SOLCHARGE

(07/22 – 07/25)

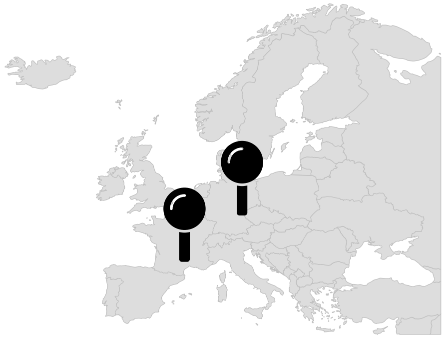
LEAP-RE

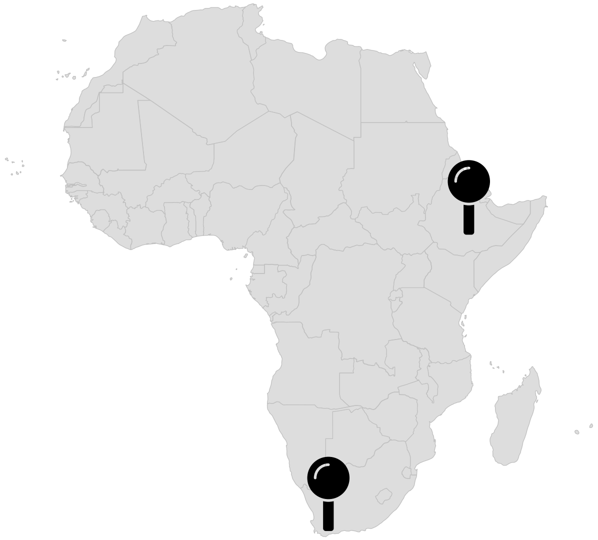
Long-Term Joint EU-AU Research
and Innovation Partnership on Renewable Energy

Pillar-1 project

The LEAP-RE project has received funding from the European Union's Horizon 2020 Research and Innovation Program under Grant Agreement 963530.

SolChargE - consortium





Aim of the project

Combine solar standalone systems with electric mobility

- ☼ *leapfrog fossil fuel-driven transport*
- ↔ *enable access to markets for rural population*

