn from.

Annex 9: Potential Swiss Partner-Institutions

The below listing identifies Swiss TVET institutions having renewable energy programs in their portfolio:

Fachhochschule Nordwestschweiz FHNW Hochschule für Technik Steinackerstr. 5 5210 Windisch Tel.: 056 462 44 11 URL: http://www.fhnw.ch/technik/eut E-Mail: info.technik@fhnw.ch	HSR Hochschule für Technik Rapperswil Oberseestr. 10 Postfach 1475 8640 Rapperswil SG Tel.: +41 55 222 41 11 URL: http://www.hsr.ch E-Mail: office@hsr.ch
ZHAW Zürcher Hochschule für Angewandte Wissenschaften School of Engineering Technikumstr. 9, Postfach 8401 Winterthur Tel.: +41 58 934 45 49 URL: http://www.zhaw.ch/engineering E-Mail: info.engineering@zhaw.ch	NTB Interstaatliche Hochschule für Technik Buchs NTB Campus Buchs Werdenbergstrasse 4 9471 Buchs SCHWEIZ Tel. +41 81 755 33 11 Direct : +41 81 755 34 26 daniel.gstoehl@ntb.ch
Fachhochschule Westschweiz HES-SO Rektorat Route de Moutier 14 2800 - Delémont T +41 58 900 00 00 - F +41 58 900 00 01 info@hes-so.ch	
HBU Höhere Berufsbildung Uster Berufsschulstr. 1 8610 Uster Tel.: +41 44 943 64 22 URL: http://www.hbu.ch E-Mail: **info@hbu.ch**	**sfb Bildungszentrum** Bernstr. 394 8953 Dietikon Tel.: +41 848 80 00 84 URL: http://www.sfb.ch E-Mail: **info@sfb.ch**
ABB Technikerschule Wiesenstrasse 26 5400 Baden Tel.: 058 585 33 02 URL: http://www.abbts.ch E-Mail: **info@abbts.ch**	**TEKO Schweizerische Fachschule** Pilatusstr. 38 6003 Luzern Tel.: +41 41 210 77 56 URL: http://www.teko.ch E-Mail: **luzern@teko.ch**
ZbW Zentrum für berufliche Weiterbildung Gaiserwaldstr. 6 9015 St. Gallen Tel.: +41 71 313 40 40 URL: http://www.zbw.ch E-Mail: **info@zbw.ch**	**Bildungszentrum für Technik Frauenfeld (BZTF)** Kurzenerchingerstrasse 8 8500 Frauenfeld Tel.: +41 58 345 65 00 URL: http://www.bztf.ch E-Mail: **info@bztf.ch**

HES/FHS Valais (Sion): Institute of sustainable energy: The activities of the Institute of Sustainable Energy include the production, management, and storage of renewable energies, the management of multi-energy grids, and electric mobility. All addressed issues and developed solutions include a strong assessment of their environmental impact.	**Prof. Stéphane Genoud** stephane.genoud@hevs.ch https://www.hevs.ch/en/rad-institutes/institute-of-sustainable-energy/ diplôme d'ingénieur HES, licence en économie, plusieurs masters (finance Université de Genève et énergie EPFL)
EPFL: The Mission of the Energy centre (CEN) is to catalyse energy research led by EPFL labouratories, notably in collabouration with industrial and institutional partners, and enhance EPFL's impact and image as a world leading research and education institution contributing to the transition towards a sustainable energy future.	**Daniel Favrat** daniel.favrat@epfl.ch https://cen.epfl.ch/about-us/our-team/ From August 2013 he works at EPFL Energy Center first as director ad interim and now as director technologies. His research fields include systemic analyses accounting for energy, environment and economics (so-called environomic optimisation) and advanced conversion systems for a more rational use of energy (heat pumps &ORC, engines, fuel cells, power plants, etc).
ZHAW: INE Institut für Nachhaltige Entwicklung: Das Institut für Nachhaltige Entwicklung erforscht den wirtschaftlichen, regulatorischen und sozialen Kontext von Energietechnologien und -systemen. Es identifiziert relevante Trends und schätzt die Entwicklung von Technologien und deren Akzeptanz ab. Die Faktoren und Prozesse, die das individuelle Konsum- und Investitionsverhalten von Energienachfragern und -anbietern treiben, werden untersucht und Möglichkeiten zur zielgerichteten Beeinflussung dieses Verhaltens entwickelt.	**Prof. Dr. Bettina Furrer** bettina.furrer@zhaw.ch https://www.zhaw.ch/storage/hochschule/forschung/dossier_energie/energiebroschuere-forschen-fuer-die-energiewende.pdf
WSL Energie und Landschaft: Die Energiestrategie 2050 des Bundes sieht den Ausstieg aus der Atomenergie und mehr erneuerbare Energien vor. Dies wird sich sowohl auf die Umwelt als auch auf die Gesellschaft auswirken. Wir ermitteln mögliche Folgen für die Landschaft.	**Dr. Astrid Björnsen Gurung** astrid.bjoernsen@wsl https://www.wsl.ch/de/landschaft/energie-und-landschaft.html Energiewende, Strategie- und Projektentwicklung, Wissens- und Informationsmanagement, Wissens- und Technologietransfer
Hydro-exploitation SA (Sion) HYDRO Exploitation est un prestataire de services de premier plan en Suisse dans l'exploitation et la maintenance des aménagements électriques. Specialiser en O&M dans l'hydro	**Alexandre Bircher (ou Elmar Kämpfer directeur)** 0041 (0)27 328 44 11 / info@hydro-exploitation.ch https://www.hydro-exploitation.ch/

Companies/Institutes:

https://www.swissolar.ch/

https://www.newenergyscout.com/company.html

https://www.bfe.admin.ch/bfe/de/home/versorgung/erneuerbare-energien.html

https://swissmallhydro.ch/de/

https://www.energieschweiz.ch/page/de-ch/kontakt

https://swisspower.ch/ueber-uns/swisspower-renewables-ag

https://www.swissolar.ch

https://www.swv.ch/fachinformationen/wasserkraft-schweiz/

https://www.bfe.admin.ch/bfe/de/home/versorgung/erneuerbare-energien/wasserkraft.html

Solar Alliance AG Hertistrasse 1 8304 Wallisellen	E-Mail. info@solaralliance.ch Tel. +41 44 830 40 50

Annex 10: Geographical Focus

Arguments supporting an engagement in eastern Indonesia:

