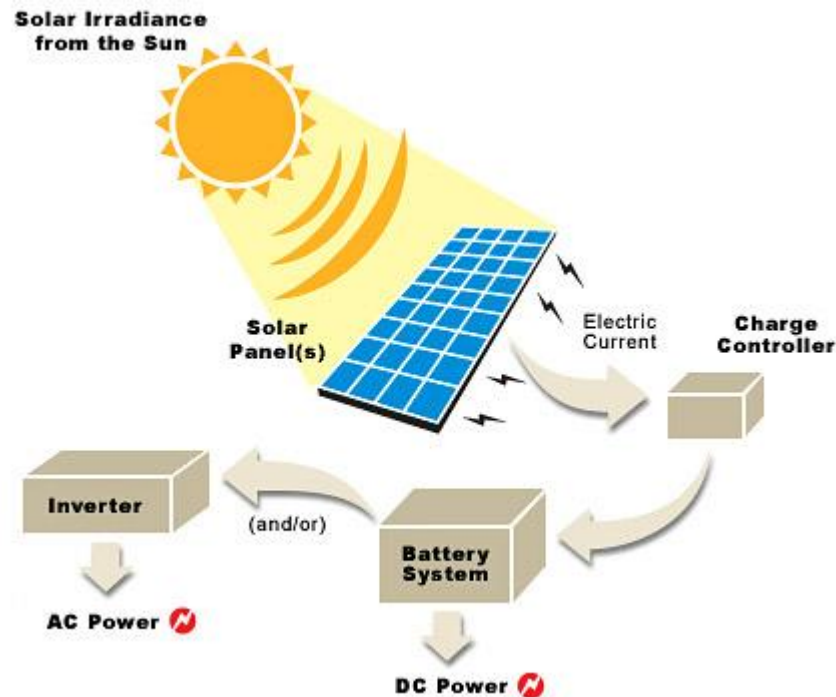# Solar Power Calculator

What is it?

- Calculate the benefit of installing solar panels on a house
    - how much power produced
    - how much power used
    - cost benefit analysis
        - payback time
        - overall income / savings

What is the project?

- Build a cloud based solar power calculator
    - determine benefit based on
        - solar system details
        - location of system
            - impact of installation
            - feed-in tariffs and electricity costs
- Multiple interfaces
    - web, application, mobile app, …
        - at least 2
    - take advantage of local device features

Motivation

- Solar systems are expensive
- Rules about feed-in tariffs are complicated
- Current electricity cost is inexpensive
  - compared to solar generation
- Sales people want to sell
  - not provide full discussions of all issues
- Maybe something about being "green"

Minimum Requirements

- Estimate of annual electricity generation
- Estimate of return on investment
  - how long to payback system cost
  - savings/income over 25 year lifespan of system
- At least two different interfaces
- Considers average electricity usage during hours of sunshine

Minimum Requirements

- Accommodates all factors that reduce system efficiency
  - orientation
  - installation angle
  - panel degradation over time
  - wiring loss
  - inverter efficiency
  - realistic average hours of sunshine

Extensions

- Sophisticated cost-benefit analysis
  - help estimate day time electricity usage
  - compare against other savings options
- Location awareness
  - determine optimal installation details
  - feed-in tariffs and rules
  - electricity costs
- …

User Stories

Solar Panel Calculator
by Green Hat

Student Number   Team Member Name

1. Release

1. Interation

| Story ID: 1 | **Energy Usage Input** | Priority: M | Story Points:1 |

As a Potential Customer I want the system to allow me to provide information about my current electricity usage so that my current electricity need will be accounted for in the final calculation.

Acceptance Criteria:

- User input field for energy usage in kWh, including options for usage distribution (i.e. predominant usage is night time or day time)
- Alternative input method for typical usage based on family size & number of appliances
- User input field for energy price ($/kWh). Default value is based on user's location.

Notes: The electricity usage is used to calculate the amount of energy usage which will ultimately be replaced by the solar system. This is required for financial calculations.

| Story ID: 6 | **Solar Power Generation** | Priority: M | Story Points:4 |

As a Potential Customer I want the system to tell me how much solar power I might generate with the selected equipment so that I can compare this to my current power usage.

