Renewable Energy Implementation(REI)Toolkit

——Overview & Application

Global Environmental Institute (GEI)

Renewable Energy Implementation
Partners

Partners:

- The Center for Climate Strategies (CCS)
- Guangzhou Institute of Energy Conversion (GIEC)
- Global Environmental Institute

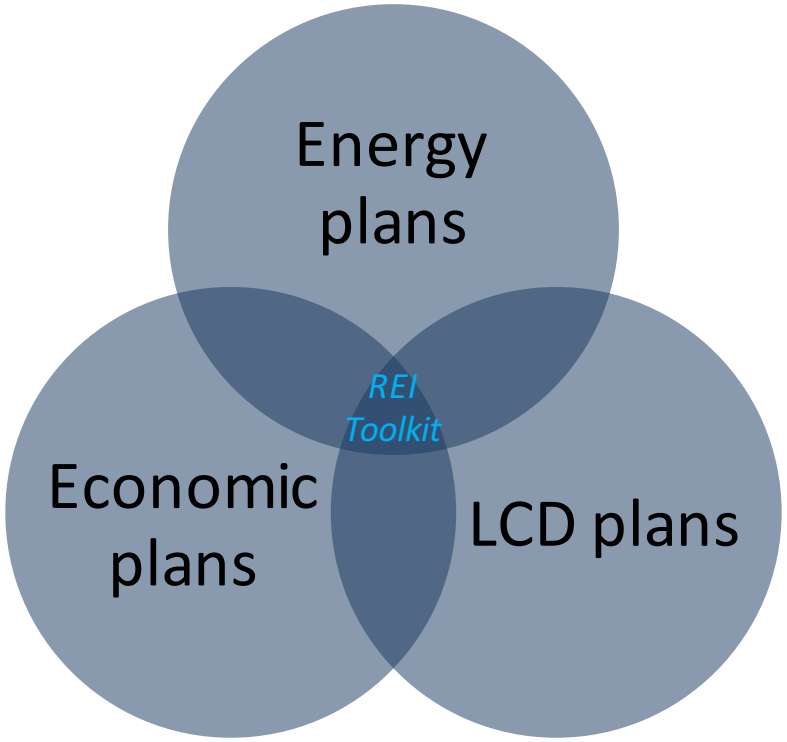
Pilots projects:

- Huangpu, Guangzhou City, South China
- Gampola Town, Central Province, Sri Lanka

Renewable Energy Implementation Toolkits

LCD Planning Step-Wise Process

REI toolkit
links to other Tools



REI toolkit:
To address a specific and pre-determined need for local implementation and scale-up of RE "technology applications"

REI toolkit

Steps

1, Jurisdictional-scale assessment of renewable energy zones (REZs)

2, Selection of one or more RE resources (wind, solar, or biomass, for example)

3, Characterization and selection of an RE technology application

4, Development of a detailed RE Implementation model(business implementation model)

5, Technology Implementation Documentary (TID)

REI toolkit

Key Functions

Implementation Step	Tool	Function
1.Jurisdictional-scale assessment of REZs; 2. Select RE resource and location	Spatial Analysis Tool (e.g. QGIS)	Characterize jurisdictional scale RE resource categories (wind, solar, biomass, hydro)
3. Selection of RE technology application	Spatial Analysis Tool (e.g. QGIS)	Local scale RE technology application potential (e.g. rooftop solar solar PV, ground-mounted solar, micro-hydro, biomass feedstock, on or offshore wind)
	RE Technology Multi-Criteria Assessment(MCA) Scoping Tool	Assessment of optimal RE technologies for each resource category at the local level based on both empirical analysis and expert ratings of: • Available local potential • Expected performance • ……
	RE MCA ….	……

REI toolkit

Key Functions

Implementation Step	Tool	Function
3. Selection of RE technology application	……	……
	RE Technology Multi-Criteria Assessment(MCA) Scoping Tool	…… • Expected cost • Alignment with jurisdictional/national objectives on clean technology, energy security, GHG emissions, etc
	RE MCA Screening Survey Tool	Used to engage a local group of RE experts who provide input on technology application choice and prioritization for local implementation.
4. Energy supply and demand assessment	Low Carbon Development (LCD) Toolkit Baseline Modules	Energy and GHG Baseline Workbooks— • Energy Supply • Energy Demand: • Residential, Commercial, Institutional • Industrial • Transportation
	LEAP	… …