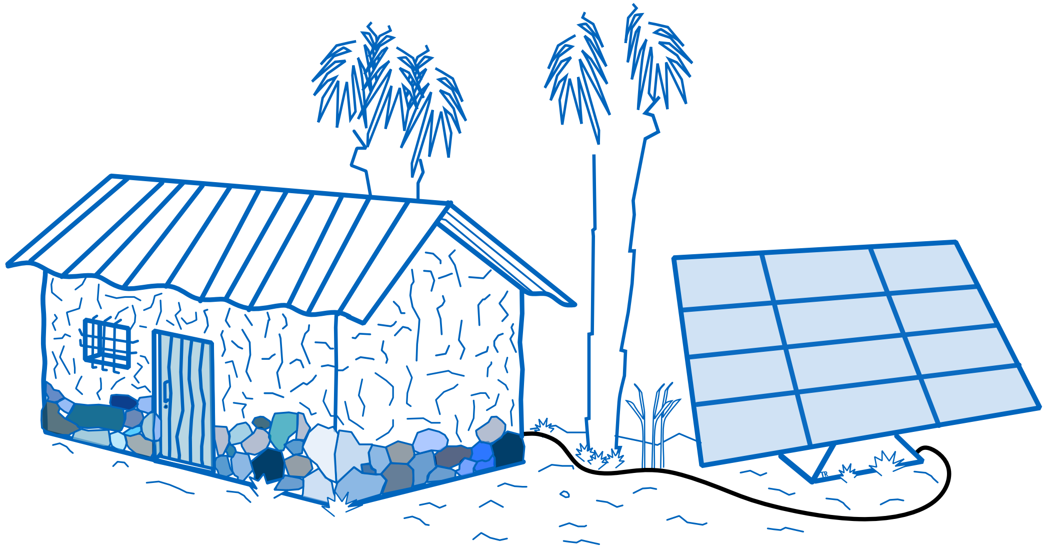
MAR 3 – smart standalone systems

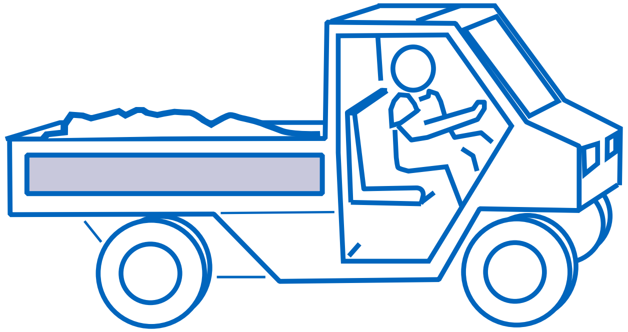
ETH: 80% of the national population subsists without a sustainable supply of energy (Getie, 2020)

SA: 8 million persons living with no access to electricity at all (Sarkodie & Adams 2020)

