Internationalizing SAM: Using SAM for India-based Projects

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Overview

- Introduction to SERIIUS
- Motivation
- Implementation
- Ongoing work and Applications

SERIIUS Solar Energy Research Institute for India and the United States

The Vision of SERIIUS

To create an environment for cooperation & innovation "**without borders**" to develop & ready emerging revolutionary solar-electricity technologies…"

JAWAHARLAL NEHRU NATIONAL SOLAR MISSION
Building Solar India

SunShot
U.S. Department of Energy

SERIIUS

Solar Energy Research Institute for India and the United States

The Team – India & US Working Together

India

United States

Consortium Leads

Indian Institute of Science – Bangalore
Dr. Kamanio Chattopadhyay

National Renewable Energy Laboratory
Dr. David Ginley

Research Thrust Leadership

Indian Institute of Technology Bombay
Center for the Study of Science, Technology and Policy

Sandia National Laboratories
RAND Corporation

Consortium Partners

Institutes and National Laboratories

International Advanced Research Centre for Powder Metallurgy and New Materials

National Institute of Solar Energy

Lawrence Berkeley National Laboratory

University Partners

Indian Institute of Technology Madras

Indian Association for the Cultivation of Science

Arizona State University
Binghamton University
Carnegie Mellon University
Colorado School of Mines
Colorado State University
Massachusetts Institute of Technology
Purdue University
Stanford University
University of Central Florida
University of Colorado Boulder
University of South Florida
Washington University in St. Louis

Industry Partners

Bharat Heavy Electricals Ltd.*
Clique Developments Ltd.
GAIL (India) Limited
Hindustan Petroleum Corporation Ltd.
Infosys Ltd.
Moser Baer IndiaLtd.
Thermax Ltd.
Wipro Ltd.

Alpha Metals, Inc.
Corning Research and Development Corporation
Eastman Kodak Company
Interphases Solar
Semlux Technologies, Inc.
Sigma-Aldrich
Solarmer Energy, Inc.
Underwriters Laboratories

*New Partners - SERIIUS

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SERIIUS aims to improve solar technology and deployment through 3 integrated research areas

SEI has included techno-economic modeling and analysis, including collaboration between NREL, RAND, and CSTEP to develop a “SAM for India v1.0”

Purpose

Modify the existing SAM tool to facilitate ease of use in analyzing India-based projects with a particular focus on weather data and financial structure

Overview of Changes

- Expansion of location database
- Inclusion of India-specific finance elements
- Rupee denominated input and output display support
- Development of wizard walkthrough for new users