REI toolkit

Key Functions

Implementation Step	Tool	Function
5. RE financial and social impact analysis	Financial and Social Impact Tool	Conducting risk adjusted net present value(NPV) assessments of selected RE technologies for multiple objectives: • NPV of program/project costs and benefits/savings, including financial and social impact criteria • Financial return metrics, including Discounted Cash Flow (DCF) based analyses of NPV, Internal Rate of Return, Payback Period, etc. • Risk evaluations for key areas, such as technology, market, costs, and governance. • Risk-adjusted Financial and Social Metrics
6. RE Business Implementation Model and documentation	RE Technology Implementation Template	Documents the following: • Description of Selected RE Technology • Business Implementation Model (stepwise implementation elements, agreements, actions, and requirements for each responsible party) • Baseline Conditions: current and business as usual (BAU) energy supply and demand conditions…

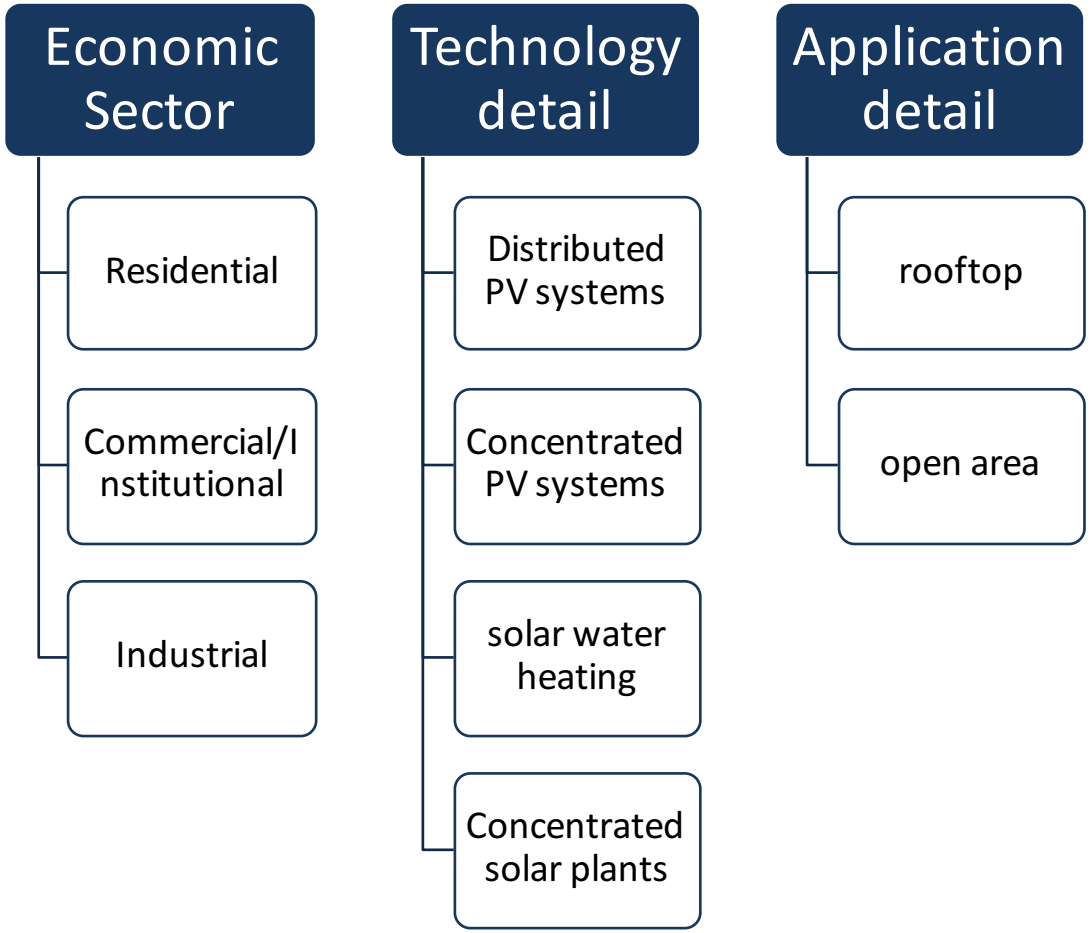
REI toolkit

Information Requirement/Collection

- Land Use/Land Cover
- Protected and Sensitive Areas
- Digital Elevation Models(DEM)
- Population Density
- Agricultural Production
- Infrastructure
- Solar Insolation
- Wind Speed
- Stream Levels and Stream-flow