1. The current Indonesian government is stressing the fact that eastern Indonesian development has been slow over the last decades and development support efforts in eastern Indonesia are welcomed.
2. The 1,000 Islands – Renewable Energy for Electrification Programme (REEP and KfW) – are focussing on eastern Indonesia and offers potential synergies in the locations proposed.
3. At all locations selected renewable energy plants are operated, ready to be operated or planned. Therefore skilled personnel will be needed to plan, build and operate RE plants.
4. In Makassar PLN has a training centre to train staff in RE technology.
5. Makassar – South Sulawesi is expanding renewable energy with large hydro power plant and wind power. Solar is also sought to be added in South Sulawesi grid which has extended to Central Sulawesi and South East Sulawesi provinces, and will be connect with the Northern Sulawesi grid. This will enable a lot of renewable energy to come into the grid. PLN renewable energy training centre along with the local polytechnics can be good partners in providing RE competent labour force.
6. Manado – Utility scale solar PV 1.5 hours away from Manado.
7. Kupang – There is a 5MWp solar PV, Poltek Kupang with a renewable energy department and GIZ has worked with stakeholders in Kupang that a future project can learn from.
8. The MoEMR has concrete plans to build a RE Poly in Bali.
9. Lombok – Sinergi has worked with SMKs and Polytechnic there and has provided occupationally training for utility scale solar PV companies and PLN. Many of the graduates were hired by private companies and PLN and could be good source of information. In addition four 5MW solar power plants are installed in Lombok. Lombok can be supported from Poly EBT Bali.

Below table is used to assess the suitability of the pre-selected locations.

Aspect	Manado	Makassar	Kupang	Lombok/Bali
RE market potential	Geothermal, solar and hydro plants in operation. Good market potential in hospitality sector, on islands, and for company and private use. Marketing is needed.	South Sulawesi is pioneering big scale RE with bid dams, and wind energy. There is also a market for small scale and roof-top installation, but marketing is needed.	NTT consist of hundreds of island ideal for solar (and partly wind) power generation. There are already about 10 companies mainly for small and roof-top solar installation.	High dependence on tourism market. There is a clear trend to become a green touch. High potential for solar in resorts and hotels, but also for the private (household) market.
Access to eastern Indonesia	North Molukas, Halmahera, Sangihe, north and central Sulawesi	The door to eastern Indonesia. Molukas, Papua, Banda Sea, South and Souh-East Sulawesi	East-Nusa Tenggara, Timor, Alor, Sumba, Rote, Flores	Bali, Lombok, West-Nusa Tenggara
SMK level schools with some engagement in RE	SMKN 1 KOTAMOBAGU SMKN 2 Manado and more	SMKN 3 MAKASSAR SMKN 2 KENDARI	SMKN 2 KUPANG SMKN 5 KUPANG SMK NEGERI 2 ENDE SMK NEGERI 2 SOE SMK NEGERI 1 SIKUR and more	SMKN 2 KURIPAN SMKN 1 SAKRA SMK NEGERI 1 SIKUR SMKN 1 TANJUNG SMKN 3 MATARAM and more
Polytechnic	Poltek Negri Manado - Highly motivated - Senior staff - Some equipment - Management support	Poltek Negri UPG - Highly motivated - Senior staff - Good equipment - Energy department	Poltek Negri Kupang - Motivated - Some equipment, but in bad shape	Poltek RE MoEMR, Bali - Depends on BPSDM - Will likely try to build leading position in Res sector

		- Management support	- Management support if DIKTI is not objecting - Supported by ELREN project of GIZ	- Has also to serve private market
University interest	-	UNHAS - Supported by ELREN project of GIZ	-	University of Materam
Prior Swiss involvement	ISPP II to IV	ISPP II to IV	ISPP II to IV	SUSTUR
PLN	Regional Office	RE training centre	NTT Office	Regional Offices

The FS concludes that all four locations would be suitable. During a potential project inception phase more in-depth negotiations need to be conducted with all polytechnics potentially participating in the RESD project (Makassar, Manado, Kupang, Jakarta and EBT Bali).

On request of RISTEKDIKTI the FS Team added the Polytechnic Negri Jakarta. The rationale behind the request is that the demonstration impact and publicity in Jakarta would be much higher than in eastern Indonesia, and that the project impact could be higher if a well renowned institutions, such as Poly Jakarta, would join the project.

In addition the FS Team would like to highlight the opportunities for trial in Jakarta and the strong cooperation track record Poly Jakarta has with Switzerland.

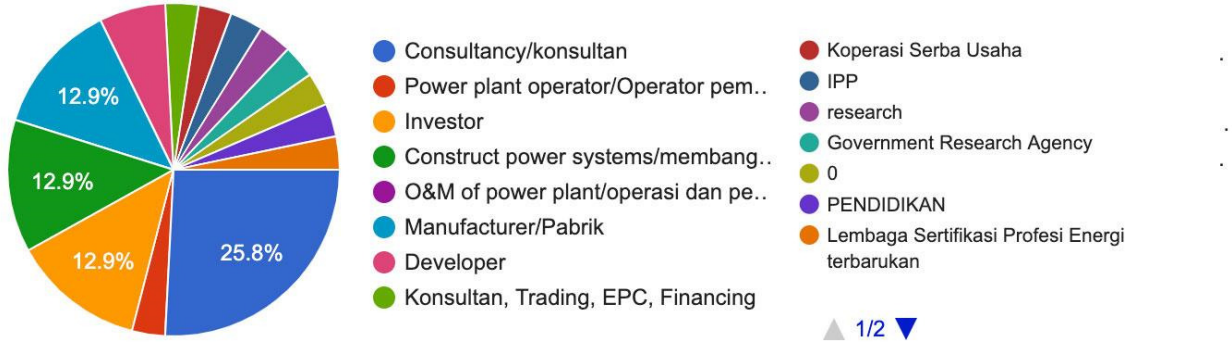
Annex 11: Labour Market Scan

This survey has been composed and launched by the FS Team. The survey has been conducted with the help of google survey. The request to fill in the survey form (with a direct link) has been sent to 350 WhatsApp and e-mail accounts. The form could be filled in using the mobile phone or the computer.