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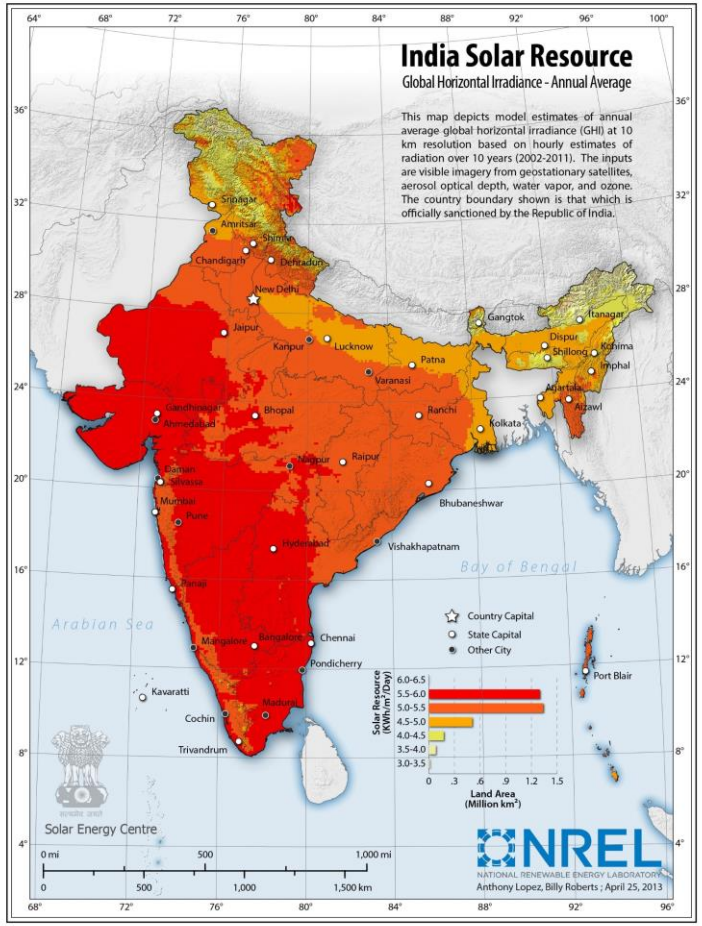
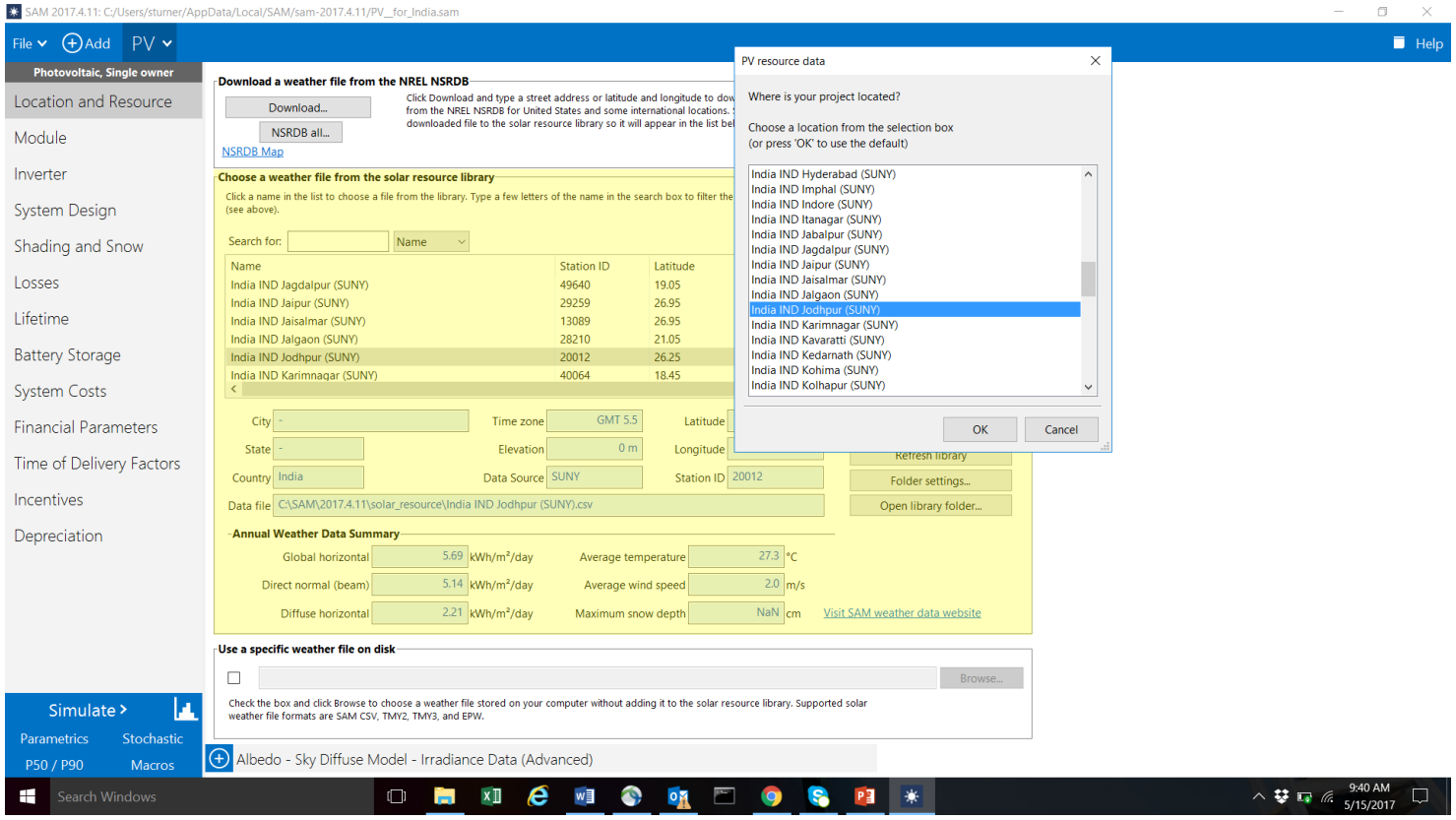
Addition of Locations