REI toolkit

List of Solar Technology for Screening

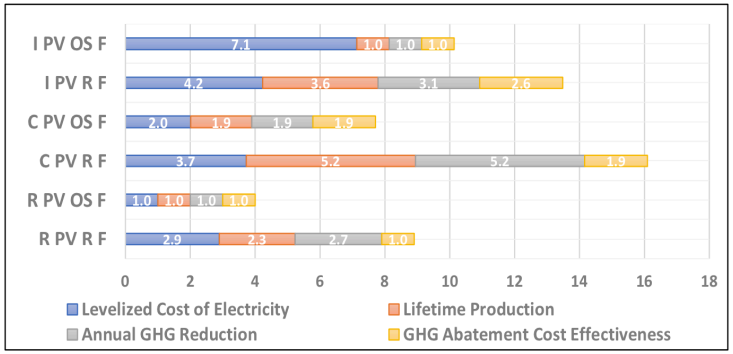


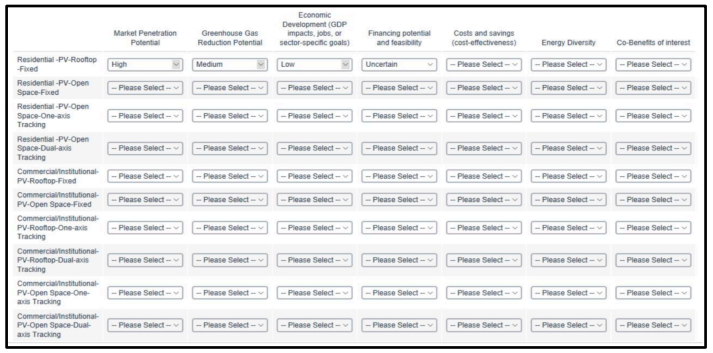
REI toolkit

Screening Metrics of Technology Application

Multi-Criteria Assessment (MCA) Scoping Tool:

Empirical scoring from the tool	Expert rating scores
• Levelized cost of Electricity (LCOE) ($US/kW)	• Alignment with nationally-declared contribution (NDC) or similar national goal
• Lifetime Production (MWh)	• Air pollution benefits
• Annual GHG Reduction (tCO_2e)	• Government financial support
• GHG Abatement Cost Effectiveness($/$tCO_2e$)	• Other environmental benefits
	• Gross State Product (GSP)/Jobs
	• Energy Security