SolChargE – The Problem

MAR 3 – smart standalone systems



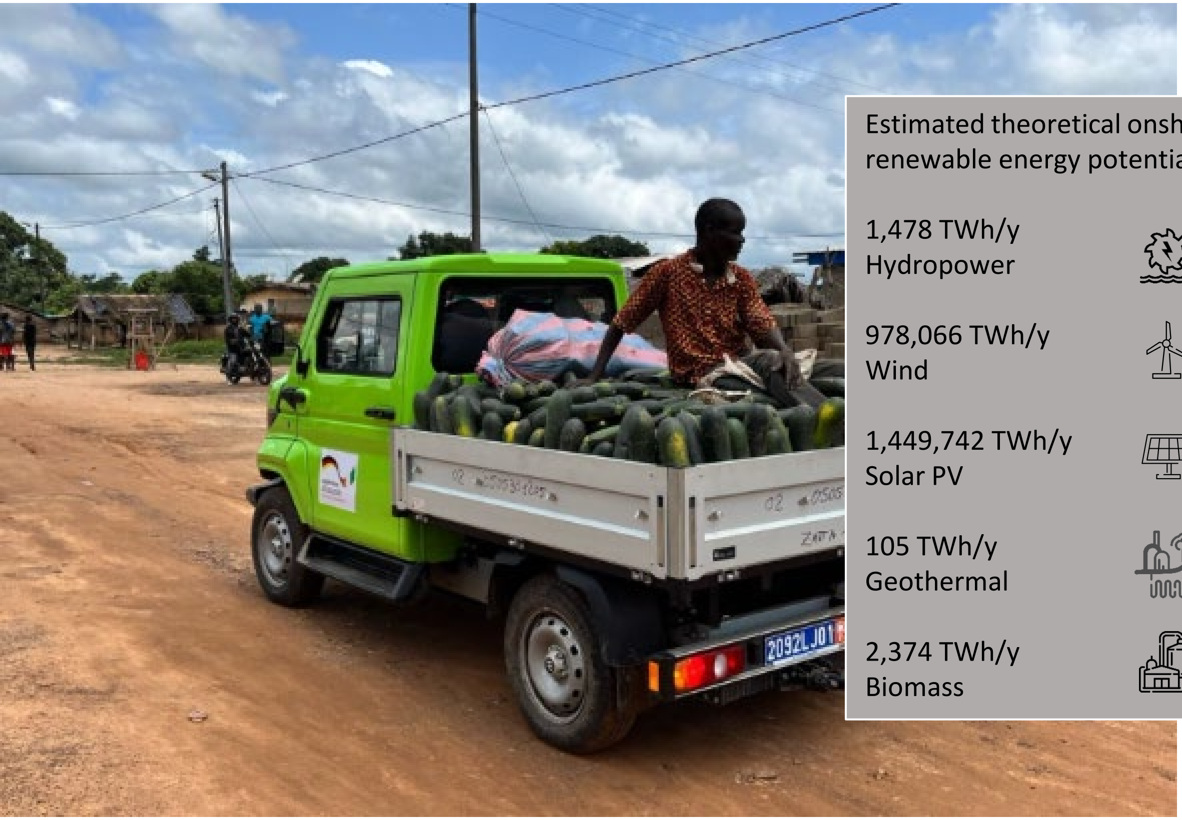


Renewable electricity must generate revenue

Mobility as a productive use case

SolChargE – The Solution

MAR 3 – decentralized transportation hubs to connect farmers with markets



Estimated theoretical onshore renewable energy potential in Africa

1,478 TWh/y
Hydropower

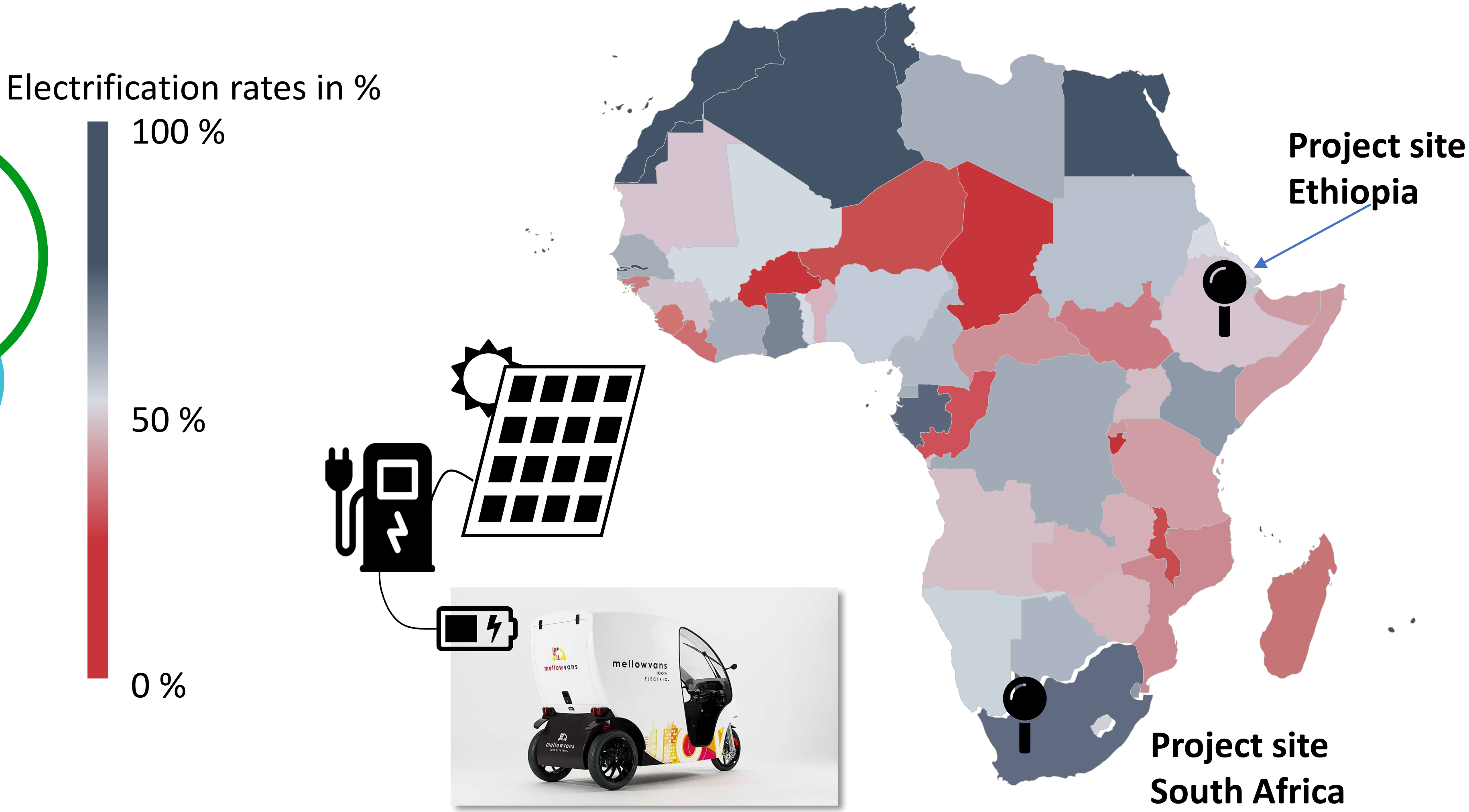
978,066 TWh/y
Wind

1,449,742 TWh/y
Solar PV

105 TWh/y
Geothermal

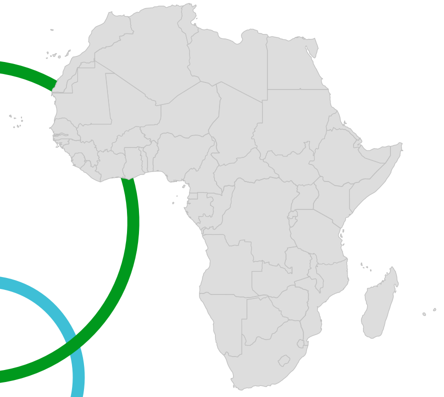
2,374 TWh/y
Biomass

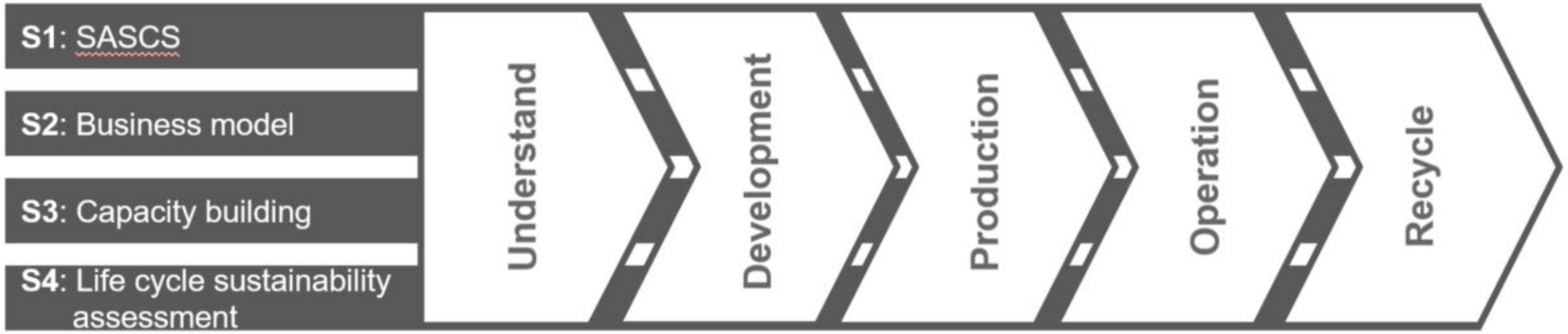
SolChargE – Implementation



LEAP-RE

SolChargE – Workplan Overview



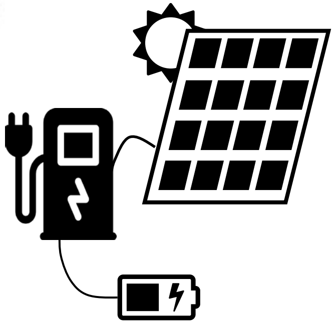


