Estimating solar power potential at neighbourhood level

How much Electricity can be generated in De Laarse, Enschede from Solar power?

INTRODUCTION

The capacity of solar power in the Netherlands by the end of 2018 is about 4300 MW of PV. In 2018 about 1400 MW of new capacity was installed, which was second highest in Europe last year. Also where class size of installation capacity was below 10kW covered 79% of the total market share in Netherland. This indicates the usage at small scale production is very high. Advantages of installing solar PV systems reduces wasteful consumption habits , eliminate need for extra land and improve cost savings in communities. Thus need for conducting the study arises.

KEYMAP

THE NETHERLANDS (SOURCE: SKETCH BUBBLE)

FIGURE 1: METHODOLOGY

DIGITAL ELEVATION MODEL(AHN 2 5m)-> HILLSHADE for 3D effect

BUILDING FOOTPRINTS FOR NEIGHBOURHOOD

1 DATA COLLECTION AND PREPARATION

EXECUTE AREA SOLAR RADIATION(SPATIAL ANALYST)

RASTER CALCULATOR FOR UNIT CONVERSION (ASR/1000)

MAPPING SOLAR ENERGY **2**

CREATE **SLOPE ASPECT FROM DEM**

PERFORM QUERY FOR CRITERIAS(mentioned in map)

CREATE ZONAL STATISTICS FOR BUILDINGS(COUNT, AREA, MEAN)

3 IDENTIFY SUITABLE ROOFTOPS

CALCULATE USABLE SOLAR RADIATION(AREA * MEAN / 1000)

CALCULATE ELECTRIC POWER PRODUCTION (15% EFFICIENCY * 86%PERFORMANCE RATIO * USABLE SOLAR RADIATION)
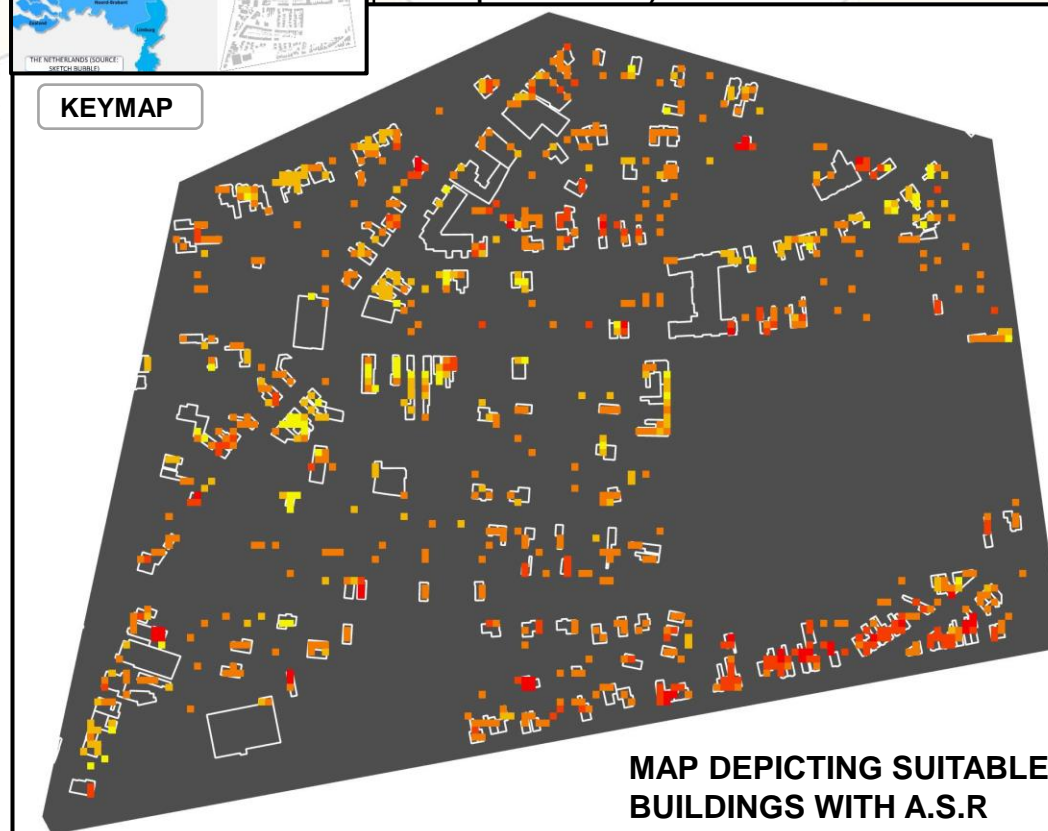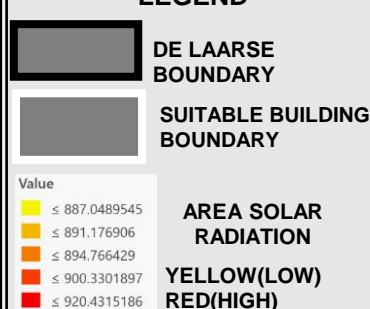
CALCULATE POWER/BUILDING **4**
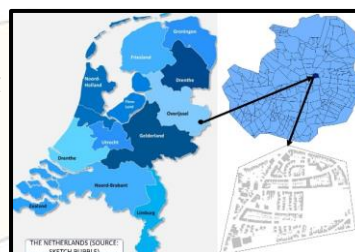
RESULTS/OUTPUT