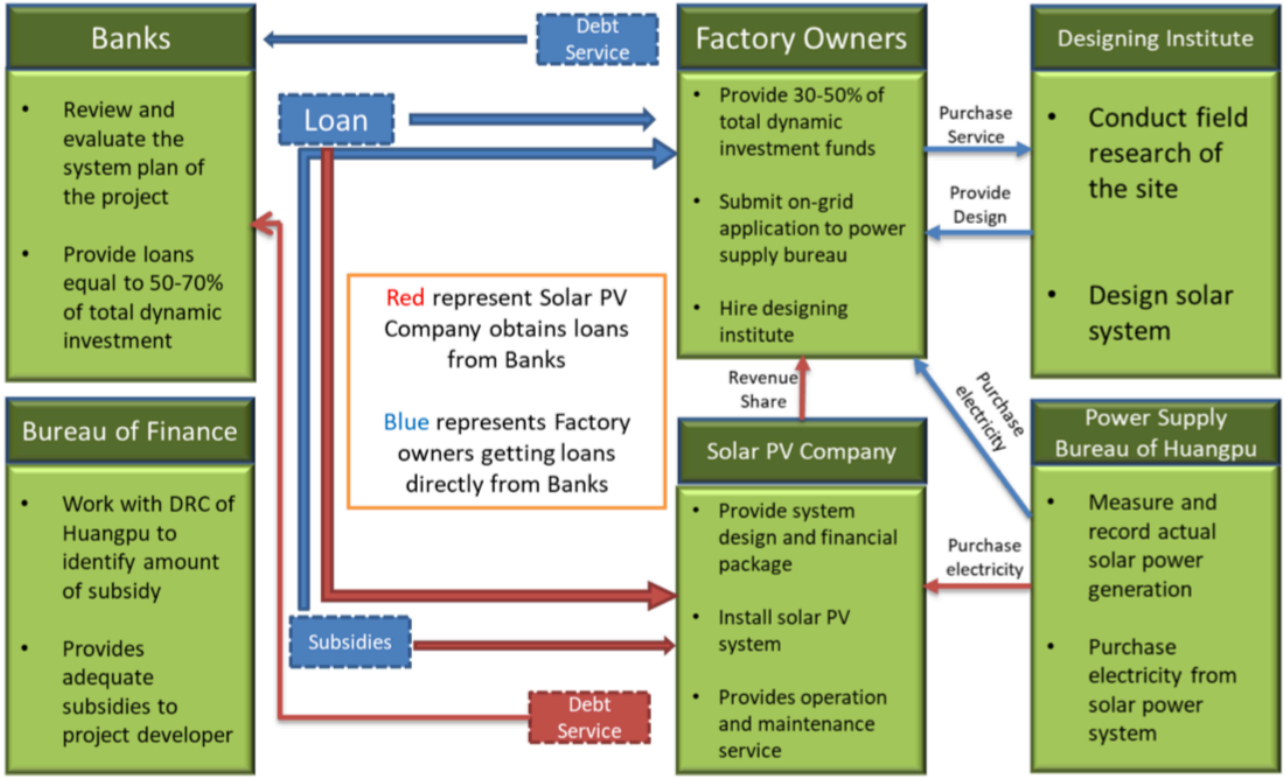


REI toolkit

Business Model/Financial Risk

To be Covered by Tomas Peterson (CEO & President , CCS) on Day 2

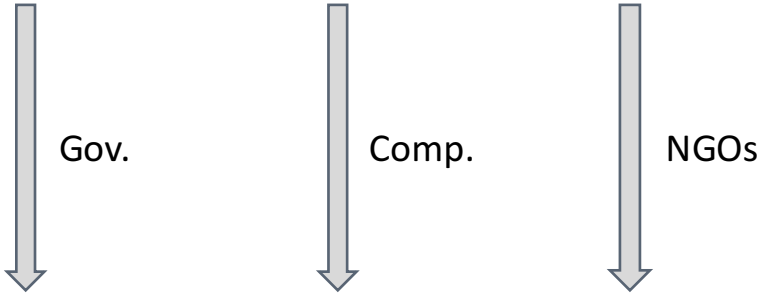
Presentation: Business Plan/Implementation Model Development for Promoting Renewable Energy



REI toolkit

Sri Lanka (Solar) Application

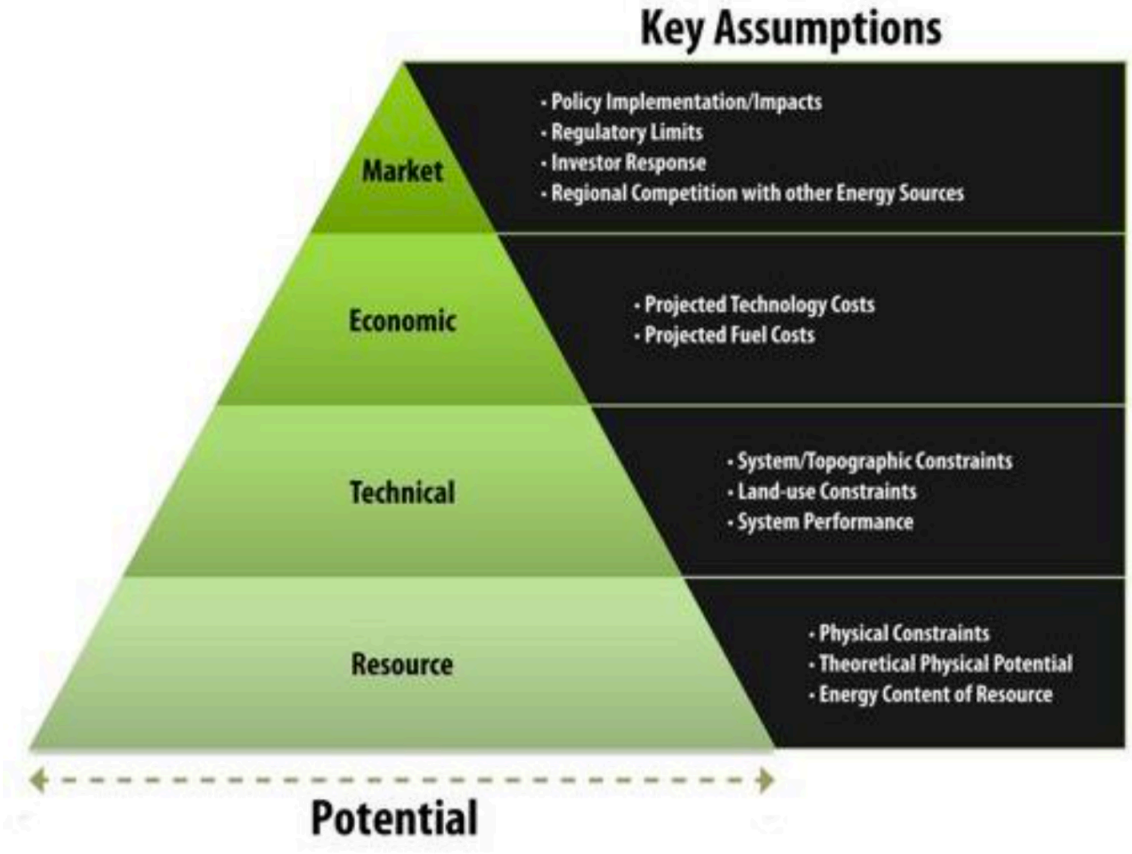
- South-South Cooperation on Climate Change (Fund)
- Belt and Road Initiative (BRI)



- Tackle Global Climate Change and Environmental Issues
- Promote Renewable Energy Use