S1: SASCS

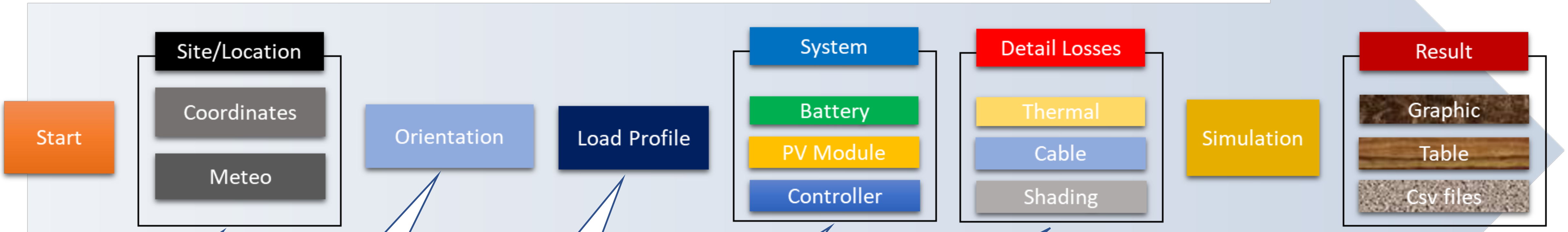
S2: Business model

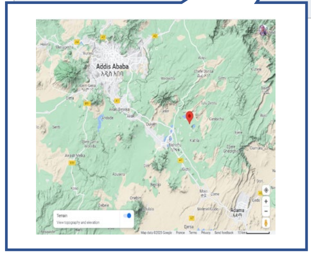
S3: Capacity building

S4: Life cycle sustainability assessment

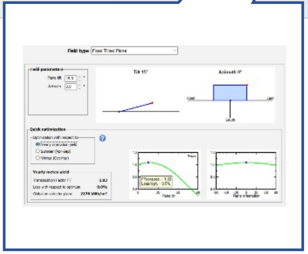


SolChargE – SASCS Simulation

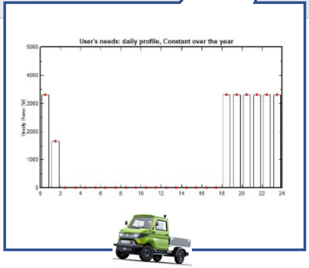




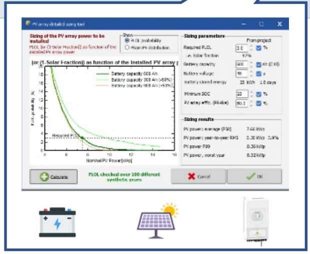
- Determine the coordinates of the site. As a result, obtaining the meteo data
- Location in Coordinates 8°48’42.6’’N and 39°3’59.7’’E and import meteo data over the year from PVGIS



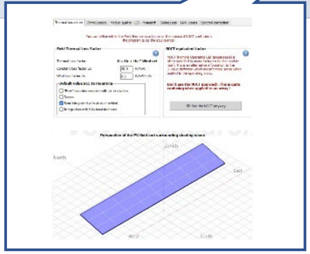
- Determine the field type (e.g; Fixed tilted)
- Determine the tilted and azimuth