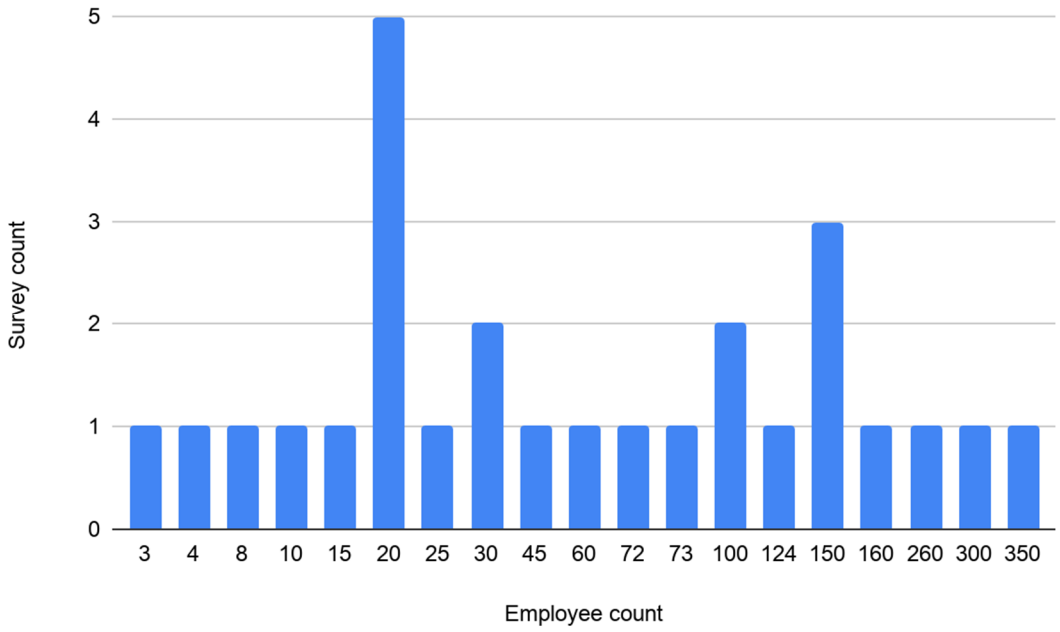
Between the 28th of August and the 30th of September 31 individuals filled-in the questionnaire.

1. Company Profiles

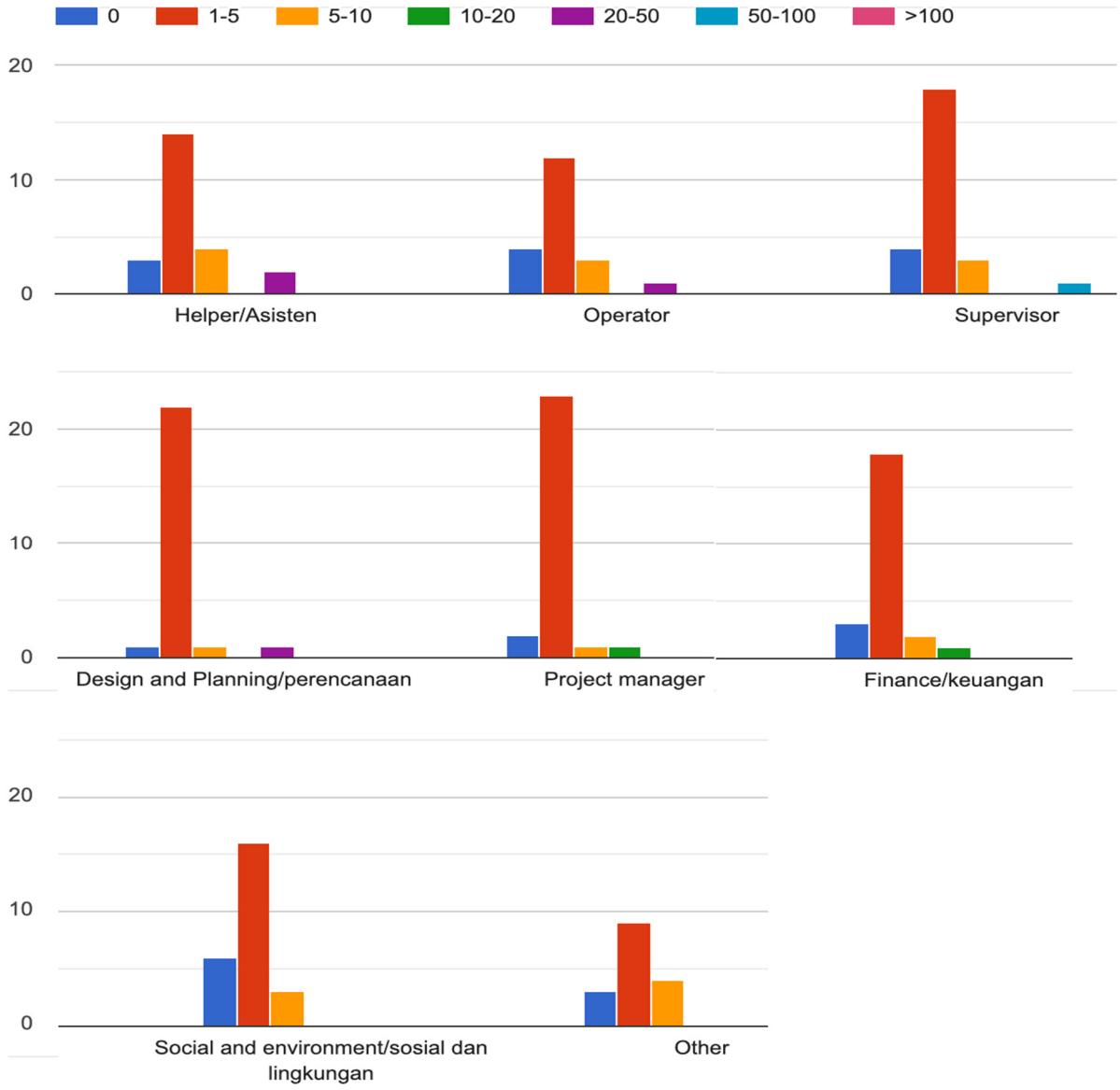
Respondent company type



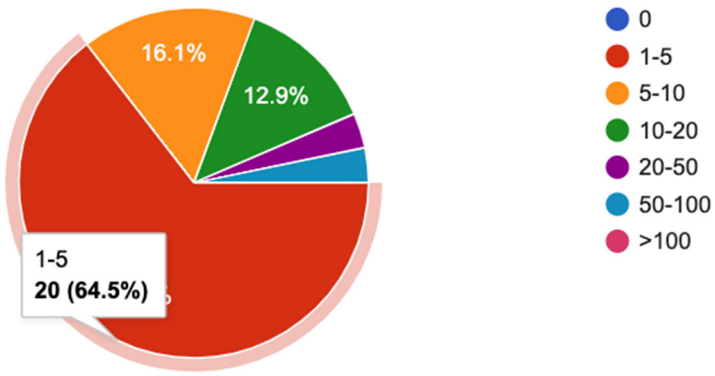
Number of employees in respondents' companies