REI toolkit

Assessment of market potential



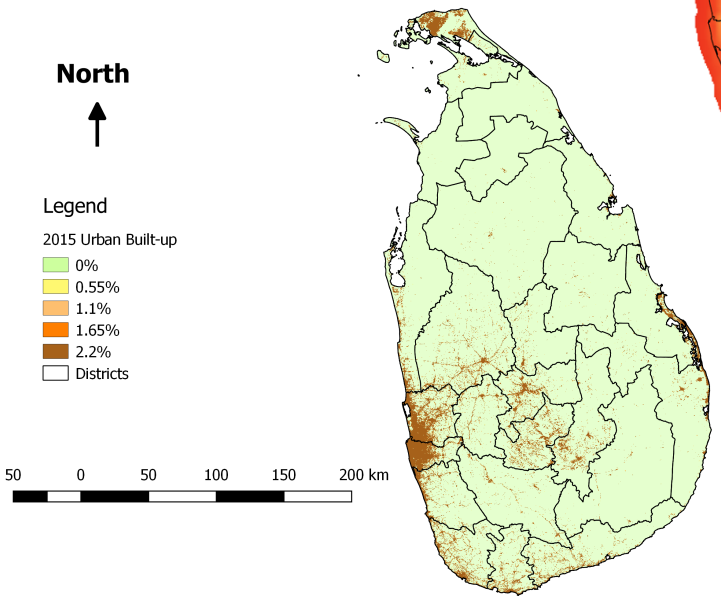
Source: NREL

REI toolkit

Application

Sri Lanka

Rooftop Solar Potential (Analysis) – Sri Lanka

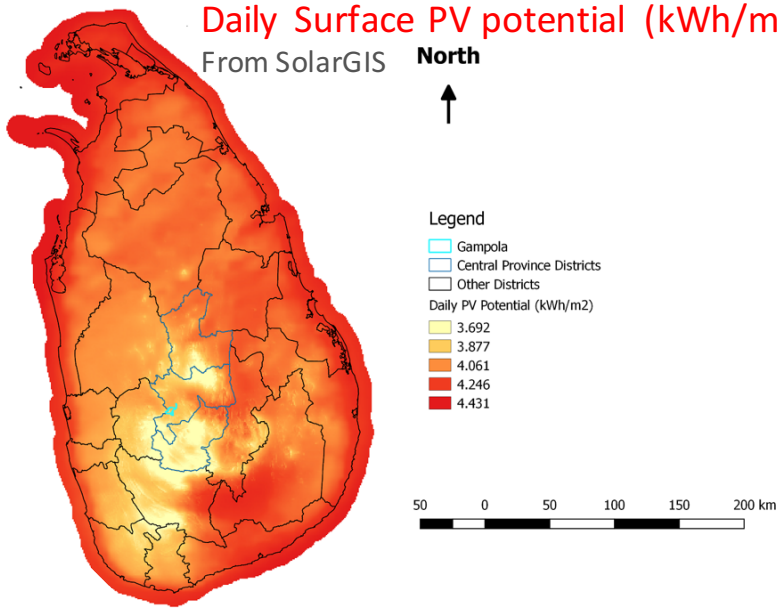


Urban Built-up 2015

http://ghsl.jrc.ec.europa.eu/ghs_bu.php

Daily Surface PV potential (kWh/m2)