Acceptance Criteria:

- The output shows a single value for each of the following: annual average solar power generation, average power generation for each quarter, average daily power generation and peak daily power generation.

Notes: Power generation per quarter can be compared to the customer's electricity bills

| Story ID: 7 | **Disclaimer** | Priority: M | Story Points:1 |

As an installing company I want a clear disclaimer to be shown to users so that they understand the nature of the estimate, its reliance on their data, and that the calculator is meant as a guide rather than an accurate tool.

Acceptance Criteria:
- The disclaimer should be shown on the help page for the website or on a help page for the android application.
- The disclaimer should be shown at the bottom of printable reports.

Notes: There may be tools to automatically generate an appropriate disclaimer

| Story ID: 52 | **Environment Configuration** | Priority: M | Story Points:2 |

As a developer I want to configure my environment so that I can start the development

Acceptance Criteria: Setting up Eclipse Juno & Helios, installing Eclipse plug in for GIT & Android (ADK)

Notes:

| Story ID: 55 | **Backend** | Priority: M | Story Points:16 |

As a developer I want to configure the backend components so that I can implement the solution according to specification related to unit testing, coverage, etc.

Acceptance Criteria:

- 90% of the operation must have a unit test

- 90% of the code must covered

- Create neccessary classes and databases

Notes:

| Story ID: 56 | **Basic Entry Form** | Priority: M | Story Points:4 |

As a potential customer I want the calculation tool to provide an entry form so that I can enter data to perform calculations.

Acceptance Criteria:
- Entry form is provided containing fields for general customer information, location, roof, equipment, hours of sunlight

Notes:

No database-tables created, because that might be part of user-profile & save stories (tbd)

2. Interation

Story ID: 2	**Payback Period**	Priority: M	Story Points:8

As a Potential Customer I want the system to be able to show me how long it will take to pay off a solar system so that I can decide whether I should install a solar system.

Acceptance Criteria:

- The payback period should be listed in the financial section of the output screen as a single value.

- Period should be rounded to the nearest year.

Notes:

Time for Implementation: 4h

Story ID: 3	**Solar Radiation**	Priority: M	Story Points:2

As a Potential Customer I want the system to accurately determine solar radiation at my location so that an estimate of power throughput is based on the local average of solar radiation available at my location.

Acceptance Criteria:

- Uses latitude to work out typical solar radiation
- Takes into account average cloud cover
- User can override the calculated value solar radiation value

Notes: : Investigate websites that provide solar radiation information. Will depend primarily on location

| Story ID: 4 | ROI Calculation | Priority: M | Story Points:4 |

As a potential customer I want to calculate the Return of Investment over a specified period of time of a possible solar panel installation so that justify the purchase of a solar panel system.

Acceptance Criteria:
- The ROI period can be customised by the user but defaults to 25 years
- The ROI output shows a table or graph of the ROI at annual intervals up to the specified period of time

Notes: The maintenance costs should be included in the calculation
Dependant on story 56

Story ID: 5	**Printable Report**	Priority: M	Story Points:2

As a potential customer I want to be able to produce a printable report so that I can print the result of the calculation.

Acceptance Criteria:

- The report should either be a web page that can be printed on a single A4 page or an A4 PDF file.

Notes: Report can be either a single calculation or a comparison of multiple calculations.

Time for Implementation: 8h

| Story ID: 31 | **Send Report via Email** | Priority: S | Story Points:2 |

As a sales person I want to be share the calculation results so that I can provide information to my customers.

Acceptance Criteria:

- The process of sharing should be completed easily. So in the final screen there will be a button "send email". Then the sales person can input his customer email and send the report to them.

Notes: Shared via email in form of PDFs and/or links

| Story ID: 11 | **Default Values** | Priority: S | Story Points:2 |

As a potential customer I want the calculator tool to minimise my input by using default values where appropriate so that I am able to complete a calculation without performing intense research upfront.