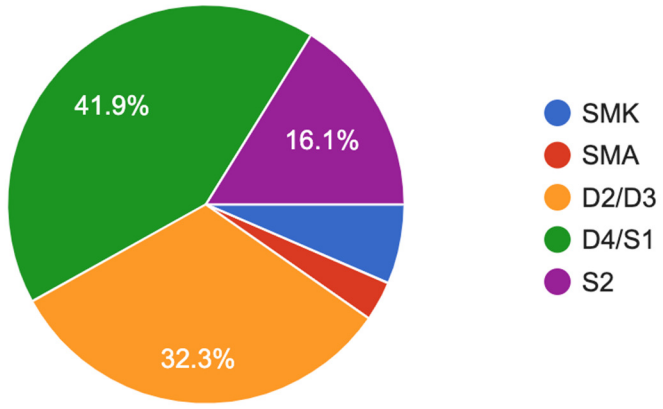
Number of employees in RE companies, by task



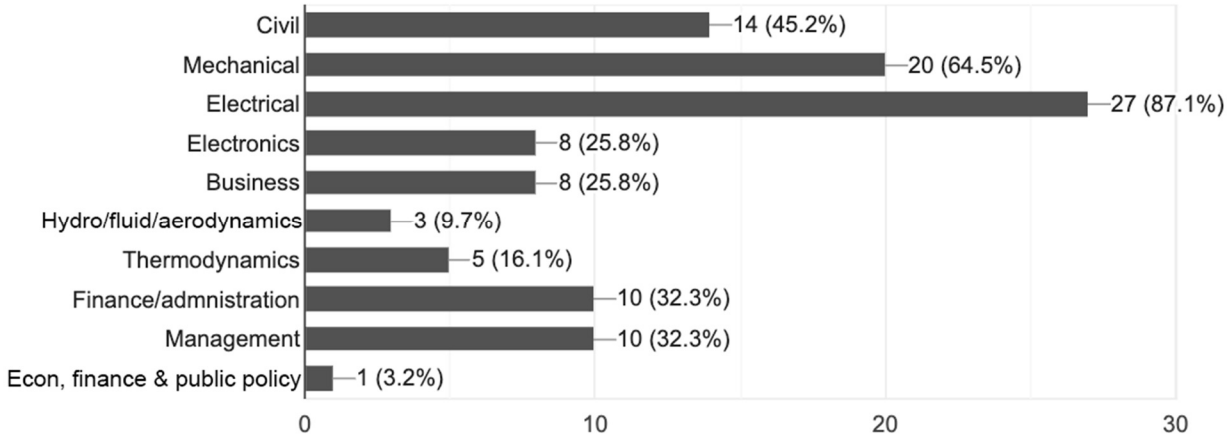
Yearly demand of personnel (additional or replacement) for RE-related jobs



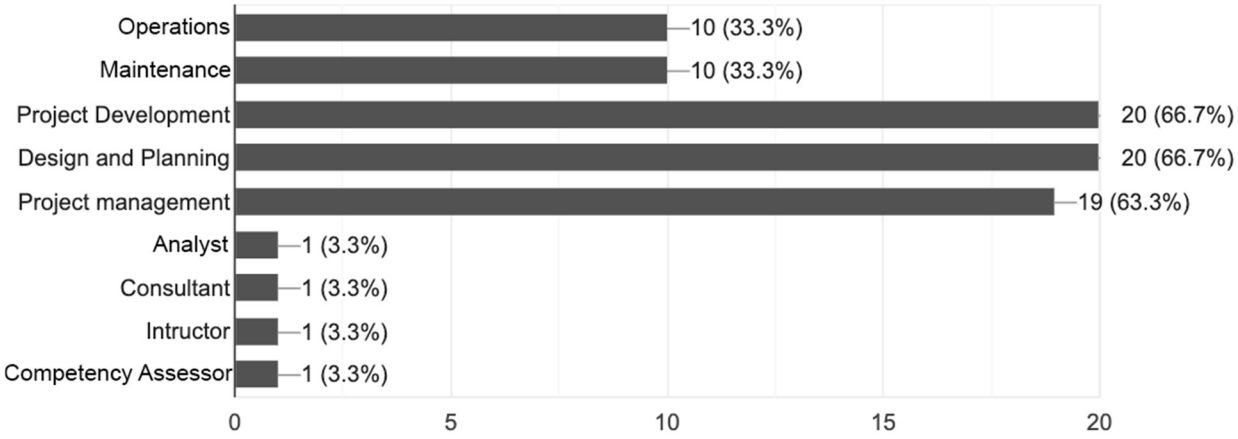
Desired level of education for new staff



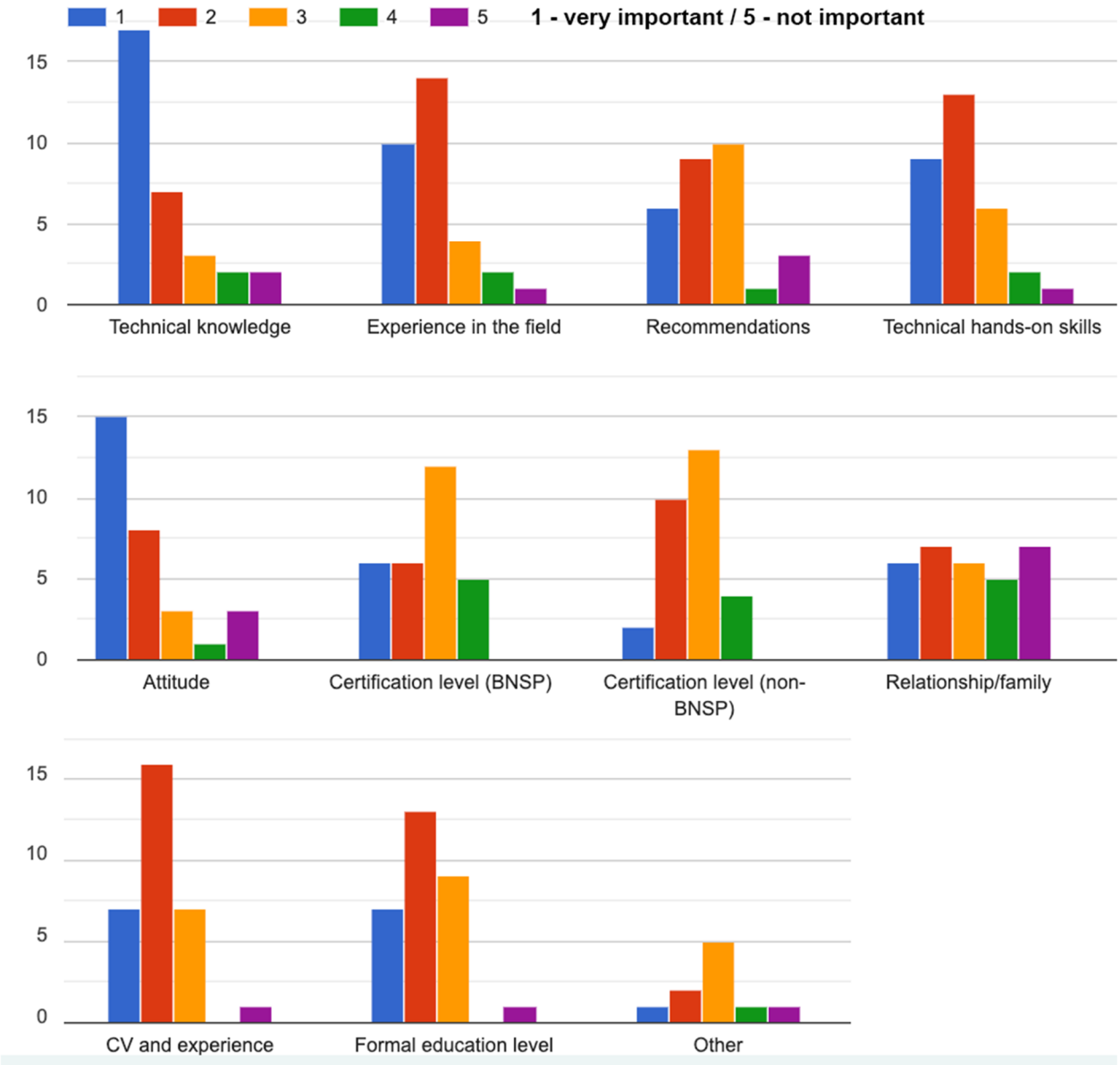
Desired educational background/technical training of new staff



