

FIG WORKING WEEK 2019

22-26 April, Hanoi, Vietnam

Presented by the FIG Working Week 2019,
April 22-26, 2019 in Hanoi, Vietnam

"Geospatial Information for a Smarter Life
and Environmental Resilience"



Using high-resolution remote sensing images to detect suitable rooftops for solar PV installation in urban areas. Case study in Da Nang City

Presenter: Thanh Huyen Tran

*Institution: Center for Environmental Fluid Dynamics (CEFD),
University of Science, Vietnam National University (VNU – HUS)*

ORGANISED BY



PLATINUM SPONSORS





FIG WORKING WEEK 2019

22–26 April, Hanoi, Vietnam

"Geospatial Information for a Smarter Life and Environmental Resilience"



Introduction

- **Project's name:** "Assessment of Technical Rooftop Solar PV Potential in Vietnam"
- **Implemented by:** Effigis, Geo-Solutions Inc., Canada & CEFD
- **Donor:** World Bank
- **Area of Interest (AOI):** The most densely-populated urban areas in Da Nang City
- **Aims of the study:**
 - To detect, characterize and assess the solar PV potential of all Da Nang rooftops;
 - To apply 'good practices' criteria related to PV system implementation to rank their suitability.
 - Subsequently, the 500 most suitable rooftops were selected for terrain survey and upcoming PV implementation.