- In the SASCS project, the tilted plane is 15° and azimuth is 0°



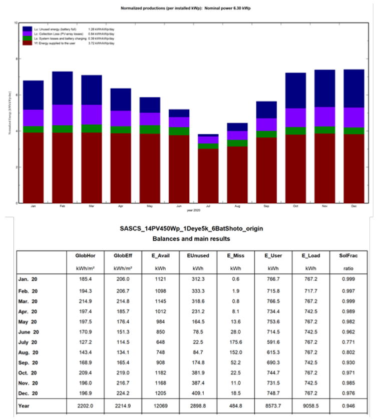
- Determine the load profile (EV battery capacity)
- here, using data from aCar manual sheet where the time charging for SOC 100% is 7.5 hours
- Load profile is constant over the year



- Presizing section (determine the PLOL, DoA)
- Determine the size and number of battery, PV and Controller (Hybrid Inverter)
- Data for SASCS is prepared in previous slide

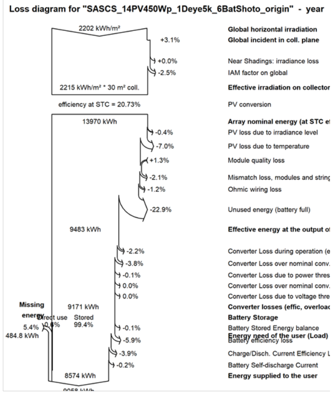


- Determine the loss in the system (e.g. Thermal, wiring)
- Determine the shading in the PV power plant
- For SASCS, the thermal loss and wiring using default value.
- No shading in the site (based on ASTU)