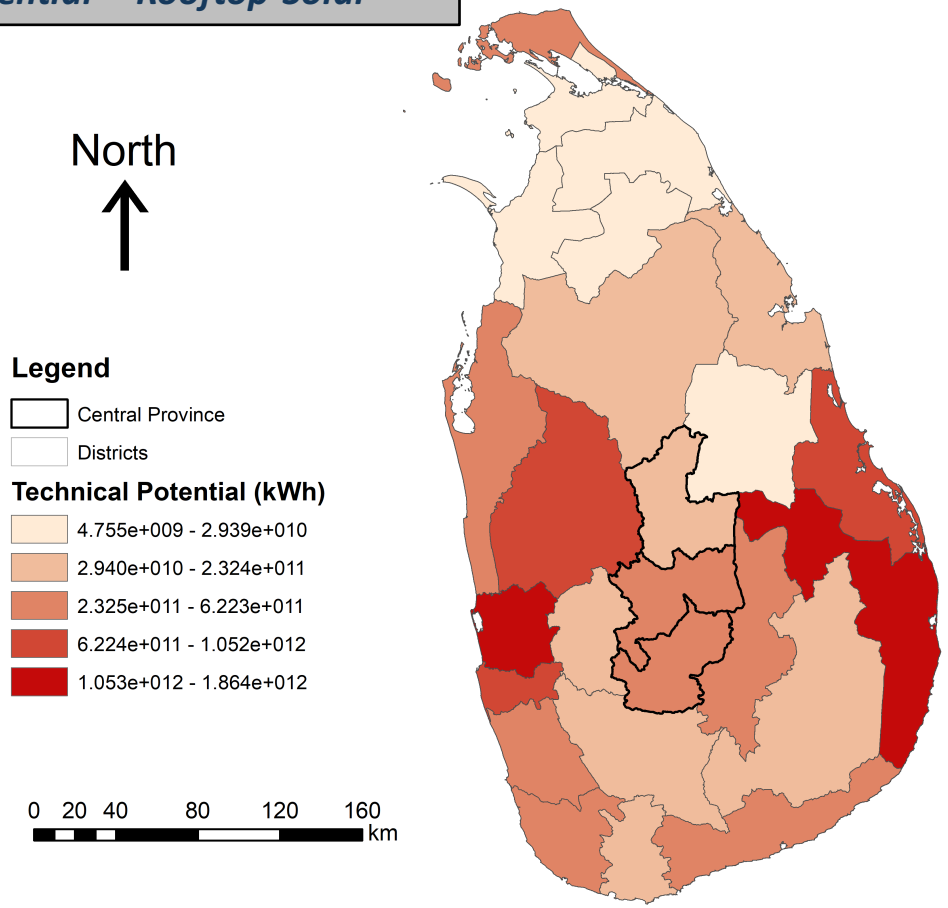
From SolarGIS



REI toolkit

Application
Sri Lanka

Technical Power Generation Potential – Rooftop Solar

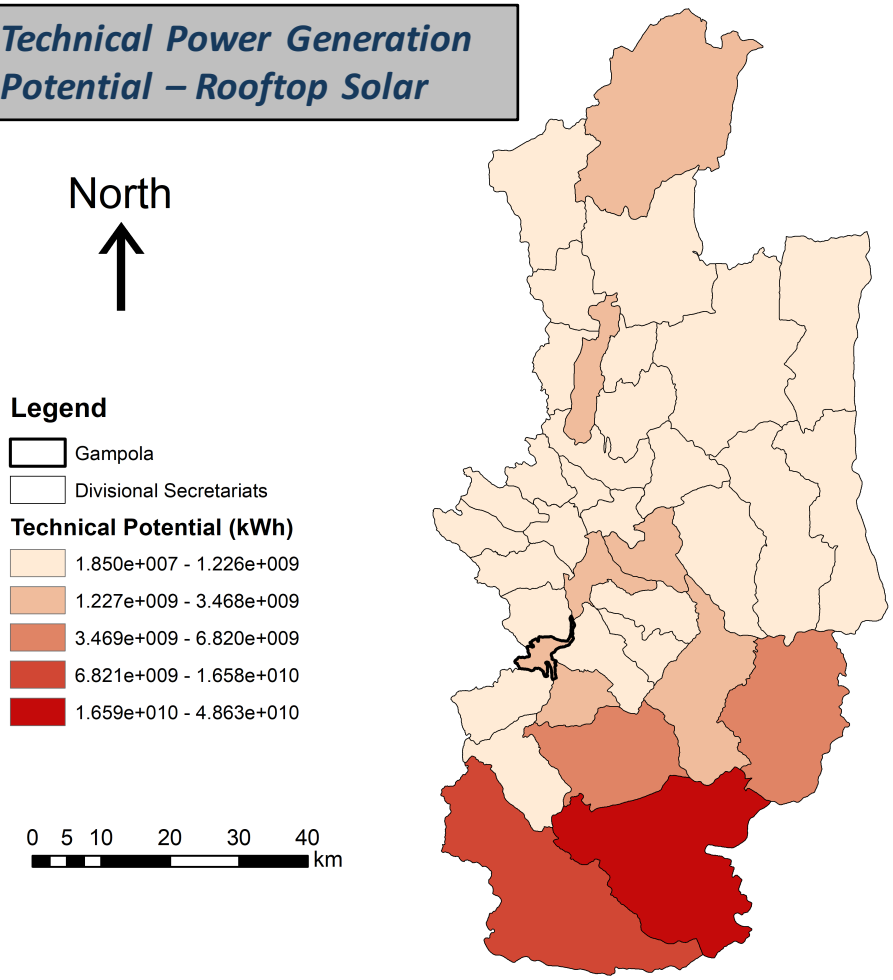


District	*Technical Rooftop Solar Potential (kWh/year)*
Ampara	1,450,478,318,801
Anuradhapura	88,146,773,269
Badulla	377,363,225,426
Batticaloa	994,766,928,779
Colombo	944,827,526,238
Galle	496,537,086,170
Gampaha	1,863,990,820,269
Hambantota	461,688,751,804
Jaffna	622,276,211,976
Kalutara	504,842,447,983
Kandy	362,920,765,865
Kegalle	126,069,686,786
Kilinochchi	22,026,647,812
Kurunegala	1,052,185,563,924
Mannar	10,867,091,412
Matale	89,175,605,786
Matara	232,405,493,382
Moneragala	111,837,065,786
Mullaitivu	17,078,359,092
Nuwara Eliya	345,194,806,769
Polonnaruwa	29,385,588,016
Puttalam	610,223,633,903
Ratnapura	169,030,407,435
Trincomalee	91,383,845,338
Vavuniya	4,755,394,239