Acceptance Criteria:

- Default values are provided for all values except Location.

Notes: It should be possible to get typical results by choosing a location only.

Time for implementation: 8h

| Story ID: 13 | **Setting customization** | Priority: S | Story Points:1 |

As a potential customer **I** want to be able to overwrite automatic settings offered by the calc tool so that **I** can improve the values provided.

Acceptance Criteria:

- Allow to change the default setting in each field of input required for the calculation

Notes:

Time for Implementation: 1h

Story ID: 18	**Default values given**	Priority: S	Story Points:1

As a Potential Customer I want the system to provide common equipment default values so that I can get a good idea of what to expect without having decided on specific details.

Acceptance Criteria:

- Each equipment listed will be provided with average values of possible their possible values

Notes: Assuming data is available. List of equipments would be given to the user to choose. Dependant on 11.

Time for Implementation: 4h

Story ID: 25	**Roof Size Input**	Priority: S	Story Points:1

As a potential customer I want to input my roof size so that the system can tell me how many panels I am able to install.

Acceptance Criteria:

- in the roof input screen, two extra input fields will be provide for roof
    dimension in cm

Notes: The story is considered for manual input only

Dependant to equipment information

Time for Implementation: 2h

Story ID: 28	**Panel Angle Input**	Priority: S	Story Points:2

As a potential customer I want to be able to input more information about panels angles so that the calculations is more accurate.

Acceptance Criteria:
- In the equipment screen, when the equipment is angle customized, the system will provide in extra input field to enter the angle in degress

Notes:
- Research customized solar equipments based on angle

| Story ID: 32 | **Tabbed User Navigation** | Priority: S | Story Points:4 |

As a sales person I want the system to be able to access and change all calculation details quickly so that I can quickly answer questions for potential customers.

Acceptance Criteria:
- The system will provides five tabs such as: location, roof information, equipment, current electricity usage and report.
- The user will be able to navigate through the tabs and change the information in any order.

Notes:
- Tabbed navigation will be used in the Web module and in the Android module.

2. Release

3. Interation

| Story ID: 9 | **Edit Calculations** | Priority: S | Story Points: 8 |

Edit Calculations

Story ID: 9 — **Priority: S** — **Story Points: 8**

As a potential customer I want to be able to change the details of a current or past calculation so that I am able to adapt my calculation to changes.

Acceptance Criteria:
- A tabbed pane implementation for different parts of the calculation input is provided to allow users to switch between different calculation steps and change them.
- Past calculations can be loaded from a user's profile and then edited.
- The user can return to a previous input field at any time.

Notes: There are two parts to this story - Past calculations and current calculations. Past calculations can be 'loaded' and turned into a current calculation. The maintenance costs should be included in the calculation.

Dependant on Story 14

| Story ID: 14 | **Template generation** | Priority: S | Story Points:8 |

As a potential customer I want to be able to save my old calculations so that I am able to use them as a template for new calculations or review them.

Acceptance Criteria:

-- Retrieve previous calculation made

-- Change values of previous calculation

-- Save calculation

Notes: Dependancy with 15

Story ID: 15	**Save for later usage**	Priority: S	Story Points:2

As a potential customer I want to be able to save during data entry and continue to work on the calculation later so that I am not forced to finish the calculation in one sitting.

Acceptance Criteria:
- Have a save button to save user
- At front page have a button that enable user to continue on a previous calculation made before

Notes: Dependant from 14 & „User Login"

Time for Implementation: 8h

| Story ID: 23 | **Graphical output** | Priority: S | Story Points:8 |

As a potential customer I want the system to be able to show financial and energy information graphically so that it is easier to understand and analyse.

Acceptance Criteria:

- Apart from the table output, user can click view graphical information
- One bar graph comparing current energy cost and costs using solar power will be provided

Notes:

- Dependancy with 10
- Research Android APIs for graphs

Story ID: 27	**User Profile**	Priority: S	Story Points:4

As a potential customer I want to save my profile so that I can keep my information for future calculations.