SASCS_14PV450Wp_1Deye5k_6BatShoto_origin
Balances and main results

	GlobHor kWh/m²	GlobEff kWh/m²	E_Avail kWh	EUnused kWh	E_Miss kWh	E_User kWh	E_Load kWh	SolFrac ratio
Jan. 20	185.4	206.0	1121	312.3	0.6	766.7	767.2	0.999
Feb. 20	194.3	206.7	1098	333.3	1.9	715.8	717.7	0.997
Mar. 20	214.9	214.8	1145	318.6	0.8	766.5	767.2	0.999
Apr. 20	197.4	185.7	1012	231.2	8.1	734.4	742.5	0.989
May 20	197.5	176.4	984	164.5	13.6	753.6	767.2	0.982
June 20	170.9	151.3	850	78.5	28.0	714.5	742.5	0.962
July 20	127.2	114.5	648	22.5	175.6	591.6	767.2	0.771
Aug. 20	143.4	134.1	748	84.7	152.0	615.3	767.2	0.802
Sep. 20	168.9	165.4	908	174.8	52.2	690.3	742.5	0.930
Oct. 20	209.4	219.0	1182	381.9	22.5	744.7	767.2	0.971
Nov. 20	196.0	216.7	1168	387.4	11.0	731.5	742.5	0.985
Dec. 20	196.9	224.2	1205	409.1	18.5	748.7	767.2	0.976
Year	2202.0	2214.9	12069	2898.8	484.8	8573.7	9058.5	0.946



All SASCS Scenario that tested in the simulation

First Demand

SASCS 100% (PV Longi 540 Wp)

E_Unused/E_Prod (%)		Number of PV 540 Wp				
		16	18	20	21	24
Nbr. Battery 4.8 kWh	6	45,95	51,67	55,18	57,70	62,94
	8	**45,06**	50,75	55,28	57,78	63,13
	10	45,08	51,19	55,31	57,96	63,35
	12	☒	☒	☒	58,00	63,45
	13	☒	☒	☒	58,01	63,47
	14	☒	☒	☒	58,00	☒
	15	☒	☒	☒	☒	☒
Inverter	Nbr.	1	2	2	1	1
	Power (kW)	8	5	5	12	12

Missing Energy (%)		Number of PV 540 Wp				
		16	18	20	21	24
Nbr. Battery 4.8 kWh	6	3,30	3,19	1,45	1,31	0,90
	8	**1,18**	0,74	0,48	0,43	0,24
	10	0,95	0,41	0,22	0,19	0,11
	12	☒	☒	☒	0,09	0,01
	13	☒	☒	☒	0,04	0,00
	14	☒	☒	☒	0,00	☒
	15	☒	☒	☒	☒	☒
Inverter	Nbr.	1	2	2	1	1
	Power (kW)	8	5	5	12	12

Second Demand

SASCS 50% (PV Linuo 450 Wp)

E_Unused/E_Prod (%)		Number of PV 450 Wp		
		10	10	12
Nbr. Battery 4.8 kWh	3	48,90	50,34	☒
	4	47,02	**47,99**	☒
	6	46,98	47,97	56,83
	7	☒	☒	56,83
Inverter	Nbr.	1	1	1
	Power (kW)	3,6	5	5

Missing Energy (%)		Number of PV 450 Wp		
		10	10	12
Nbr. Battery 4.8 kWh	3	5,29	6,16	☒
	4	1,18	**1,24**	☒
	6	0,66	0,73	0,11
	7	☒	☒	**0,00**
Inverter	Nbr.	1	1	1
	Power (kW)	3,6	5	5

Third Demand

SASCS 100% (PV Linuo 450 Wp)

E_Unused/E_Prod (%)		Number of PV 450 Wp				
		14	16	18	20	24
Nbr. Battery 4.8 kWh	6	25,19	☒	☒	47,91	55,95
	8	**24,09**	35,12	42,28	47,11	55,97
	10	23,88	35,05	42,28	47,06	56,40
	12	☒	☒	☒	☒	56,12
	13	☒	☒	☒	☒	56,12
	14	☒	☒	☒	☒	☒
	15	☒	☒	☒	☒	56,11
Inverter	Nbr.	1	1	2	2	1
	Power (kW)	5	8	5	5	12

