



PINs and PD Developed for the Three Voluntary Carbon Market Projects in Tonga

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Outline

- n Introduction to VCS
- n Introduction to PIN development for three potential VCS project
- n PD development for the chosen project – Vava'u solar project

Introduction to VCS

- n VCS: Verified Carbon Standard
- n An independent, non-profit organization headquartered in Washington, DC.
- n Unit: VCU (Voluntary Carbon Unit), a type of voluntary carbon units
- n Tradable, usually on Markit, a global financial trading platform

Introduction to VCS

n Comparisons between VCS and CDM

	CDM	VCS
Unit	CER	VCU
Carbon Credit Type	Compliance	Voluntary
General Requirements	Consistent, transparent, conservative and additional	
Requirement of DNA	Yes	No
No. of Registered Projects ¹	4,455	866
Price	High	Low

[1] Till 08/2012

Popua 1MW solar farm – PIN introduction

PIN Introduction	
Objective	Utilize the solar resources to replace diesel for electricity generation
Technology	Silicon solar cell
Description	Constructed by Meridian company from New Zealand 9 million USD of fund provided by New Zealand's Ministry of Foreign Affairs & Trade Aid Programme
Location	Popua, Tongatapu, Tonga

Popua 1MW solar farm – PIN introduction

PIN Introduction	
Project Participants	Tonga Power limited & Meridian Energy
GHG Target	CO ₂
Total Cost (estimated)	12.5 million USD
Capital Cost	11.8 million USD
Annual O&M Cost (estimated)	20,000 USD



Popua 1MW solar farm – PIN introduction

PIN Introduction	
Commissioning Time	07/2012
Project Lifetime	35 years
Estimated Average Annual GHG Emission Reductions	1,437 tCO ₂ e
In a Period of 10 Years	14,375 tCO ₂ e

Popua 1MW solar farm – PIN introduction

PIN Introduction

Sector Background	<p>An important part of the Tonga Energy Road Map (TERM) 2010-2020</p> <p>Provide about 4% of Tongatapu's energy supply and save 470,000L diesel annually</p>
Baseline	<p>1,880MWh of electricity supply from the diesel generators dominated Tongatapu's grid</p>

Popua 1MW solar farm – PIN introduction

PIN Introduction

Methodology	AMS-I.F. – Renewable electricity generation for captive use and mini-grid
Additionality	<p>A grid-connected PV plant with an installed capacity up to 15MW should be automatically defined as additional¹.</p> <p>The capacity of the Popua solar farm is 1MW, so it is additional.</p>

[1]https://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid05.pdf

Popua 1MW solar farm – PIN introduction

Environmental/Social/Economic benefits

Environment	<ul style="list-style-type: none">ü GHG emission reductionsü Air pollutant emission reductions & better air qualityü No influence on local water qualityü Will be recycled after lifetime
Socio-economic	<ul style="list-style-type: none">ü Supply electricity in a clean wayü Job opportunitiesü Energy securityü Training program for further development of Tonga renewable energy industry
Environmental Strategy	<ul style="list-style-type: none">ü Fight against climate change and sea level rise

Popua 1MW solar farm – PIN introduction

Comments	
Advantages	<ul style="list-style-type: none">ü Has been put into operation alreadyü One of the first solar project in Tonga
Challenges	<ul style="list-style-type: none">ü Lack of emission reduction funding consideration in the beginningü Lack of communication with project developer

Combined solar and wind power project – PIN introduction

PIN Introduction	
Objective	Utilize the solar and wind resources to replace diesel for electricity generation
Technology	Silicon solar cell & Wind turbine
Description	Capacity: Solar: 500kW Wind: 500kW Will be funded by the Japan Bank for International Cooperation (JBIC)
Boundary	Tonga

Combined solar and wind power project – PIN introduction

PIN Introduction	
Project Participants	Tonga Energy Road Map Implementation Unit (TERM-IU)
GHG Target	CO ₂
Total Cost (estimated)	6.339 million USD
Capital Cost (estimated)	5.103 million USD
Annual O&M Cost (estimated)	49,373 USD

Combined solar and wind power project – PIN introduction

PIN introduction	
Expected Start Time of Construction	2013
Expected Commissioning Time	2014
Project Lifetime	25 years
Estimated Average Annual GHG Emission Reductions	1,302 tCO ₂ e
In a Period of 10 Years	13,024 tCO ₂ e