Acceptance Criteria:
- the user profile will be created when the user creates a new account with basic info (user email, password). And the profile can be changed on any time
- the profile also includes information such as, my profile, my current usage, my tariffs and fees, my color scheme

Notes:
- to enter the system the user is obligated to login

4. Interation

| Story ID: 10 | **Compare Results** | Priority: S | Story Points:16 |

As a potential customer I want to compare different calculations easily so that I am able to find the investment that suits my ideas and possibilities the most.

Acceptance Criteria:

- Results from different calculations are displayed in aligned columns
- Graphical results are displayed on a single graph where appropriate (Eg. ROI)
- Different calculations can be compared by saving calculations that need to be compared

Notes: Highlighting of import information like "Overall Costs", "Break Even", "ROI", "Amount of Energy generated", "Investment Costs„.

Dependant on 23 & 14

Story ID: 12	**Localization with a smartphone**	Priority: S	Story Points:8

As a potential customer I want to use my smartphone to locate my position/latitude so that I don't have to use a map.

Acceptance Criteria:

- Position and latitude automatically generated in the location input

Notes: Location specified via GPS, compass and will be synchronised with the application device.

| Story ID: 17 | **Automatic localisation** | Priority: S | Story Points:4 |

As a Potential Customer I want the system to let me select my location from google maps so that I don't have to enter my location manually.

Acceptance Criteria:

-- Identify my current location

-- input current location into the location input

Notes:

Story ID: 24	**Equipment maintenance cost**	Priority: S	Story Points:1

As a potential customer I want to see the annual maintenance costs so that I can plan my budget.

Acceptance Criteria: Expected fix costs and variable costs
- Apart from the total system cost the system will show the estimate cost with maintenance per year
- Maintenance information will be shown in the Equipment screen and also in the final report

Notes:

-This is included in the output report.

- Need a good source of information for solar power equipment (needs interned research

Dependant for equipment information

Time for Implementation: 2h

| Story ID: 29 | **Specific final report for sales person** | Priority: S | Story Points:1 |

As a sales person I want to be able to generate an one page overview about the calculation details so that all relevant information is accessed easily.

Acceptance Criteria:

. - While creating the profile the user defines his role (sales person, prospective owner, current owner), so the system can decide what is the best report to show

. - Reports for sales person must compares at least one similar equipment in the same report

Notes:

- We need to refine the specific fields relevant for sales person

3. & 4. Release

| Story ID: 8 | **Google Maps Roof Direction** | Priority: S | Story Points:8 |

As a Potential Customer I want to check my roof orientation using Google Maps so that I am able to figure out the correct direction without using any additional equipment.

Acceptance Criteria:

- A compass (or similar) is projected onto Google Maps at the desired location
- An input field is located near the Google Maps projection such that users can read the compass direction off the map and input it directly into the input field.

Notes: URL with example is http://www.renewable-energy-concepts.com/german/sonnenenergie/basiswissen-solarenergie/ausrichtung-azimuth-stromertrag.html (German Website)

| Story ID: 16 | **Power statistic comparison with neighbourhood** | Priority: S | Story Points:32 |

As a Potential Customer I want the system to be able to provide me with power throughput statistics for other solar system owners in my area so that I can gain a realistic idea of what to expect from a solar system.

Acceptance Criteria:

- Show in a map the statistics of the neighborhood within a range of up to 5 kilometers

- If there is no neighbors, show the average statistics of the city in a map

Notes: E.g see http://www.tpg.com.au/maps/.

Assuming that there is no existing database.

| Story ID: 19 | Up to date tariff and rates customised to location | Priority: S | Story Points:4 |

As a Potential Customer I want the system to include up to date information about tariffs and rates in my location so that I don't have to research the information myself.

Acceptance Criteria:

- Information of the tariff and rates based on the location given by users should be no more than 1 month out of date.

Notes:
- Find websites that provide information.
- Web administrator will need to change information monthly

Story ID: 20	**Equipment Optimisation**	Priority: S	Story Points:8

As a Potential Customer I want the system to be able to optimise the solar system equipment so that I do not have to work out the optimal set up manually.