Missing Energy (%)		Number of PV 450 Wp				
		14	16	18	20	24
Nbr. Battery 4.8 kWh	6	5,38	☒	☒	3,31	1,51
	8	**3,51**	2,40	1,60	1,23	0,52
	10	3,02	2,07	1,38	0,88	0,22
	12	☒	☒	☒	☒	0,13
	13	☒	☒	☒	☒	0,08
	14	☒	☒	☒	☒	☒
	15	☒	☒	☒	☒	0
Inverter	Nbr.	1	1	2	2	1
	Power (kW)	5	8	5	5	12

LOW

Investment in battery

HIGH

🟦 Reference (ASTU)

🟩 low Battery cost

🟨 medium Battery cost

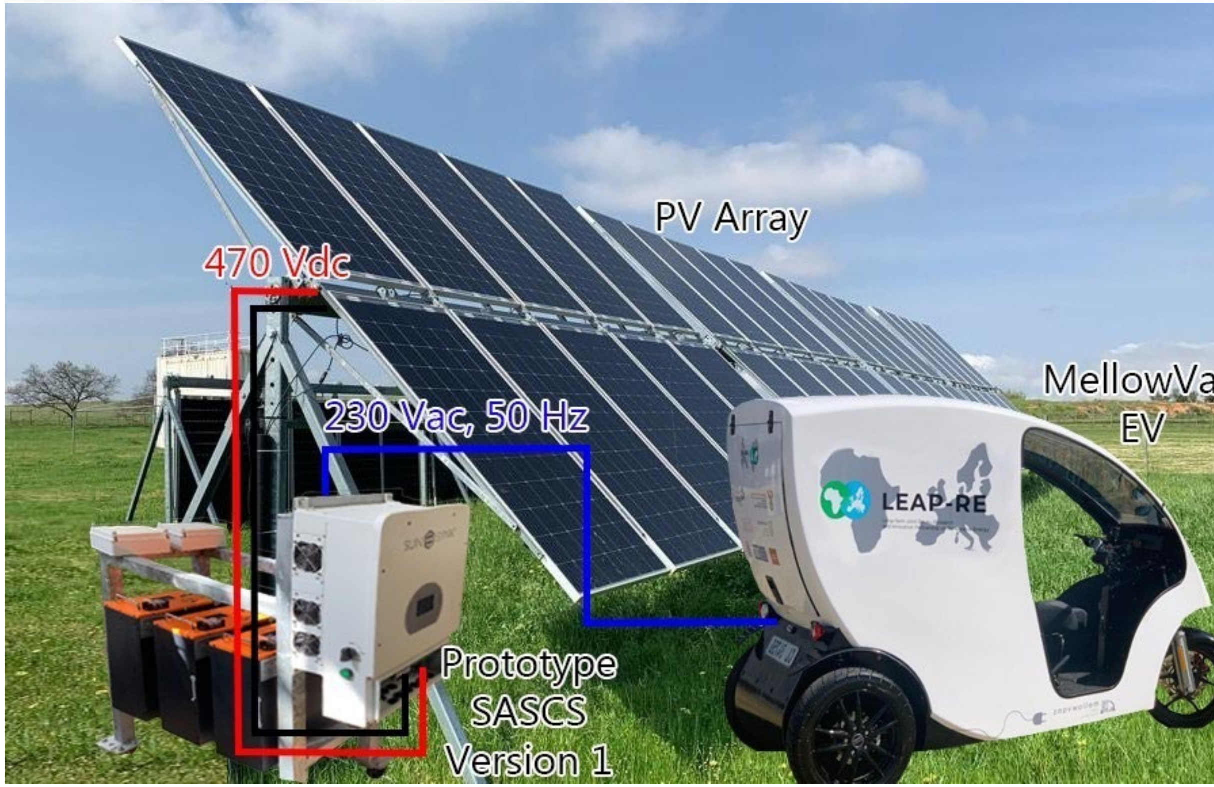
🟥 high Battery cost

☒ No tested area

LOW → HIGH

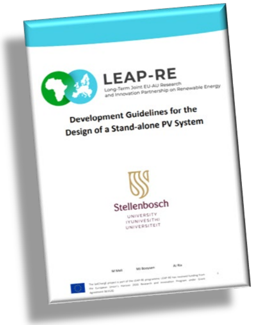
Investment in PV, Inverter and area installation