REI toolkit

Application (Central Province)

Technical Power Generation Potential – Rooftop Solar



Divisional Secretariat	Building area (m2)	Techinal Potential (kWh)
1,313,696	172	225,323,884
605,284	310	187,368,566
1,218,824	543	662,361,233
568,423	520	295,299,517
1,811,995	309	560,707,460
79,885	367	29,355,560
9,321,691	359	3,347,009,069
3,622,393	470	1,700,836,646
1,109,358	1,105	1,226,161,284
334,597	1,545	516,886,412
341,017	508	173,329,427
1,610,474	646	1,040,467,666
1,584,171	276	436,478,669
482,248	499	240,691,363
438,853	327	143,671,756
415,430	309	128,301,048
145,718	1,653	240,885,228
3,354,241	555	1,861,268,579
1,945,806	396	770,439,928
1,865,655	413	769,931,623
54,856	337	18,498,367
852,868	2,898	2,472,018,906
587,677	1,237	726,926,296
16,289	2,310	37,629,378
3,595,246	430	1,544,999,337
187,923	1,757	330,088,492
112,085	528	59,137,993
285,982	592	169,412,007
1,049,627	464	487,458,104
37,673	1,733	65,296,203
270,999	360	97,620,553
6,382,984	2,598	16,581,141,980
2,619,637	1,324	3,467,543,338
4,513,551	1,223	5,518,994,240
18,607,654	2,613	48,629,055,780
3,558,344	1,917	6,819,992,469

REI toolkit

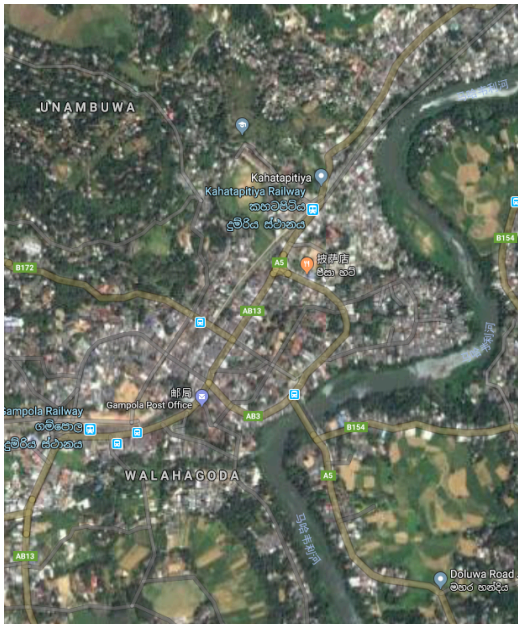
Low Carbon Town Gampola (MCA Screening)

Why Gampola Town	Why Solar	Financial Support
Local Development Plan by Sri Lanka Gov. -- gov. plans	Easy to install	Belt & Road Initiative Country
Small area with good potential of Solar energy	Short-term construction	South-South Climate Fund support (RE Equipment)
A lot of daily tourists traveling through Gampola	Electricity tariff from the government	Local government development plan with financial support
A good location and small enough for low carbon town demonstration (population: 50,000)	Good potential	
Power grid covered		

REI toolkit

Low Carbon Town Gampola (Technology application)

Residential Rooftop	Institute/Commercial Rooftop
Private access	Public access
Permission to install, complicated	Permission to install from Urban Council
Small scattered	Relative large area



