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United Nations Institute for Training and Research

EEE POM PV Panel Calculator Manual

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Abbreviations

EEE : Electrical and Electronic Equipment
POM : Placed on Market
PV : Photo Voltaic
MW : Megawatt
kg : Kilogram

1. Introduction

The “Electrical and Electronic Equipment (EEE) Placed on Market (POM) Tool for Photo Voltaic Panels” is developed to assist the user in preparing, adjusting, and converting the available country data on EEE POM of Photo Voltaic (PV) Panels (UNU-KEY 0002) prior to inserting them in the E-waste generated Tool.

The user has to perform only one step inside the tool to get the output:

- Insert the available country data on installed capacity in megawatt (MW) per year

The Tool will automatically do the following steps mentioned below:

- Calculate the changes in installed capacity in MW and their unit conversion to kilogram (kg)
- Further calculate the net changes in installed capacity in tonnes (t)
- Estimate the Placed on Market data (POM) of PV panels

The purpose of this manual is to help users with step-by-step guidance on how to operate the PV Panels Tool to estimate the placed on market data of UNU-KEY 0002.

2. Overview

The PV panels Tool consists of four sheets which act as a template to estimate the placed on market data of UNU-KEY 0002. A brief description of all the four sheets is given in the table below.

Table 1 Description and purpose of worksheets of PV panel Tool

Sheet Name	Purpose/Description
0.Content	Overview of the sheets and meaning of colored cell legend
RAW_DATA	It acts as an interface in which the installed capacity (in MW) data of given country is entered into column B per year which will further estimate the total e-waste generation in column F
Conversion	This sheet includes data conversion table for kg_per_MW and kg_per_panel from 1980 to 2021
POM_to_Tool	The final output of placed on market data of solar PV panels (UNU-KEY 0002) is given and will be used as an input to the E-waste generated Tool.

The user should not change the sequence of sheets to avoid malfunctioning of the Tool. The user can insert the data of installed electricity capacity in MW of country under investigation in column B of worksheet RAW_DATA.

3. Using the PV Panels Tool

3.1 Inserting installed capacity in Megawatt in RAW_DATA sheet

	A	B	C	D	E	F	AM	AN	AO
1									
2			Conversions						
	YEAR	Max_Capacity (in MW)	Changes in installed capacity (MW)	Changes in installed capacity (kg)	Net changes in installed capacity (t)	Total estimate of waste generation			
3									
4	1999	0				0			
5	2000	0	0	0	0	0			
6	2001	0	0	0	0	0			
7	2002	0	0	0	0	0			
8	2003	0	0	0	0	0			
9	2004	0	0	0	0	0			
10	2005	0	0	0	0	0			
11	2006	0	0	0	0	0			
12	2007	0	0	0	0	0			
13	2008	0	0	0	0	0			
14	2009	0	0	0	0	0			
15	2010	0	0	368	0	0			
16	2011	0	0	445	0	0			
17	2012	1	1	43000	43	0			
18	2013	1	0	0	0	0			
19	2014	5	5	346500	346	0			
20	2015	5	0	0	0	0			
21	2016	6	1	65000	65	0			
22	2017	6	0	0	0	1			
23	2018	6	0	22100	22	1			
24	2019	6	0	0	0	1			
25	2020		0	0	0	2			
26	2021		0	0	0	3			
27	2022		0	0	0	4			
28	2023		0	0	0	6			
29	2024		0	0	0	7			
30	2025		0	0	0	9			
31	2026		0	0	0	10			
32	2027		0	0	0	12			
33	2028		0	0	0	14			
34	2029		0	0	0	16			

Figure 1 Step to insert installed capacity in Megawatt (MW)

The first step is to put the maximum capacity of electricity generation in MW in sheet RAW_DATA (column B – selected cells in figure 1). Data can be obtained from various sources:

- 1) International agencies, such as IRENA database from the International Energy Agency (<https://irena.org/Statistics>)

2) Also from national statistical office, or any other government institute¹

In the next step, changes in installed capacity (MW) can be calculated by subtracting the capacity from the preceding year which will be done automatically once the installed capacity in MW entered into the column B of sheet "RAW_DATA".

3.2 Conversion of PV panels from unit MW to kg and tonnes

The changes in installed capacity in MW can be then converted to kilogram² unit using the "Conversion" sheet (column B figure 2). The conversion data could be updated in case country specific data is available.

Year	kg_per_Mw	kg_per_panel
1980	168000	12
1981	165900	12
1982	163800	12
1983	161700	12
1984	159600	12
1985	157500	12
1986	155400	12
1987	153300	12
1988	151200	12
1989	149100	12
1990	147000	12
1991	142200	12
1992	137400	12
1993	132600	12
1994	127800	12
1995	123000	12
1996	120400	12
1997	117800	12
1998	115200	12
1999	112600	12

Figure 2 Data to convert installed capacity in MW to Kilogram

¹ <https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html>

² https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2016/IRENA_IEAPVPS_End-of-Life_Solar_PV_Panels_2016.pdf

3.3 Estimating E-waste Generation

Using Weibull distribution for lifespan of PV panels, the disposal rates of PV panels is estimated per year in column H to column AL from the year 2000 to 2030. Summing the disposal rates will give the total e-waste generation as calculated in column F. Please note that the calculation will be performed automatically by the Tool.

3.4 Estimating placed on market PV panels

The last step is to calculate the placed on market photovoltaic panels. This data will be automatically estimated in sheet "POM_to_Tool" using SUMIFS in excel. Hence, the final output is given in sheet "POM_to_Tool" which will be used as an input to the E-waste generated Tool.