SolChargE – Operations ongoing…



SolChargE – Open source strategy

The development guidelines for a standalone solar system have been compiled. They can be viewed using the following QR code :



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Development Guidelines for the Design of a Stand-alone PV System

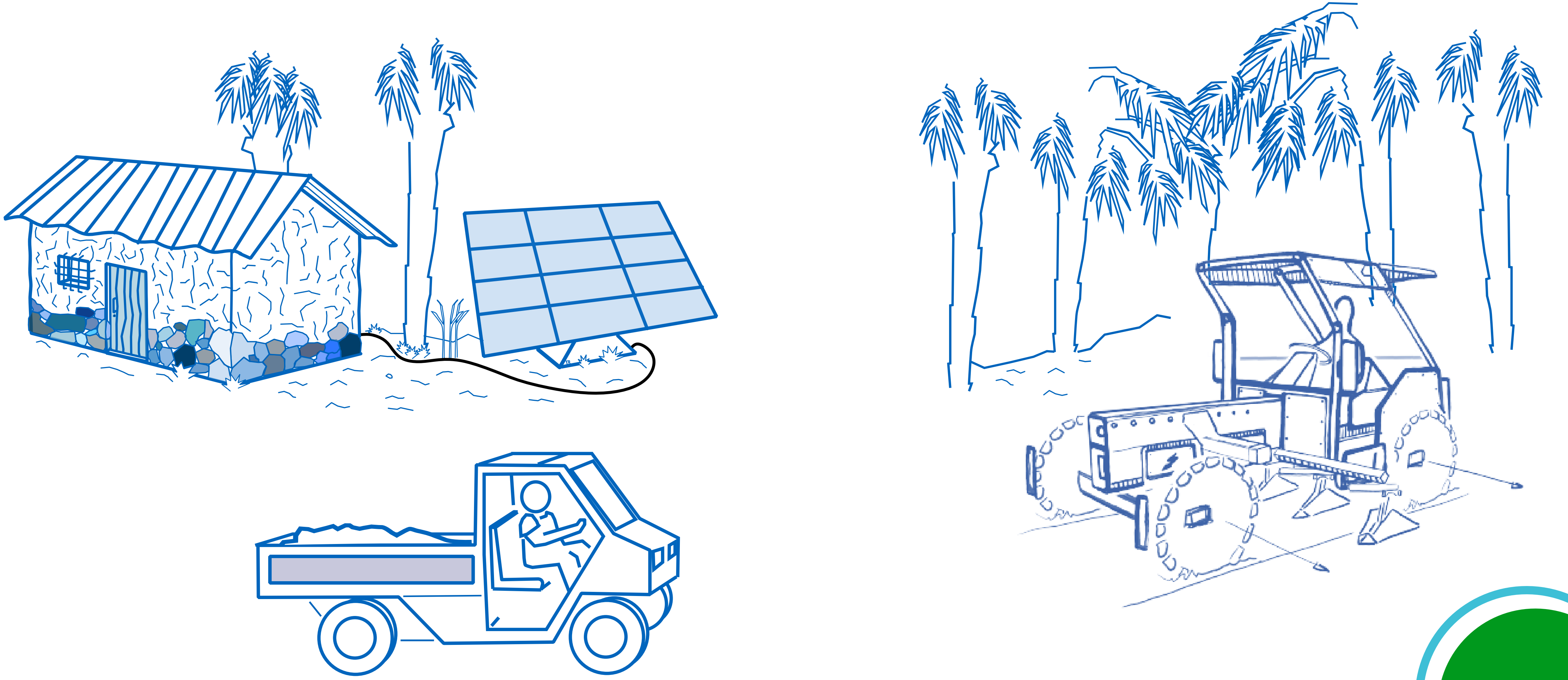
Stellenbosch
UNIVERSITY
IYUNIVESITHI
UNIVERSITEIT

Battery as a Service for Electric Vehicles: Design and Optimization of Partially Swappable and Shareable Battery System

Development and Piloting of a Novel Decentralized Solar PV Charging System for Sustainable E-Mobility in Rural Africa

SolChargE – What's next

SolChargE – Electric tractors



THANK YOU

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