Usable Solar Radiation in De Laarse – 14,665 MWh
Electricity Production Estimate – 1,892 MWh
Final Suitable rooftops Map(overlaps of ASR with rooftops boundaries):

MAP DEPICTING SUITABLE BUILDINGS WITH A.S.R

LEGEND	
▬	**DE LAARSE BOUNDARY**
▬	**SUITABLE BUILDING BOUNDARY**

Value
≤ 887.0489545
≤ 891.176906
≤ 894.766429
≤ 900.3301897
≤ 920.4315186

AREA SOLAR RADIATION
YELLOW(LOW)
RED(HIGH)

SPATIAL REFERENCE
PCS: RD NEW
GCS: AMERSFOORT
DATUM: D AMERSFOORT
UNIT: METERS

SCALE: 1:3600
Meters

CRITERIA:-
-- Slope Value > 10° ≤ 45°
-- Area Solar Radiation Value ≥ 800kWh/m²
-- Aspect Value >22.5 AND Value<337.5
-- Area of Building ≥ 30m²

N

FIGURE 2: FINAL SUITABILITY MAP

CONCLUSION

The output map is a overlay of all the maps generated from DEM like Slope, Aspect, Area Solar radiation*(space constraints/clarity/scaling issues, thus not displayed individually)* and their **intersection by queries/Con tool(Spatial Analyst).** This study in a nutshell, focused on the potential of producing electric power at a neighbourhood level by finding suitable rooftops for PV installations . The project can be done for specific seasons to come up with highest, lowest, average solar power production values as length of days & hours of sunlight are not same throughout the year.

FURTHER SCOPE/LIMITATIONS

- Analysis can be done on the Households on their usage of solar energy and the share of solar energy to the total energy consumption.
- Also the concept of SolaRoad can be worked upon, which focuses on harnessing energy from the Cycle Paths(50-70 kWh/sq.m. each year, can power street lights, traffic lights, EV's etc.)
- Further detailed studies can be conducted on Feasibility and Implementation of project.
- The consumption pattern in US per household might differ from that in NL.

ABBREVIATIONS

- DEM – Digital elevation model
- ASR – Area solar radiation
- AHN – Actueel Hoogtebestand Nederlands
- CON – Conditional tool spatial analyst

UNITS/FACTORS

- Wh/m² - watt hours per square meters
- kWh/m² - kilo watt hours per square meters
- MWh – mega watt hours
- 0.15 – Efficiency factor of solar panel
- 0.86 - Installation Performance ratio of panel
- PV - Photovoltaics

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