ORGANISED BY



PLATINUM SPONSORS





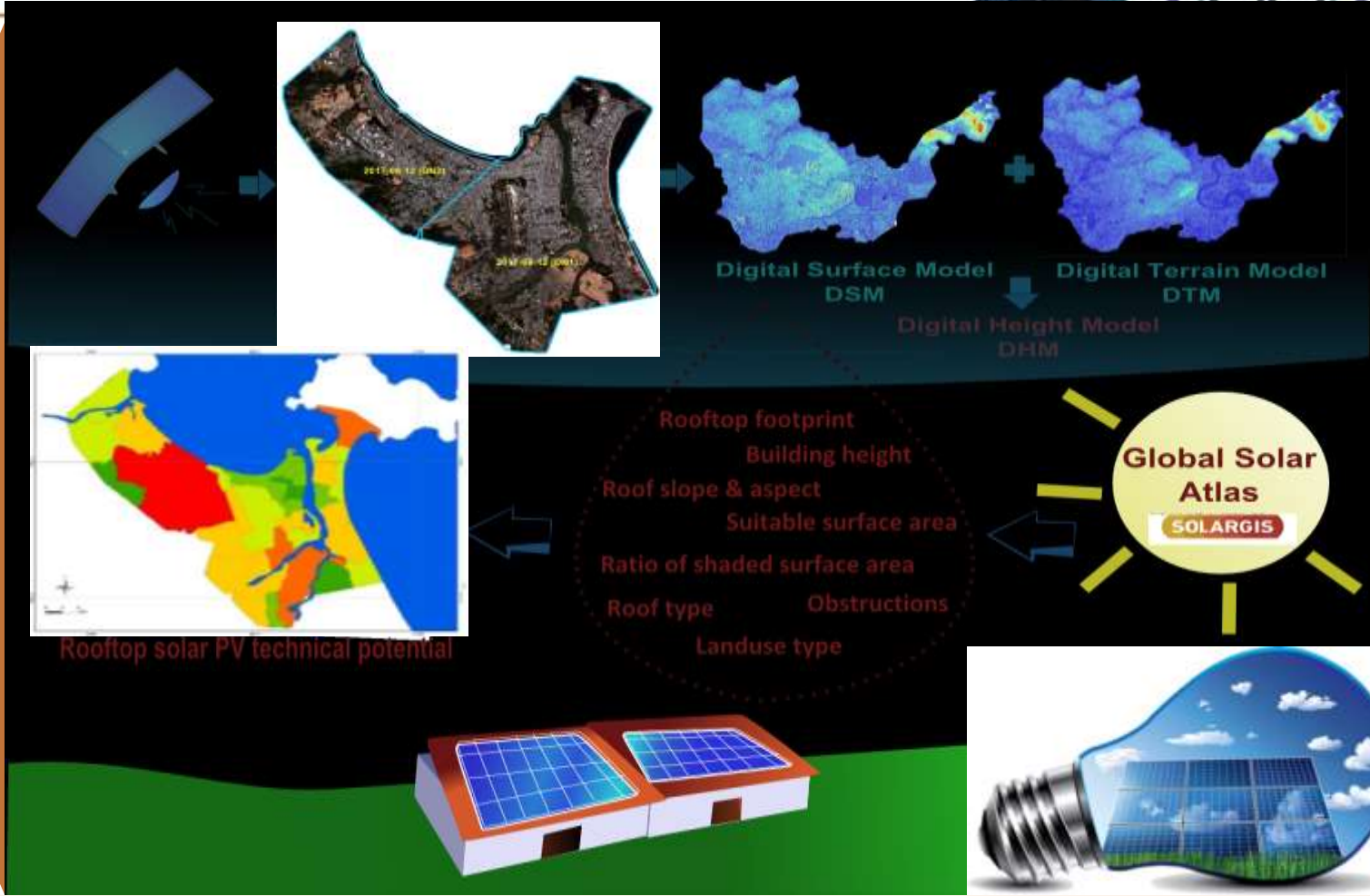
FIG WORKING WEEK 2019

22-26 April, Hanoi, Vietnam

"Geospatial Information for a Smarter Life and Environmental Resilience"



Approach
methods



ORGANISED BY



PLATINUM SPONSORS





FIG WORKING WEEK 2019

22-26 April, Hanoi, Vietnam

"Geospatial Information for a Smarter Life and Environmental Resilience"



Results from WV3 images

Flat without obstructions



Flat with 0 - 10 % obstructions



Flat with 10 - 30 % obstructions



Two-sided



Four-sided



Complex



Flat with > 30 % obstructions



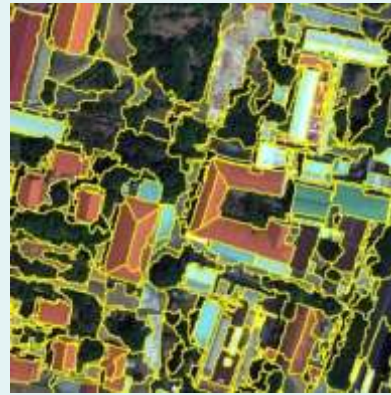
Curved



Circular



1: Segmentation



2: Classification



3: Fusion



4: Manual quality check



ORGANISED BY



PLATINUM SPONSORS

4





FIG WORKING WEEK 2019

22–26 April, Hanoi, Vietnam

"Geospatial Information for a Smarter Life and Environmental Resilience"



Some statistics

Surface areas

Total surface area of the AOI	174,690,000 m ² (175 km ²)
Total surface area of the detected rooftops	28,613,785 m ²
Total surface area of suitable rooftops	9,145,406 m ²
Surface area of suitable rooftops as percentage of total rooftops	32 %
Surface area of suitable flat rooftops without obstructions	3,967,929 m ²
Surface area of suitable flat rooftops with 0-10% obstructions	818,634 m ²
Surface area of suitable flat rooftops with 10-30% obstructions	376,657 m ²
Surface area of suitable flat rooftops with >30% obstructions	7,733 m ²
Surface area of suitable two-sided rooftops	3,681,278 m ²
Surface area of suitable four-sided rooftops	88,515 m ²
Surface area of suitable other (complex, curved, circular) rooftops	204,662 m ²

PV capacity

Total estimated roof PV capacity	1,140 MW
Estimated PV capacity on flat rooftops without obstructions	494 MW
Estimated PV capacity on flat rooftops with 0-10% obstructions	102 MW
Estimated PV capacity on flat rooftops with 10-30% obstructions	47 MW
Estimated PV capacity on flat rooftops with >30% obstructions	0.96 MW
Estimated PV capacity on two-sided rooftops	458 MW
Estimated PV capacity on four-sided rooftops	11 MW
Estimated PV capacity on other (complex, curved, circular) rooftops	25 MW

ORGANISED BY



PLATINUM SPONSORS





FIG WORKING WEEK 2019

22-26 April, Hanoi, Vietnam

"Geospatial Information for a Smarter Life and Environmental Resilience"