Desired type of work for new hires

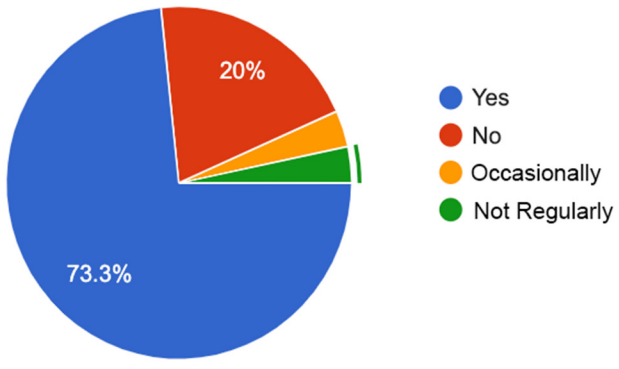


Most demanded characteristics/criteria when recruiting new staff

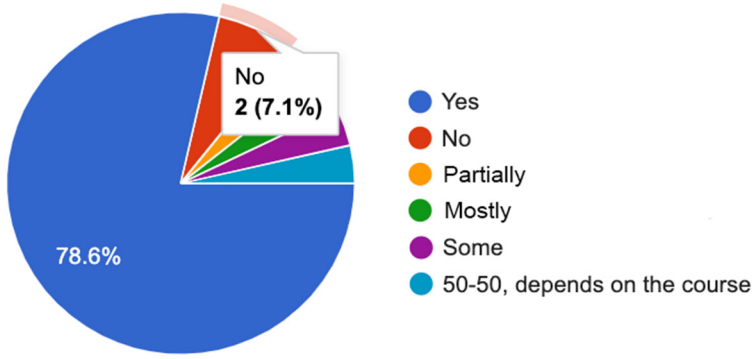


2. Current training practices

Do your employees join upskilling training on a regular basis?

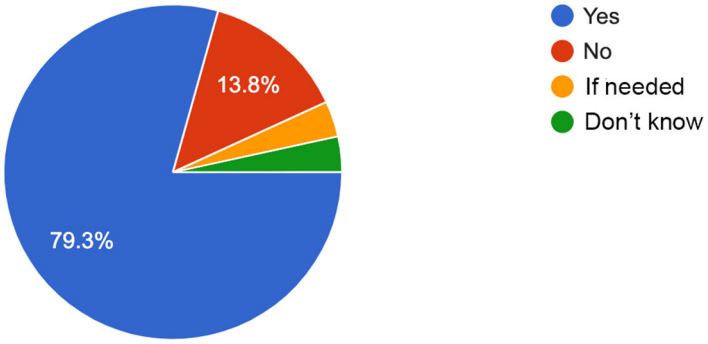


Did the training meet expectations and did the staff receive the knowledge and skills expected?

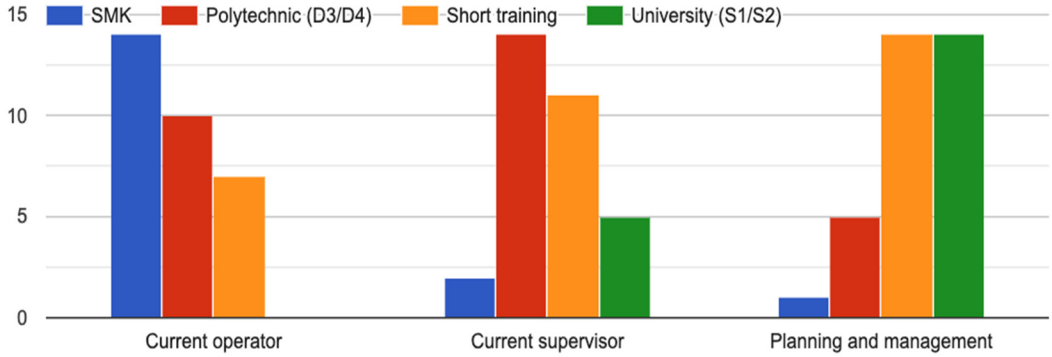


3. Internships and on-the-job training

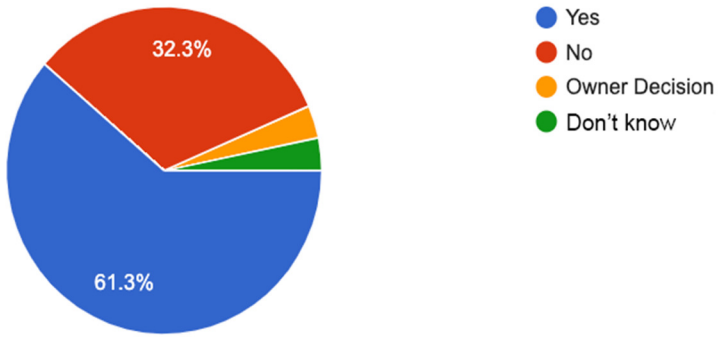
Is your company ready to support staff for upskilling or further schooling?



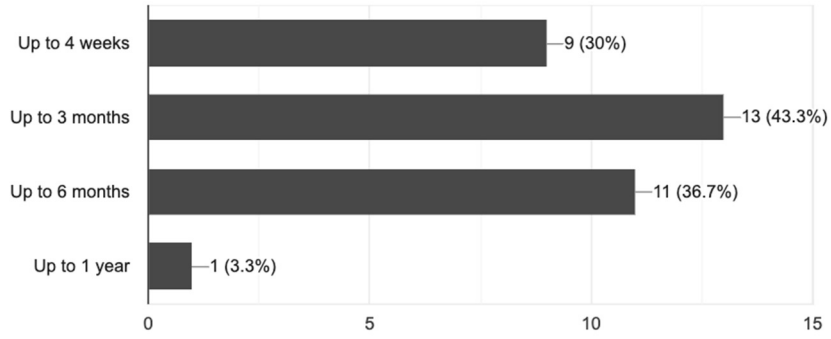
At what level does upgrading make the most sense in your opinion?



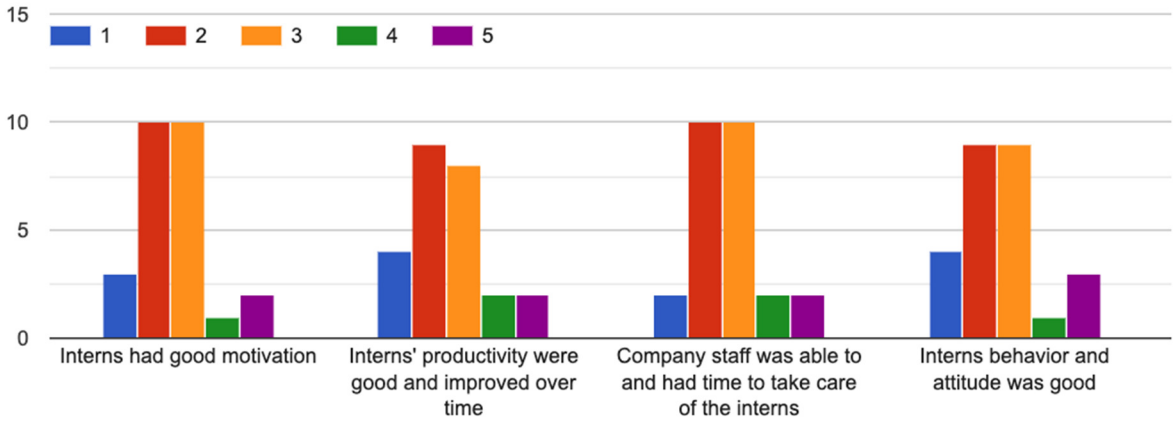
Is your company already involved in cooperation with training institutions?



Considering that interns become more productive over time, what length of internship would fit your company best?



What has been your experience with interns at your company?



Annex 12: *Shared LogFrame* Draft

Narrative	Indicator Swiss (project)	Indicator Indonesia (partner)	Gov. Partner
Project Goal Contribute to expanded access to electricity from renewable energy sources and ensure its reliability through competent designing, planning, installation, operation and maintenance	-	- RE sector is growing in % with respect to total electricity market	MoEMR EBTKE
		- Fossil fuel based and energy production impacting global warming is reducing in absolute numbers	MoEMR-EBTKE
		- Domestic and international investors find the required labour force on the Indonesian labour market	BPSDM
Outcome 1 Formal, multidisciplinary RE specialisation programs at D4 level are in place and produce labour market relevant graduates for the RE sector.	-	- At least three Polytechnics in eastern Indonesia are offering D4 "post graduate" studies for D3 graduates from different engineering background and enrol 30 trainees per program and year by 2023	Poly (DIKTI / MoEMR)
		- Number of graduates from D4 specialisation programs is increasing in accordance with RE sector growth	Poly
		- Curricula of offered D4 RE programs are regularly up-dated in cooperation with the private sector	Poly
		- 20% of lessons thought in the D4 programs are conducted by gust experts from private sector	Poly
		- The number of D3 graduates studying in multidisciplinary D4 "post graduate studies" has been increasing	RISTEKDIKTI
Output 1.1: Learning outcomes, structure and preconditions for a one year "post graduate" D4 program specialised in solar, solar hybrid and hydro RE production defined	- Detailed labour market assessment is conducted - DACUM workshop with private sector and Polys have been conducted for solar (including hybrid) and hydro - DACUM results are shared and discussed with the private sector and Polys	- Proposal for the inclusion of new RE D4 specialisation studies are prepared and submitted	Poly
		- D4 "studi lanjut" on solar (including hybrid) and hydro, for graduates from different engineering fields, have been included in the "Daftar Program Studi Perguruan Tinggi"	RISTEKDIKTI / MoEMR-BPSDM
Output 1.2: Road-map for the development, and clarifying of roles and responsibilities established and approved	- Draft road-map developed - Road-map discussed with main partners (Polys, BPSDM) - Final road-map presented to steering committee	- Legal and regulatory inputs to road-map provided (regulations, procedures)	Poly / BPSDM
		- Signature on final road-map proposal	Poly/ BPSDM

Narrative	Indicator Swiss (project)	Indicator Indonesia (partner)	Gov. Partner
Output 1.3: Curricula for at least two D4 specialisation programs developed and accredited	- DACUM workshop with private sector and Polys have been conducted for solar (including hybrid) and hydro - DACUM results are shared and discussed with the private sector and Polys - Curricula sharing WS with private sector organised and conducted and results followed-up defined	- Two draft D4 curricula on specialisation on solar (including hybrid systems) and hydro ready to be discussed	Poly / BPSDM
		- Curricula adjustments based on discussions with private sector done	Poly / BPSDM
		- Formal curricula accreditation process launched and followed-up	Poly / BPSDM
Output 1.4: Required equipment, testing procedures (testing facilities) and training for instructors/lecturers defined and available	- Listing and specification of required training equipment provided - Training equipment purchased with project budget identified, purchased, handed over and trainers trained	- Equipment required (but not provided by RESD project) is included to be purchased by regular school budget or provided by MoEMR	Poly / BPSDM
		- Procurement of equipment with consent of RESD expert, delivery with handing over, test run and training of trainers	MoEMR / RISTEKDIKTI
Output 1.5: Teaching aids and internship programs developed	- Teaching aids developed and introduced to partner - Internship model presented and agreed by partner - Learning outcomes for internships defined	- Internship model adopted	Poly / BPSDM
		- Private sector partner informed and placement of students organised	Poly / BPSDM
Output 1.6: ToT with at least 4 instructors/lecturers per institution conducted and participants certified	- Training of trainers elaborated and at least two trainings with support of international expert implemented - Exam for trainers developed and conducted, trainers certified by the project (or int. partner institution)	- Each Poly provided budget and time for at least three trainers to participate in ToT	Poly / BPSDM
		- Trainers trained are assigned to teach the new D4 program	Poly / BPSDM
Output 1.7: D4 “post graduate” RE programs launched at participating polytechnics	- Program introduction process monitored	- Enrolment process for RE programs launched	Poly / BPSDM
		- 2021 at least 20 D4 RE students per poly and program enrolled	Poly / BPSDM
		- Number of students for first 3 years limited	Poly / BPSDM
Output 1.8: Program implementation monitored in cooperation with private sector	- Program implementation monitored - Regular assessment briefings with private sector partners	- Monitoring system introduced	Poly / BPSDM
		- Data collected and distributed	Poly / BPSDM
		- 2022 and beyond at least 20 graduates placed in RE sector	Poly / BPSDM