Combined solar and wind power project – PIN introduction

PIN Introduction

Sector Background	<p>An important part of the Tonga Energy Road Map (TERM) 2010-2020</p> <p>Provide 1,659 MWh of electricity annually (solar: 695MWh wind: 964MWh)</p>
Baseline	<p>1,659 MWh of electricity supply from the diesel generators dominated Tonga's grid</p>

Combined solar and wind power project – PIN introduction

PIN Introduction

Methodology	AMS-I.F. – Renewable electricity generation for captive use and mini-grid
Additionality	<p>Solar part: A grid-connected PV plant with an installed capacity up to 15MW should be automatically defined as additional². The capacity of the solar part is 500kW, so it is additional.</p> <p>Wind part: High price of wind turbine Lack of investment in Tonga Lack of experienced workers and engineers</p>

[2]https://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid05.pdf

Combined solar and wind power project – PIN introduction

Environmental/Social/Economic benefits

Environment	<ul style="list-style-type: none">ü GHG emission reductionsü Air pollutant emission reductions & better air qualityü No influence on local water qualityü Will be recycled after lifetime
Socio-economic	<ul style="list-style-type: none">ü Supply electricity in a clean wayü Job opportunitiesü Energy securityü Training program for further development of Tonga renewable energy industry
Environmental Strategy	<ul style="list-style-type: none">ü Fight against climate change and sea level rise

Combined solar and wind power project – PIN introduction

Comments	
Advantages	<ul style="list-style-type: none">ü Relatively high amount of emission reductions in Tongaü Combined technology project
Challenges	<ul style="list-style-type: none">ü Still on paperü Lack of investment schedule

500kW Vava'u solar project – PIN introduction

PIN Introduction	
Objective	Utilize the solar resources to replace diesel for electricity generation
Technology	Silicon solar cell
Description	Will be constructed by Masdar Company from Abu Dhabi, the United Arab Emirates A financial grant provided by the Abu Dhabi Fund for Development (ADFD)
Location	Neiafu, Vava'u Island , Tonga

500kW Vava'u solar project – PIN introduction

PIN Introduction	
Project Participants	Tonga Energy Road Map Implementation Unit (TERM-IU) & Masdar Company
GHG Target	CO ₂
Total Cost (estimated)	5 million USD
Capital Cost (estimated)	4.75 million USD
Annual O&M Cost (estimated)	10,000 USD

500kW Vava'u solar project – PIN introduction

PIN Introduction	
Expected Start Time of Construction	09/2012
Expected Commissioning Time	09/2013
Current Status	Memorandum of Understanding (MOU) signed on 18/01/2012
Project Lifetime	25 years
Estimated Average Annual GHG Emission Reductions	531 tCO ₂ e
In a Period of 10 Years	5,312 tCO ₂ e

500kW Vava'u solar project – PIN introduction

PIN Introduction

Sector Background	<p>An important part of the Tonga Energy Road Map (TERM) 2010-2020</p> <p>Provide about 13.8% of Vava'u's energy supply and save 180,990L diesel annually</p>
Baseline	<p>695 MWh of electricity supply from the diesel generators dominated Vava'u's grid</p>

500kW Vava'u solar project – PIN introduction

PIN Introduction

Methodology	AMS-I.F. – Renewable electricity generation for captive use and mini-grid
Additionality	<p>A grid-connected PV plant with an installed capacity up to 15MW should be automatically defined as additional³.</p> <p>The capacity of the Vava'u solar farm is 500kW, so it is additional.</p>

[3]https://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid05.pdf

500kW Vava'u solar project – PIN introduction

Environmental/Social/Economic benefits

Environment	<ul style="list-style-type: none">ü GHG emission reductionsü Air pollutant emission reductions & better air qualityü No influence on local water qualityü Will be recycled after lifetime
Socio-economic	<ul style="list-style-type: none">ü Supply electricity in a clean wayü Job opportunitiesü Energy securityü Training program for further development of Tonga renewable energy industry
Environmental Strategy	<ul style="list-style-type: none">ü Fight against climate change and sea level rise

500kW Vava'u solar project – PIN introduction

Comments	
Advantages	<ul style="list-style-type: none">ü Good communicationü Early involvement of VCS in the project starting
Challenges	<ul style="list-style-type: none">ü Relatively low amount of emission reductions