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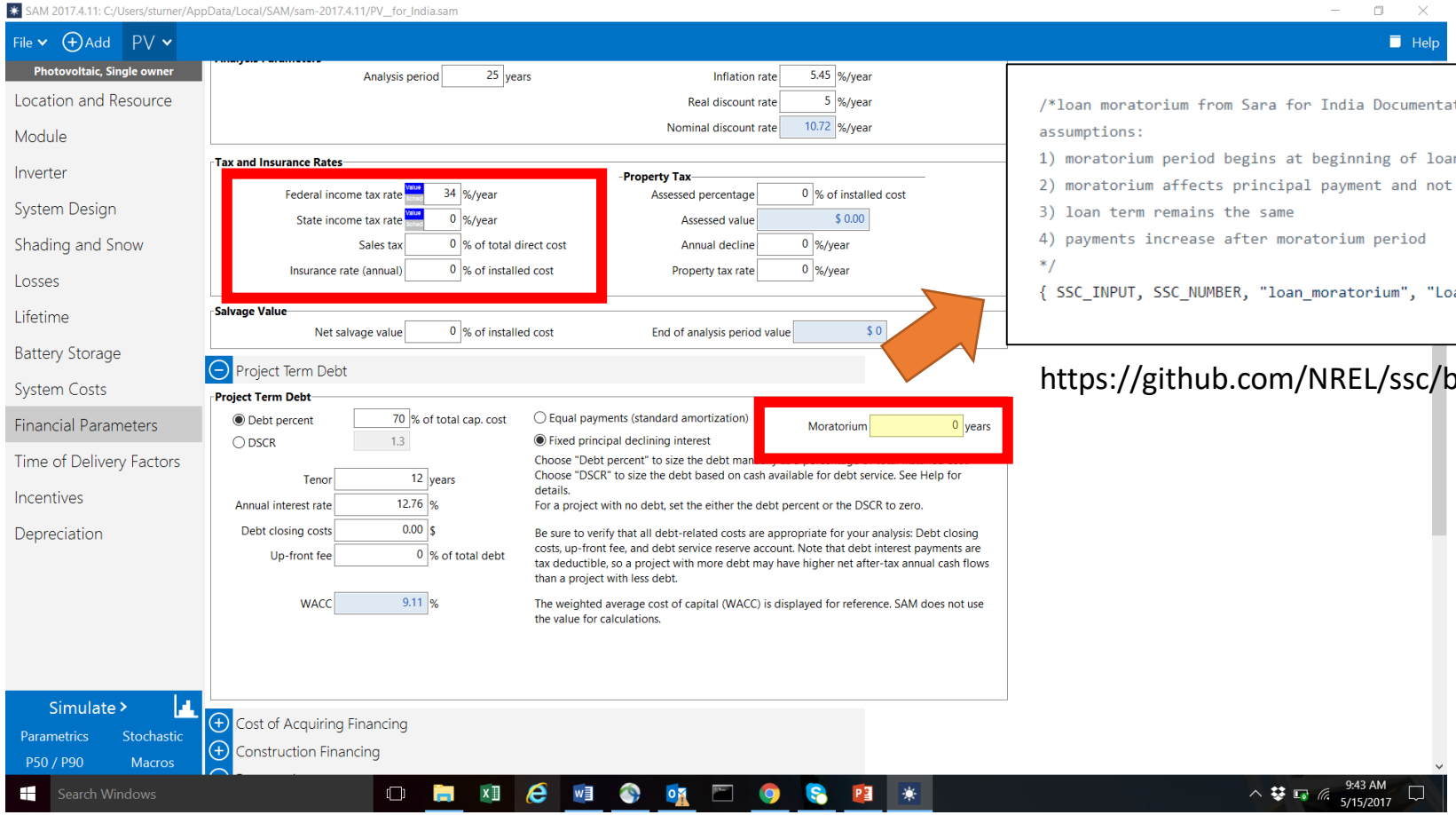
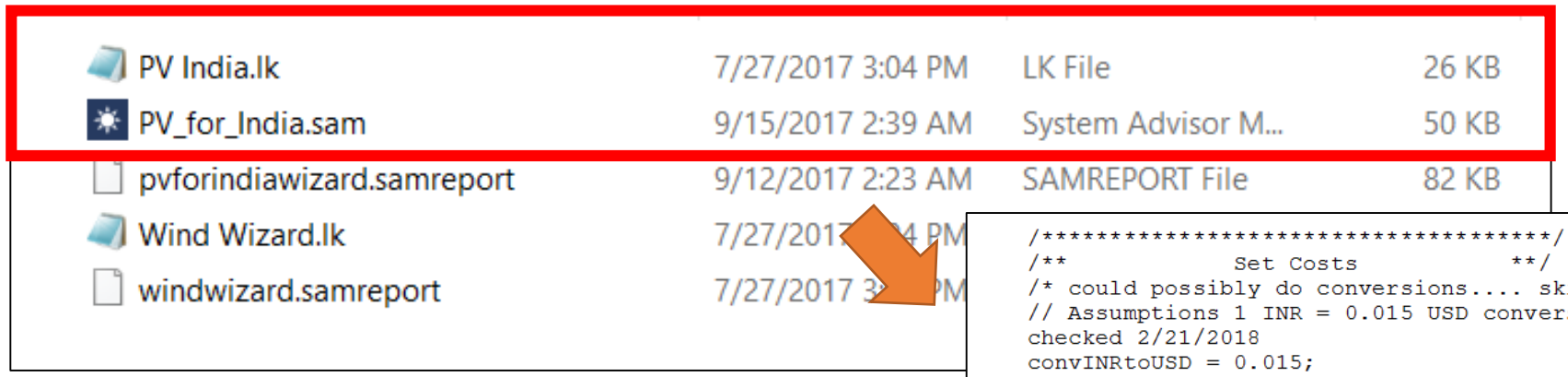
Improving Indian Finance Representation




```
/*loan moratorium from Sara for India Documentation\India\Loan Moratorum
assumptions:
1) moratorium period begins at beginning of loan term
2) moratorium affects principal payment and not interest
3) loan term remains the same
4) payments increase after moratorium period
*/
{ SSC_INPUT, SSC_NUMBER, "loan_moratorium", "Loan moratorium period", "years", "", "Moratorium", "?=0", "INTEGER,MIN=0", "" },
```

https://github.com/NREL/ssc/blob/develop/ssc/cmod_singleowner.cpp

Making Modifications Easy to Access




```
/************************************/
/**            Set Costs            **/
/* could possibly do conversions.... skip fo now
// Assumptions 1 INR = 0.015 USD conversion rate 1/30/2017
checked 2/21/2018
convINRtoUSD = 0.015;
convINRtoUSD = in( "SAM calculates all values in USD. This
Wizard allows entries in INR assuming a INR to USD conversion
rate. Enter the desired conversion rate or hit enter.",
                  convINRtoUSD,
                  'Rupees to Dollars',
                  [defaultX, defaultY]);
exitIf( convINRtoUSD  <= 0 );
*/
// Get capital cost from user - all costs in BOS bucket per file
from Sara
// capCostINR = to_real(get('bos_equip_fixed')) / convINRtoUSD;

show_page('System Costs');

// Highlight resource selection box in UI
focusto('per_module');
geom = widgetpos('per_module');
transp( geom, 'yellow', 70 );
millisleep(500);
```

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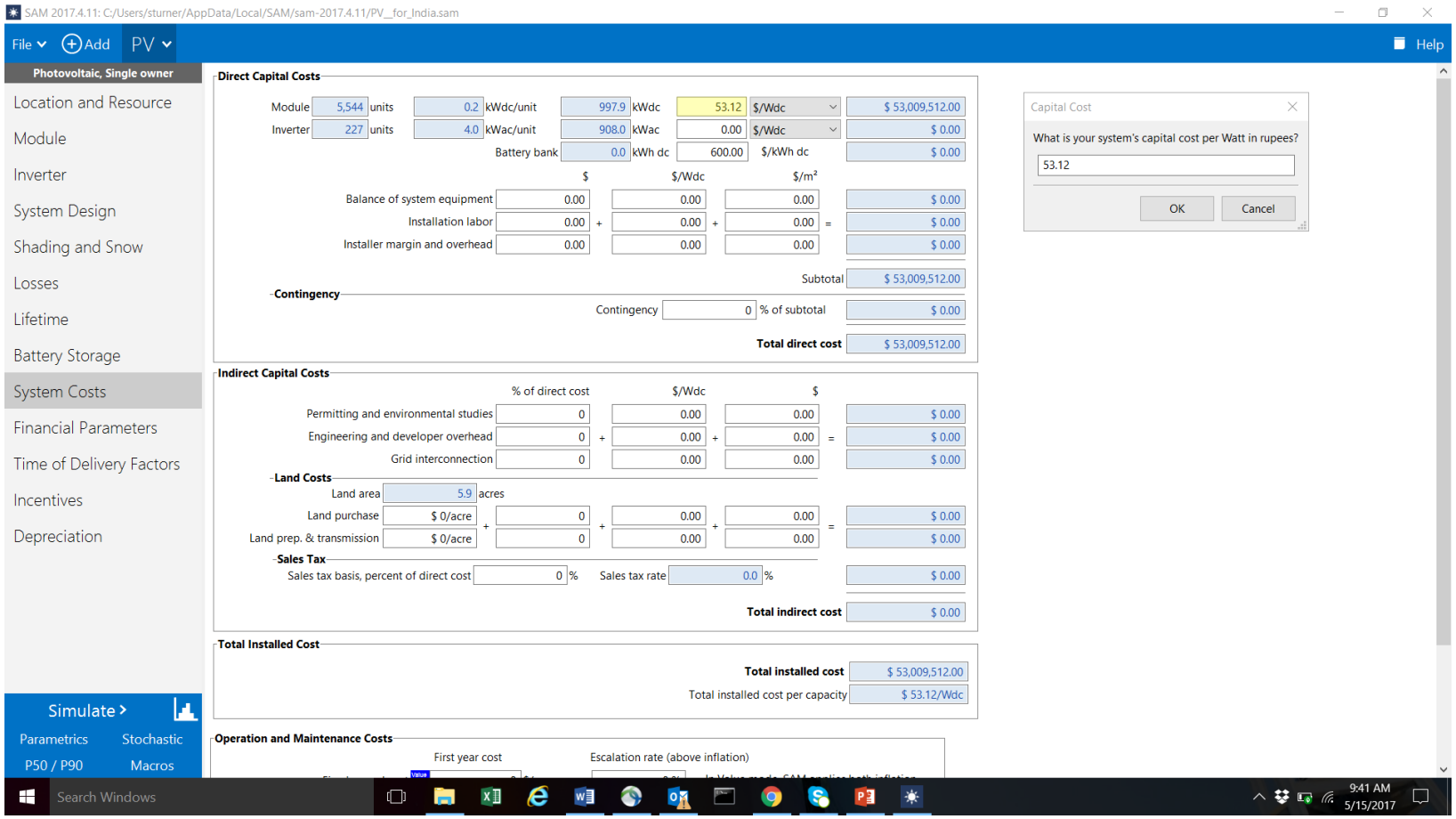
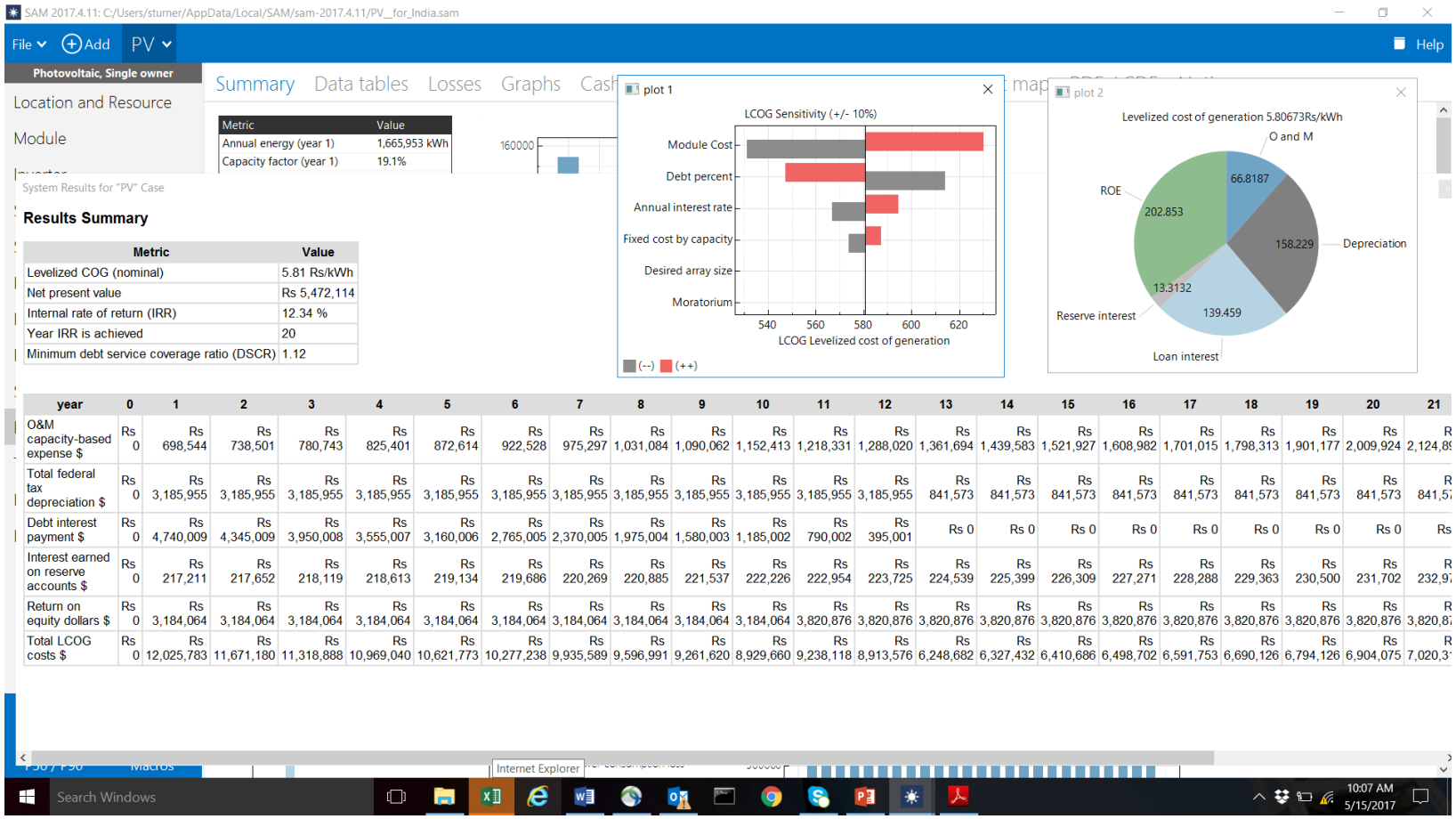
Rupee Input/Output Display Support



Wizard for New Users



Ongoing Work and Future Applications

- Planned and Ongoing Activities
  - Application to degradation tradeoff analysis
    - Analysis of cost and degradation for panels in different climate conditions
  - Application to roof-top PV analysis