Narrative	Indicator Swiss (project)	Indicator Indonesia (partner)	Gov. Partner
Outcome 2 Different training provider offer non-formal modular trainings in accordance with higher national skill standards providing skill and knowledge up-grading in eastern Indonesia relevant to the RE labour market.	- Modular training series for hydro and solar (including hybrid systems) with same level of qualification as D4 "post graduate" program developed - Training program and materials free of charge available on the internet	- Modular trainings have produced at least 20 graduates at IQF level 6 - 8	PPSDM / EBTKE
		- Private sector is recognising certification as entry level for supervisor operation and maintenance	PPSDM / EBTKE
		- At least 5 graduates are engaged in training provision	PPSDM
Output 2.1: Learning outcomes, structure and preconditions for modular short-term training based on D4 specialisation program defined	- Modular training based on D4 "post graduate" program is structured - Certification scheme is clarified (in cooperation with BNSP, LSP BPSDM and Private Sector)	- Development of modular training by local experts	PPSDM
		- Modular training is included in training portfolio	PPSDM
		- Certification scheme processed by LSP BPSDM for BNSP accreditation	BPSDM/ PPSDM
Output 2.2: Road-map for the development, clear roles and responsibilities are established and approved	- Draft road-map developed - Road-map discussed with main partners - Final road-map presented to steering committee	- Legal and regulatory inputs to road-map provided (regulations, procedures)	BPSDM/ PPSDM
		- Signature on final road-map proposal	BPSDM/ PPSDM
Output 2.3: Series of modular trainings developed	- Structure of modular training defined and discussed with partner - Regular/planned exchange with development team of PPSDM conducted and recorded	- Development of modular training by local experts	PPSDM
Output 2.4: Teaching aids developed and required equipment and training for instructors/lecturers defined (D4 adjusted)	- Teaching aids developed and introduced to partner - Listing and specification of required training equipment provided - Training equipment purchased with project budget identified, purchased, and handed over - Training of trainers implemented and assessed	- Equipment required (but not provided by RESD project) is included to be purchased by regular budget or provided by MoEMR	BPSDM/ PPSDM
		- Procurement of equipment with consent of RESD expert, delivery with handing over, test run and training of trainers	BPSDM/ PPSDM
		- Teaching aids tested and approved	PPSDM

Narrative	Indicator Swiss (project)	Indicator Indonesia (partner)	Gov. Partner
Output 2.5: Needs for ToT assessed and training to fill gaps conducted and trainer certified	- Trainer standards clarified and training of trainers elaborated and at least two trainings with support of international expert supported - Exam for trainers developed and conducted, trainers certified by the project (or int. partner institution) - Potential training institutions identified (e.g. BLK)	- At least two ToT trial conducted and 20 trainers from other institutions (e.g. BLK) trained	PPSDM
		- At least 5 institutions are supported to introduce modular training for RE experts - Certification of trainees created	BPSDM/ PPSDM
Output 2.6: New modular training programs introduced at public and private training provider	- Program introduction process monitored	- Enrolment process for RE programs launched at 5 training providers and PPSDM	Private sector, BPSDM/ PPSDM
Output 2.7: Program implementation monitored by Indonesian partner in cooperation with private sector	- Program implementation monitored - Regular assessment briefings with private sector partners	- Monitoring system introduced	BPSDM/ PPSDM
		- Data from other training providers collected and disseminated	BPSDM/ PPSDM
Output 2.8: Training results and required adjustments assessed and reported	- Training outcome assessed - Corrective measures elaborated (in case needed) - Results reported to steering committee	- Training data collected - At least a total of 300 trainees participated in a modular training - 10 trainees joint the whole training series and achieved IQF level 7	BPSDM/ PPSDM
Output 2.9: National standards (IQF level 6 to 8) developed and approved and training programs of component 1 and component 2 adjusted if required	- Process of developing national standards IQF 6 – 8 for the RE sector is facilitated	- Working committee appointed and clear task description provided	BNSP
		- National standards for RE specialists and experts (IQF level 6 – 8) developed and proposed	Private sector, EBTKE
		- National standards approved	BNSP
		- Training programs adjusted to reach appropriate level of expertise	Polytechnics, PPSDM

Narrative	Indicator Swiss (project)	Indicator Indonesia (partner)	Gov. Partner
Outcome 3 Exchange and understanding within the RE sector and with the education sector has led to a higher acceptance and use of RE	- No. of activities taking place not initiated by the project - No. of vertical twinning agreement - No. of international horizontal twinning	- Stakeholders take ownership of activities	EBTKE
		- Exchange platforms managed by stakeholders	EBTKE
Output 3.1: Web-platform on Indonesian RE sector (technologies, policies, regulations, government institutions, training options, private sector companies, services, experts, etc.) established and launched	- Assess available platforms and propose cooperation approach - RE platform containing general information, specific information for different RE technologies, Indonesian regulations, Indonesian institutions, training provider, training programs on offer, association, private service providers, etc. is operational - Use of platform is monitored, increasing use	- Relevant government agencies provide link on RE platform	MoEMR EBTKE
		- DIKTI and MoEMR promote platform with official letter	MoEMR
		- At least 100 private sector companies provide data to the RE data base	EBTKE
Output 3.2: Awareness campaigns for wider introduction of RE technologies supported with expertise	- Criteria for RESD project support to awareness raising developed and approved by SECO - Indonesian initiatives to promote use of RE technology supported and impact assessed - Scholarship program for D4 “post graduate” RE developed, and 4 student fees provided	- No of proposals activities to promote RE technology	EBTKE
		- Documentation, press clipping on RE promotional activities	EBTKE
		- 4 scholarships provided at each Poly involved	Polys
Output 3.3: Three yearly Indonesian RE sector conference organised and conducted (donors, government, private sector, national and international training institutions, certification bodies, etc.)	- Draft road-map developed and 50% budget sponsoring secured - Road-map discussed with main partners and approved by steering committee - Conferences implemented and public and policy reactions monitored	- Legal and regulatory inputs to road-map provided (regulations, procedures)	EBTKE
		- Signature on final road-map proposal	EBTKE
		- Conference budget sponsored by at least 50%	Private sector
Output 3.4: National and international training institutions linked	- Cooperation between project partners and international training institutions promoted - At least two international expert missions per year to Indonesia organised - ToR for international expert missions	- 4 request for int. Expert support per year	Polys / Unis
		- Active participation/organisation in/of Expert missions	Polys / Unis

Annex 13: Polytechnics Assessment

Perceived Interest / Motivation	Local Renewable Energy	Relevant degree programs	Relevant Facilities	Access to Eastern Indonesia	Additional Comments
Poltek Negri UPG (Makassar) Poly teachers and management highly motivated Proposed RESD D4 model similar to already introduced D4 program	South Sulawesi is pioneering big scale RE with big dams, and wind energy. There is also a market for small scale and roof-top installation, but marketing is needed.	Civil Engineering (D3 & D4), Electrical engineering (D3 & D4), PLN Cooperation Class Program (KKS PLN), Electronic Engineering Study Program, (D4), Energy Conversion Engineering Study Program (D3) Mechanical Engineering (D3 & D4) Accounting (D3 & D4)	Laboratory equipped with new Lucas Nuelle equipment for electrical engineering Single solar panel setup	The door to eastern Indonesia. Moluccas, Papua, Banda Sea, South and Souh-East Sulawesi	Already running D3 - D4 'top up' programs Experience with previous Swiss cooperation Cooperation with PLN in recruitment established
Poltek Negri Jakarta Poly teachers and management highly motivated	Access to RE industry in Jakarta	Civil Engineering (D3 & D3) Mechanical Engineering, Power Plant study (D3 & D4) Industrial Electronics Engineering (D3&D4) Electrical Engineering (D3 & D4) Energy Conversion Engineering Study Program (D3) Accounting (D3 & D4)	Laboratory equipped with new Lucas Nuelle equipment	Rather for Jakarta labour market	Recommended by DIKTI as a well-resourced polytechnic in Jakarta with existing facilities for RE study Laboratory and general condition of campus and buildings was very well maintained Located at University of Indonesia campus Cooperation with PLN in recruitment established
Poltek Negri Manado Teachers highly motivated, management supportive The Poly management is very keen to introduce the proposed RESD D4 model	Geothermal, solar and hydro plants in operation. Good market potential in hospitality sector, on islands, and for company and private use. Marketing is needed.	Civil Engineering (D3), Building Construction (D4), Informatics Engineering (D4), Computer Engineering (D3), Electrical Engineering (D3 & D4) Mechanical Engineering (D3), Mechanical Engineering Production and Maintenance (D4) Accounting (D3 & D4)	Grid-tied solar panel setup Older (circa 1990s) electrical and mechanical engineering lab equipment	North Moluccas, Halmahera, Sangihe, North and Central Sulawesi Many students are from Eastern Indonesia (Ambon, Ternate, Papua).	Already running D3 - D4 'top up' programs IPPs UPC and Vena attended workshop and signalled interest in internships/OJT The Electrical Engineering Department currently has a cooperation program with PLN that has been running for 6 years. PLN is involved in developing the course content, training lecturers, and quality control. PLN then hires all graduates from this program. SMK Manado attended discussions and is motivated to be a part of project (under component 2)
Poltek Negri Kupang Teachers motivated to join Management supports as long as DIKTI approves	NTT consist of hundreds of island ideal for solar (and partly wind) power generation. There are already about 10 companies mainly for small and roof-top solar installation.	D3 in Electrical, Mechanical and Civil Engineering D4 in Electrical Installation	Laboratory equipment poorly maintained Larger solar equipment, but needs to be repaired	East-Nusa Tenggara, Timor, Alor, Sumba, Rote, Flores	Previously cooperated with GIZ's ELREN project Cooperation with PLN in recruitment established

Annex 14: Detailed Tentative Budget

Budget Item	Year 1	Year 2	Year 3	Year 4	Total
Component 1					
Inception and planning workshops	20	10	10	10	**50**
Curricula development	20	15	10	0	**45**
Training of trainers	30	30	10	0	**70**
Studies and consultancies (e.g. labour market)	30	20	20	10	**80**
Other activities	20	20	20	20	**80**
Support to laboratory and training equipment	50	250	100	0	**400**
Participation of Swiss partners in comp. 1	80	60	40	30	**210**
Local travel (each partner at least 4 times a year)	8	8	8	8	**32**
Accommodation and allowances	15	15	15	15	**60**
Total C1	**273**	**428**	**233**	**93**	**1'027**
Component 2					
Inception and planning workshops	10	5	5	5	**25**
Modular training development	10	15	15	5	**45**
Training of trainers	20	30	20	10	**80**
Other activities	20	30	30	20	**100**
Studies and consultancies (e.g. labour market)	10	20	20	0	**50**
Support to laboratory and training equipment	50	100	50	0	**200**
Participation of Swiss partners in comp. 2	50	50	50	40	**190**
Local travel (10 local flights a year)	5	5	5	5	**20**
Accommodation and allowances	10	10	10	10	**40**
Total C2	**185**	**265**	**205**	**95**	**750**
Component 3					
Digitalisation (e.g. workshops, procurement)	30	30	30	10	**100**
Participation in conference and awareness funding	30	40	40	20	**130**
Participation of Swiss partners in comp. 3	20	20	30	30	**100**
Studies and sub-contracts (e.g. digital platform)	30	50	50	30	**160**
Activities in Switzerland (e.g. partner workshops)	10	20	20	20	**70**
Total C3	**120**	**160**	**170**	**110**	**560**
Project Management and Administration					
Project Manager (PM) 100%	200	200	200	200	**800**
Swiss Junior Expert	150	150	150	150	**600**
Housing PM & JE	75	75	75	75	**300**
Home leave (6 pax)	9	9	9	9	**36**
PSU expert staff (5 staff)	210	210	210	210	**840**
PSU support staff (3 staff)	60	60	60	60	**240**
Office equipment, IT, communication	20	2	2	2	**26**
Office rent and operation in Jakarta	75	75	75	75	**300**
Total Management and Administration	**799**	**781**	**781**	**781**	**3'142**
Total RESD Operation	**1'377**	**1'634**	**1'389**	**1'079**	**5'479**
Project Management and Administration (12.5%)	**172**	**204**	**174**	**135**	**685**
Reserve 5%	**69**	**82**	**69**	**54**	**274**
Total Project Value	**1'618**	**1'920**	**1'632**	**1'268**	**6'438**

(all in CHF 1'000)