Comparisons between PD (VCS) and PDD (CDM)

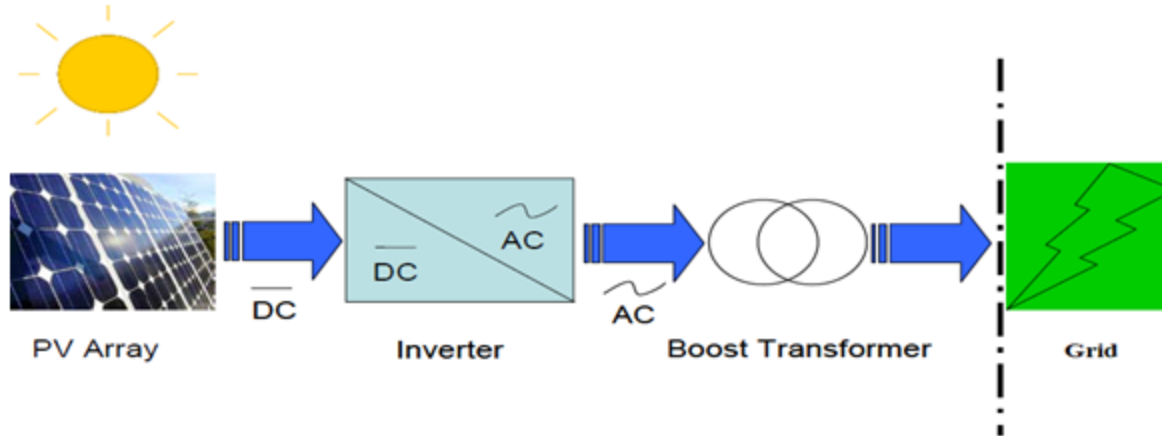
PD: Project Description Document PDD: Project Design Document

Item	PD (VCS)	PDD (CDM)
Methodology	VCS , CDM and CAR (Climate Action Reserve) meths, except for CAR's Forest protocol.	CDM meths approved by EB
Start Date	Begin generating greenhouse gas emission reductions	The earliest date at which either the implementation or construction or real action of a project activity begins

Comparisons between PD (VCS) and PDD (CDM)

Item	PD (VCS)	PDD (CDM)
Prior Consideration	No need, but validation shall be completed within two years of the start date	Inform DNA & UNFCCC within six months of the project start date
Approval	Letter of No Objection or other similar legal documents	Letter of Approval by DNA
Crediting Period	10 years twice renewable	7 years twice renewable or 10 years fixed

500kW Vava'u solar project -technology description



- n 3,570 of 1.43m² amorphous silicon thin film PV modules
- n Inverter for converting DC to AC for electricity transmission

500kW Vava'u solar project - methodology

Methodology: AMS-I.F. – Renewable electricity generation for captive use and mini-grid

Applicability:

The Related Requirement of The Methodology	The Situation of The Vava'u Solar Project
Install a new power plant at a site where there was no renewable energy power plant before	No renewable energy power plant in Vava'u yet; electricity supplied by diesel generators now
The capacity of the grid not exceeding 15 MW	The capacity of the grid in Vava'u is 1.87 MW

500kW Vava'u solar Project - additionality

- n A grid-connected PV plant with an installed capacity up to 15MW should be automatically defined as additional².
- n The capacity of the Vava'u solar farm is 500kW, so it is additional.

[2]https://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid05.pdf

Vava'u solar project - baseline

- n Baseline: the annual electricity generated by the solar farm (695MWh) times an emission factor

500kW Vava'u solar project - emission factor

n From the methodology AMS-I.F. :

Emission Factors for diesel generator systems (in kg CO₂e/kWh) for three different levels of load factors

Cases:	Mini-grid with 24 hour service	(i) Mini-grid with temporary service (4-6 hr/day); (ii) Productive applications; (iii) Water pumps	Mini-grid with storage
Load factors [%]	25%	50%	100%
<15 kW	2.4	1.4	1.2
>=15 <35 kW	1.9	1.3	1.1
>=35 <135 kW	1.3	1.0	1.0
>=135 <200 kW	0.9	0.8	0.8
> 200 kW	0.8	0.8	0.8

n Capacity: 500kW so emission factor: 0.8tCO₂e/MWh

THANKS FOR YOUR ATTENTION!

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