Acceptance Criteria:

- Based on inputs such as location, roof size and roof position the equipment input provides default values in

order to produce the maximum energy.

- Number of Panels for each roof side (North or South) will be suggested

Notes:

- If the equipment input is the first screen then after entering the location and roof inputs the system will prompt a message asking if the user wants to replace the equipment info with default values

Story ID: 21	**Android detect roof position**	Priority: S	Story Points:8

As a Potential Customer I want to be able to tell the system which direction my solar panels are pointing using the android compass so that I don't have to manually enter the information.

Acceptance Criteria:

- Android device captures the house position and matches with the GPS position,

- User must accept the position suggested or change that manually

Notes:

- That information will be provided in the Roof position input screen. User can input position manually or select Android detection

| Story ID: 22 | **Input guidance** | Priority: S | Story Points:2 |

As a Potential Customer I want the system to be able to provide additional guidance on inputs when required so that I can complete the calculation accurately if I do not have the required background knowledge.

Acceptance Criteria:

- Have a help sign like "? " next to the input area where user can click to get more information about the sort of input that it is required

Notes: Context help could be used.

Story ID: 26	**Reverse Calc - Equipment suggestion**	Priority: S	Story Points:4

As a potential customer I want the calculator to give me suggestions about the equipment based on my electricity needs so that I can get the right choice for my needs.

Acceptance Criteria:
- in the screen "Current Usage" the user can decide to go further with normal calculation or the user can choose "see suggested equipment"
- the system must allow the user to keep the suggest equipment or back to the previous selected equipment

Notes:
- Preserve the pre-entered equipment info in memory

| Story ID: 30 | **Customised Report** | Priority: S | Story Points:4 |

As a sales person I want to be able to decide what information is shown on an overview page so that I can produce individual pages for my customers.

Acceptance Criteria:

- - Part of the user profile will be the fields to be show in the calculation (columns in the report). Also, the period of time used for the calculation can be customized.

Notes:

- - We need to defined in details what fields will be part of the report.

| Story ID: 33 | **Customised Report 2** | Priority: S | Story Points:2 |

As a sales person I want the calculation tool to be able to see calculation details if required so that I can confirm the calculations are correct and have confidence I am providing accurate information to clients.

Acceptance Criteria:

- When the user profile is "sales person" the final report will provide some extra information about the calculation. For example: hard coded values and formulas

Notes: Help page with formula(s)

| Story ID: 34 | **Configuration Comparison** | Priority: S | Story Points:4 |

As an existing solar system owner I want the system to be able to compare my current configuration with an alternative configuration so that I can determine whether I should upgrade my solar system.

Acceptance Criteria:
- Output configuration from comparison is provided
- Upgrade suggestion is displayed

Notes:
- Should the user provide the configuration settings?
- Dependant to 10.

| Story ID: 35 | **Energy Earning Comparison** | Priority: S | Story Points:4 |

As an existing user I want to enter the amount of energy I collected so that I can compare my real „energy earnings" with the estimated figures.

Acceptance Criteria:

- Amount is entered correctly

Notes: Comparison on daily/monthly basis.

| Story ID: 36 | **Annual Power Generation** | Priority: S | Story Points: 2 |

As an existing owner I want to see the ideal annual power throughput that my solar panel should be producing so that I can determine whether mine needs maintenance.

Acceptance Criteria:
- Final report should have a maintenance section that takes account of solar panel degradation.
- Annual power throughput is displayed in kilowatts

Notes:
- Need to research panels' decline in efficiency over time

Story ID: 37	**Extra Panel Required**	Priority: S	Story Points:4

As an existing owner I want to know how many extra solar panels I would need to buy if I introduced new appliances so that I can decide whether it is worth the investment.

Acceptance Criteria:
- Extra panels displayed based on new appliances provided

Notes:
- Expected cost for extra panels as well as expected number of panels required for an extra equipment should be displayed.
- Need to research panels' decline in efficiency over time

| Story ID: 38 | **Power Comparison** | Priority: S | Story Points:2 |

As an existing owner I want to compare my current solar power generation with a new one so that I can evaluate the performance of my solar power.