Data validation



Visual inspection and interviewing



3D model of rooftop



ORGANISED BY



PLATINUM SPONSORS





FIG WORKING WEEK 2019

22-26 April, Hanoi, Vietnam

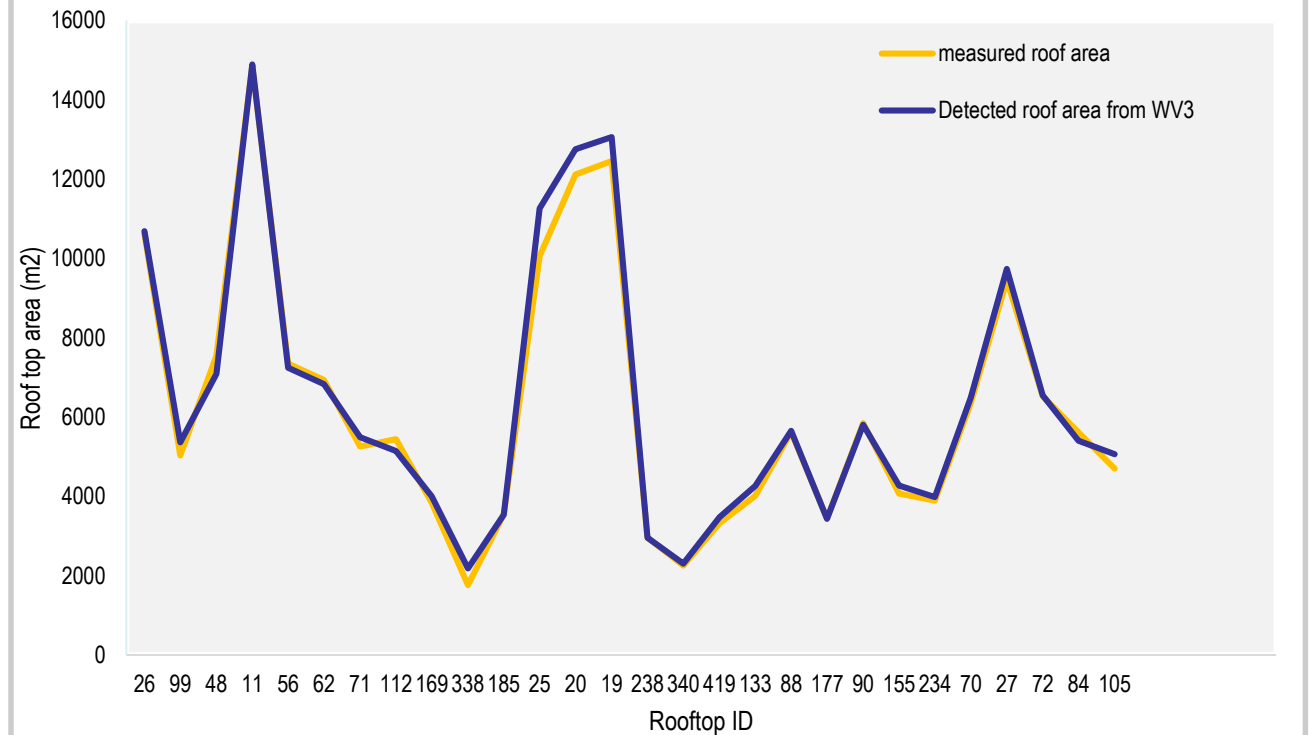
"Geospatial Information for a Smarter Life and Environmental Resilience"



Data validation

conducted survey of 108 rooftops to identify: rooftop area, height, slope, aspect, roof type, etc.

Validation of rooftop area



ORGANISED BY



PLATINUM SPONSORS





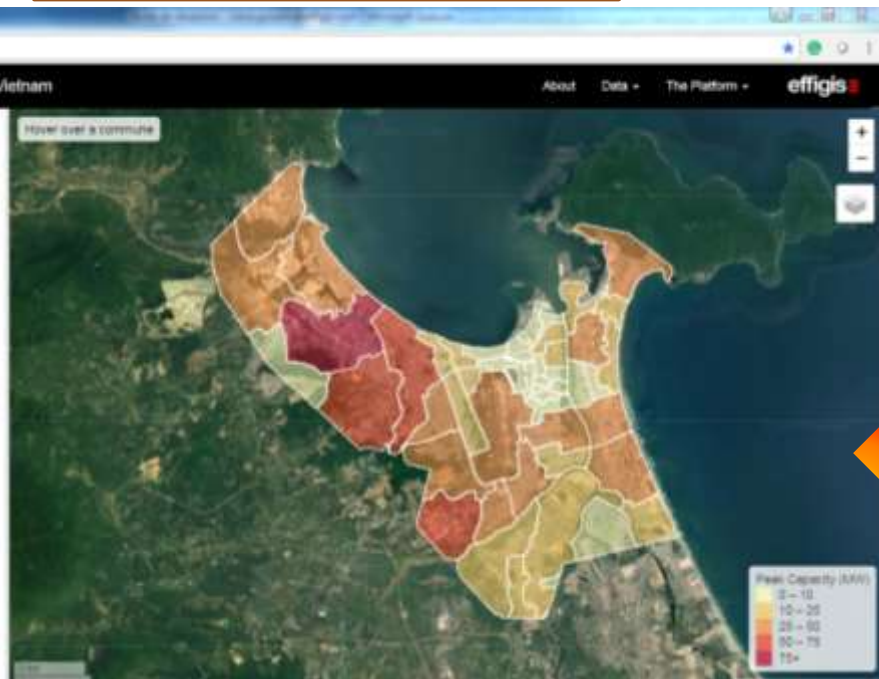
FIG WORKING WEEK 2019

22-26 April, Hanoi, Vietnam

"Geospatial Information for a Smarter Life and Environmental Resilience"



GEO Data mapping



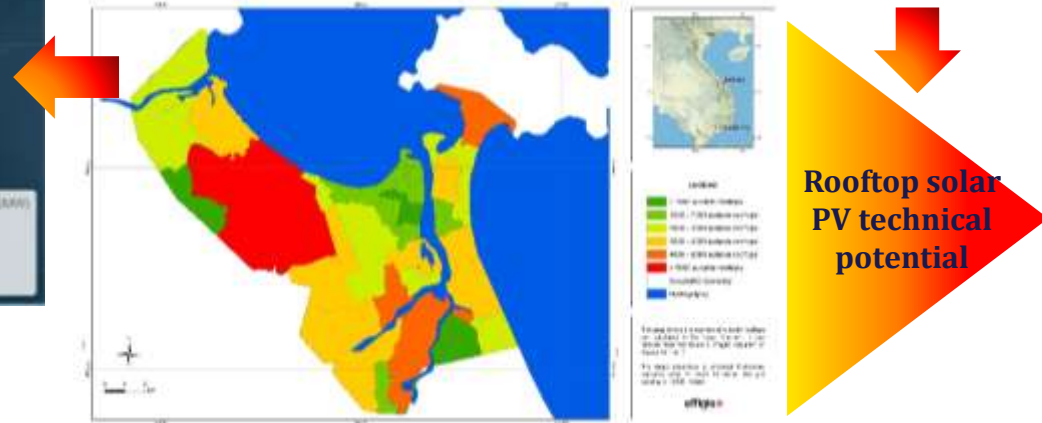
Web-based solar GEO Data



Derived rooftop technical information



Total yearly PV energy produced by Da Nang rooftops in MWh



Rooftop solar PV technical potential

ORGANISED BY



PLATINUM SPONSORS





FIG WORKING WEEK 2019

22–26 April, Hanoi, Vietnam

"Geospatial Information for a Smarter Life and Environmental Resilience"



Conclusions

- Da Nang City has a huge potential for producing PV electric energy from its rooftops (total estimated electricity potential: 3,200 GWh), in which large area rooftops share **52 % (of 1.1 GW)**
- The outcomes of this study support Da Nang decision makers to plan and develop the renewable solar energy sector
- Assuming only 5 % of all suitable rooftops are used for PV systems, **160 GWh (6.96 % of needs)** could be produced by solar PV sources. This proportion exceeds the governmental target of 6.5 % of renewable energy source by 2020

ORGANISED BY



PLATINUM SPONSORS





FIG WORKING WEEK 2019

22–26 April, Hanoi, Vietnam

"Geospatial Information for a Smarter Life and Environmental Resilience"



References

- N. M. Salih M. Kadhim, M. Mourshed, M. T. Bray, 2015, SHADOW DETECTION FROM VERY HIGH RESOLUTION SATELLITE IMAGE USING GRABCUT SEGMENTATION AND RATIO-BAND ALGORITHMS. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume XL-3/W2, 2015
- B. Y. and B. M. Dahmane M., Foucher S., Beaulieu M., Riendeau F., "Evaluation of Deep Features for Car Detection in Very High-Resolution Imagery.," *23rd Int. Conf. Pattern Recognition, December 2016, Cancun, Mex., 2016.*
- J. A. dos S. Penatti O. A. B., Keiller Nogueira, "Do Deep Features Generalize From Everyday Objects to Remote Sensing and Aerial Scenes Domains?," *IEEE Conf. Comput. Vis. Pattern Recognit. Work. 2015, 2015.*

ORGANISED BY



PLATINUM SPONSORS