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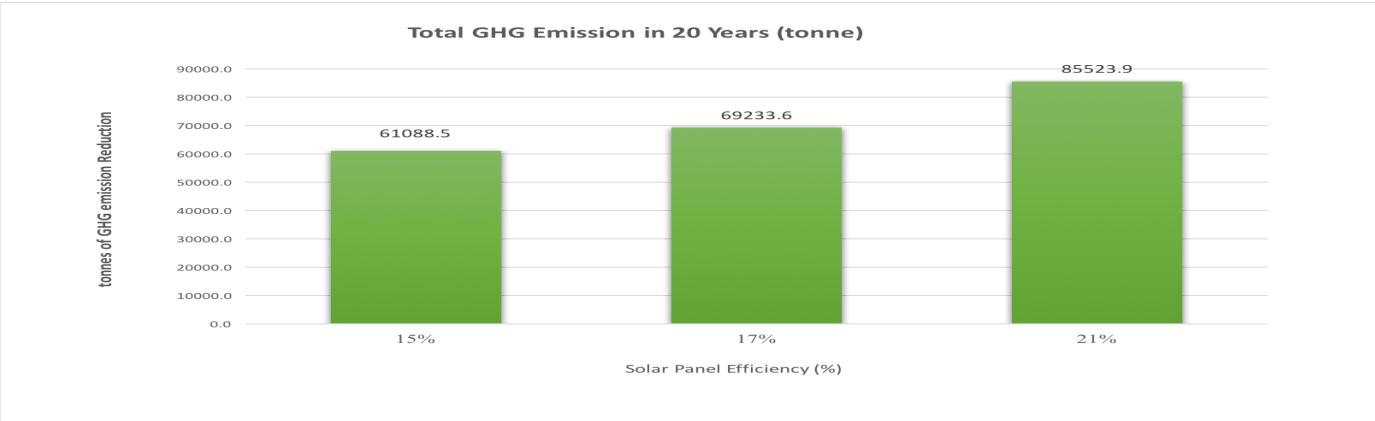
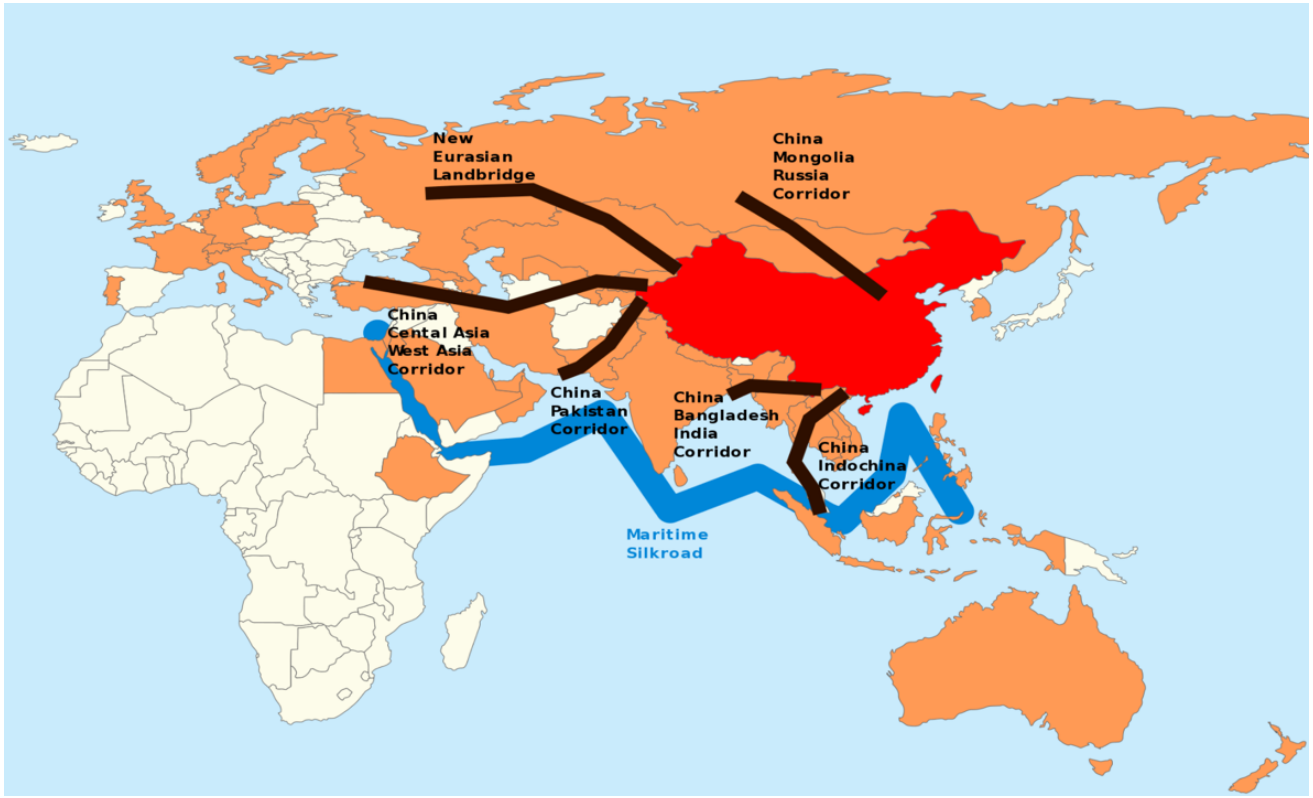
Low Carbon Town Gampola (Output)

Solar Panel Type	Energy conversion efficiency of solar panel	Annual Energy Generation (GWh)	Capacity(MW)	Annual GHG emission Reduction (tonne)
Multicrystalline	Efficiency η =15%	3.3	1.3	2909
	Efficiency η =17%	3.7	1.5	3297
Monocrystalline	Efficiency η =21%	4.6	2.5	4073



REI toolkit

Look into the Future



Promoting Renewable Energy Development with BRI
--- GEI, CCS, GIEC, etc. …