Acceptance Criteria:
- Outputs are calculated and difference provided in kilowatts

Notes:
- Need to know info about panel and other equipment used

Story ID: 39	**Database Update**	Priority: S	Story Points:4

As an administrator, I want to be able to update database information within the system so that it remains up to date.

Acceptance Criteria:
- Database can be accessed and updated

Notes:
- Need to know info on fees/tariffs, equipment, cost, etc

Story ID: 40	ROI Comparison	Priority: C	Story Points:2

As a Potential Customer I want the system to be able to compare the ROI from a solar system to a high-interest savings account so that I can select the best economical choice.

Acceptance Criteria:

- The ROI period should be customisable (default 25 years)

Notes:

• ROI can be displayed in range of years

• Dependant to 4

Story ID: 41	**Equipment Selection**	Priority: C	Story Points:16

As a Potential Customer I want the system to allow me to select the equipment I am considering from a provided list so that the provided calculations are accurate for my situation.

Acceptance Criteria:

- Equipment is selected correctly
- Calculations based on selected equipment is accurate

Notes:

- Needs to include old/outdated equipment for existing owners.
- Research for 42 done here.
- Can equipment also be entered?

| Story ID: 42 | **Cost Estimates** | Priority: C | Story Points:2 |

As a Potential Customer I want the system to provide me with estimates of equipment costs so that I have enough information to select the appropriate equipment.

Acceptance Criteria:

- Cost estimates of equipment are provided
- Appropriate equipment is selected

Notes:

- Equipment costs must be kept current

Story ID: 43	**Installation Time**	Priority: C	Story Points:2

As a potential customer I want an estimate of how long it takes to set up the solar power so that I can plan my personal schedule around the installation.

Acceptance Criteria:
- Duration given is days

Notes:
- Does it depend of number of people involved in installation?
- Who will performed the installation?

| Story ID: 44 | **Installation Steps** | Priority: C | Story Points:2 |

As a potential customer **I** want the system to create a list of further steps towards installation so that **I** know how to proceed.

Acceptance Criteria:
- Steps are provided accurately

Notes:
. Research installation procedures from panel providers

| Story ID: 45 | **Panel Angles** | Priority: C | Story Points:8 |

As an existing owner I want the system to be able to recommend panel angles for different times of the year so that I can get the most power output from my system.

Acceptance Criteria:
- Recommandations for all seasons dependent on the location of the user as part of the output page.

Notes: Dependant on output page

| Story ID: 47 | **Extra Batteries** | Priority: C | Story Points:2 |

As an existing owner I want to know how many extra batteries I would need to buy if I introduced new appliances so that I can decide whether it is worth the investment.

Acceptance Criteria: Entry field for extra appliances. Result should show amount of batteries and the expected cost for purchasing them.

Notes: Dependant on list of possible equipment and their energy usage.

Story ID: 48	**Supplier Benefits**	Priority: C	Story Points:4

As a salesperson I want to see a summary of benefits for various suppliers so that I can sell my products to various types of customer needs.

Acceptance Criteria: List of suppliers and their products including information about cost, size and performance combined in one list.

Notes:

| Story ID: 49 | **Colour Scheme** | Priority: C | Story Points:4 |

As a sales person I want the system to be able to change the colour scheme of graphical outputs so that it can match my company's colour scheme.

Acceptance Criteria: Being able to add information about the color scheme to the user profile.

Notes: Not the screen, just the output. Customized output. Part of the user profile.

| Story ID: 50 | **Reminder-Function** | Priority: C | Story Points:4 |

As a sales person I want to have a reminder-function for the calculations so that I can use the calculation tool to remind me of calling old customers again.

Acceptance Criteria: Choose reminding-date with a calendar or enter it manually. Notification should be by email.

Notes:

| Story ID: 51 | **Non-calculation Data** | Priority: C | Story Points:2 |

As a sales person I want to be able to add notes to calculations so that I can collect non-calculation data about my customers.

Acceptance Criteria: Ability to add tags to categorise customers, as well as having a entry field to enter extra information

Notes: