Wind and Solar Hybrid Farms

A wind flow analysis using WindSim

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REPOWERTECH

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About Us

Based in Austin, TX

Subsidiary of a Brazilian company Aeroespacial Ltd.

Main Services:

- Wind and solar sites prospective maps development
- Wind and solar farms evaluation and optimization
- Managing Measurement Campaign
- Special software development
- Bank reports
- WindSim Reseller

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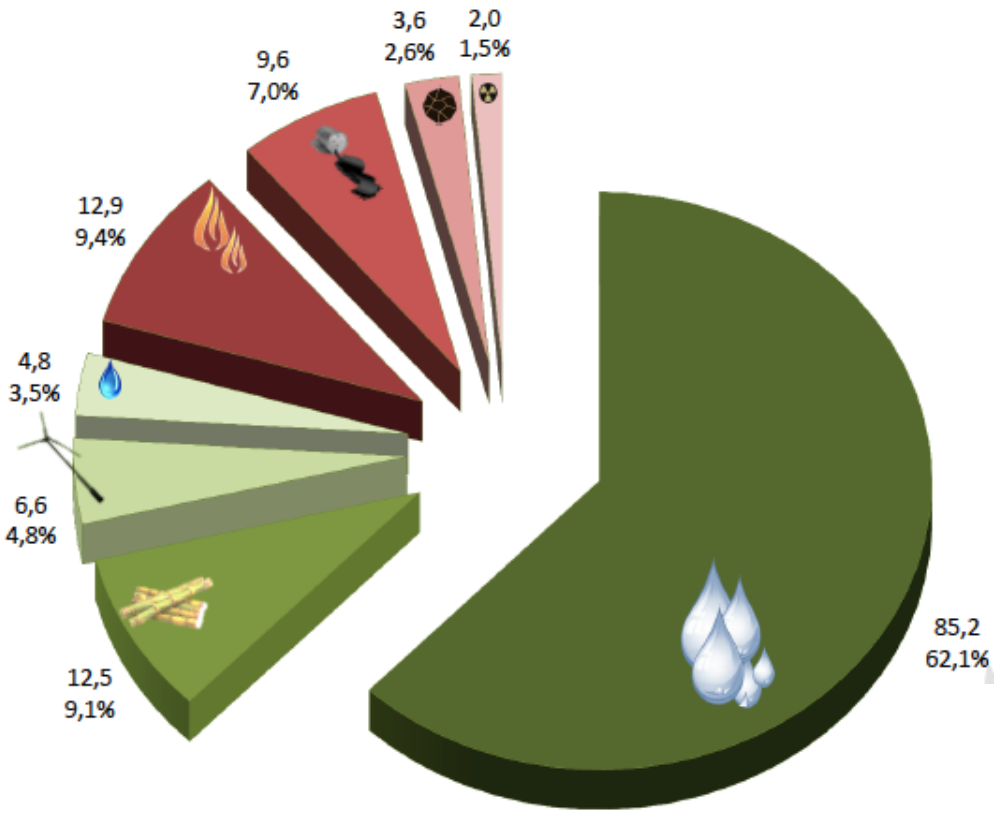
Brazilian Energy Matrix

Energy Matrix (GW)



- 62,1% Hydropower
- 9,4% Natural Gas
- 9,1% Biomass
- 7,0% Oil
- 4,8% Wind
- 3,5% small hydropower
- 2,6% Coal
- 1,5% Nuclear

* Solar only 15 MW of capacity installed

Source: ABEEólica Jun/2015

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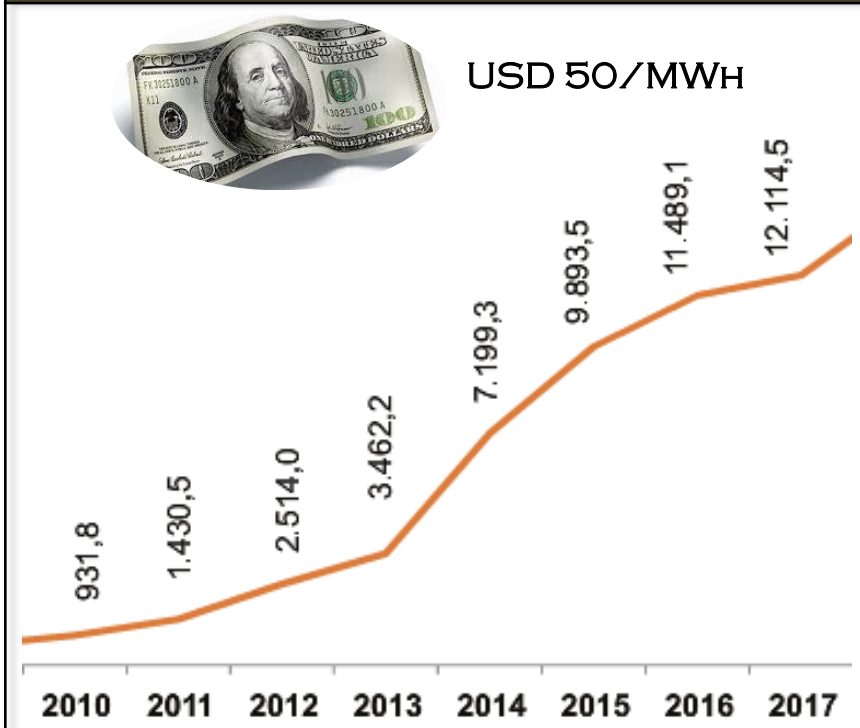
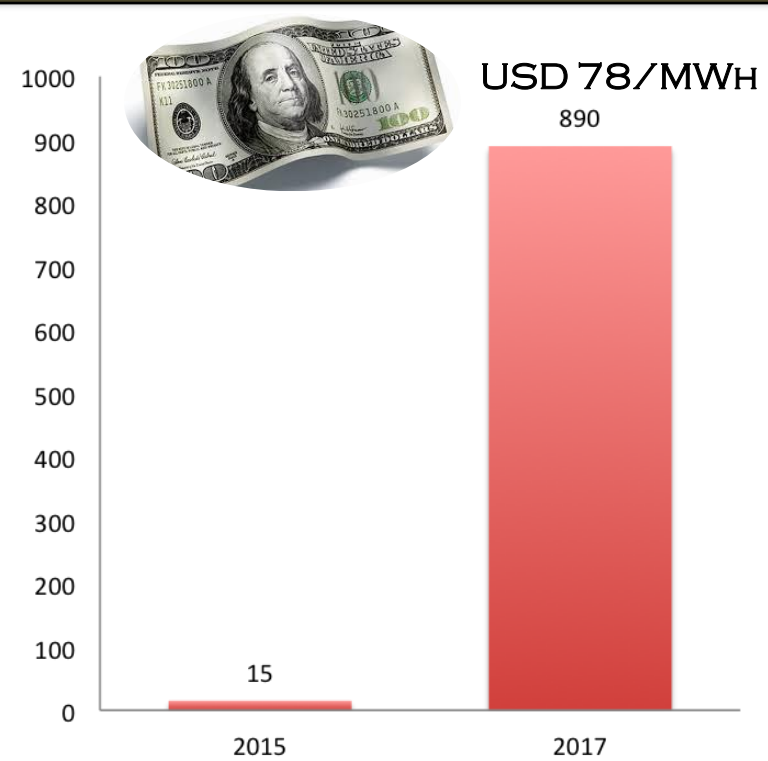
Wind and solar energy perspectives

Wind (MW)



Solar (MW)

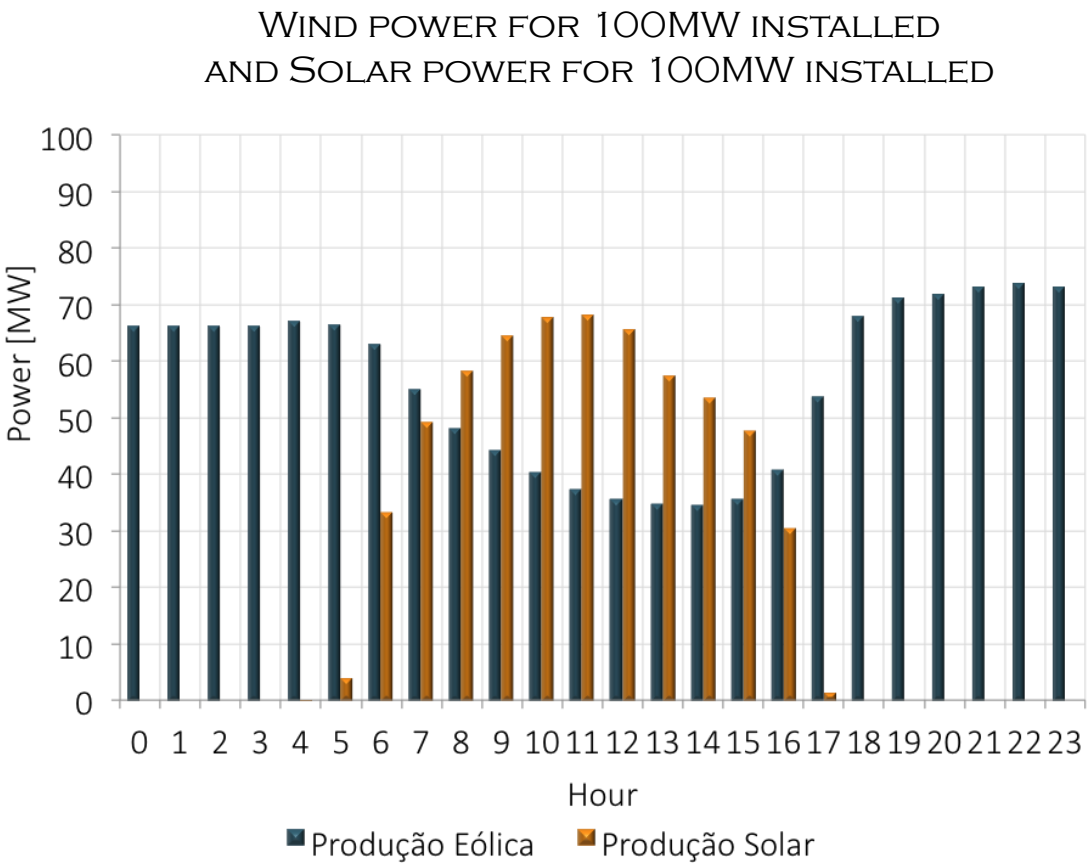


Source: Wind Energy Guide 2014/2015
Bloomberg

Wind and solar energy perspectives

Why hybrid farms?

- Large amount of solar farms will be built as hybrid farms
- Stabilization of the Energy Production
- Cost reduction – same grid connections, electrical paths, roads, equipment's, operation
- We certified 1GW of Solar power for next auction



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SIMULATIONS

Goal

- Analyse solar panels influence in front of wind turbine

Metodology

- 4 Scenarios
- Total Area of 4x4Km^2
- flat terrain
- Roughness of 0.3 (savanna)
- Obstacle (H: 2m and area: 600x400 m^2 – 24ha)
- Obstacle configured on "**use refinement file**"

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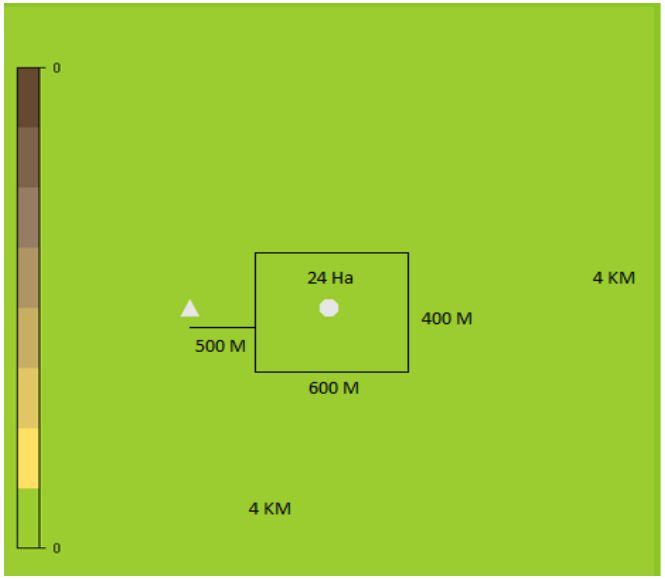
Simulations

Without obstacle	• Roughness of 0.3
Obstacle 1	• Simple obstacle • Solid
Obstacle 2	• Simple obstacle • Porosity 50%
Without obsctacle	• Roughness of 0.2 for 24ha



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Simulations

Variable	Parameters
Wind speed	8 m/s
Wind direction	90º
Air density	1.225
Turbulence model	Standard k-epsilon
Turbine	Eco122 2.7MW
Hub	89; 119;139
Diameter	122m
Distance between solar panel and turbine	500m
Solar panel area	24ha (600x400m^2)
Height of model	387.0 m
roughness	0.3 (savanna)
Stability	Neutral

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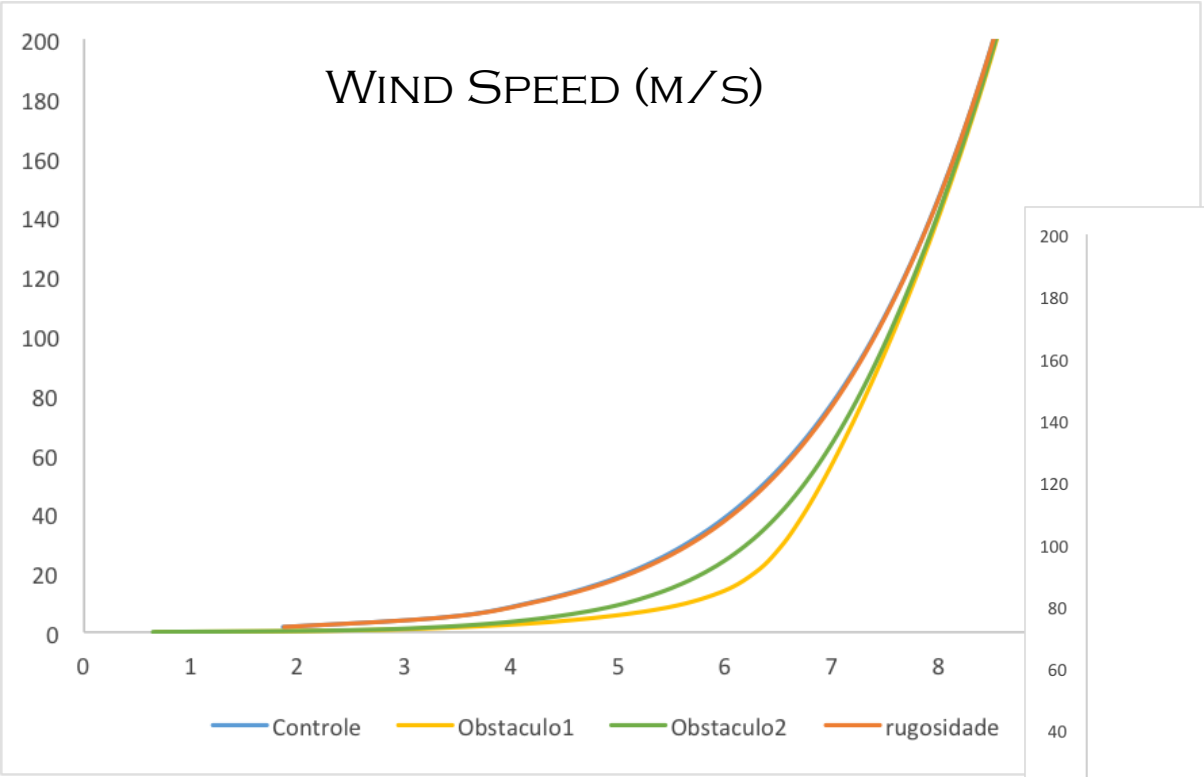
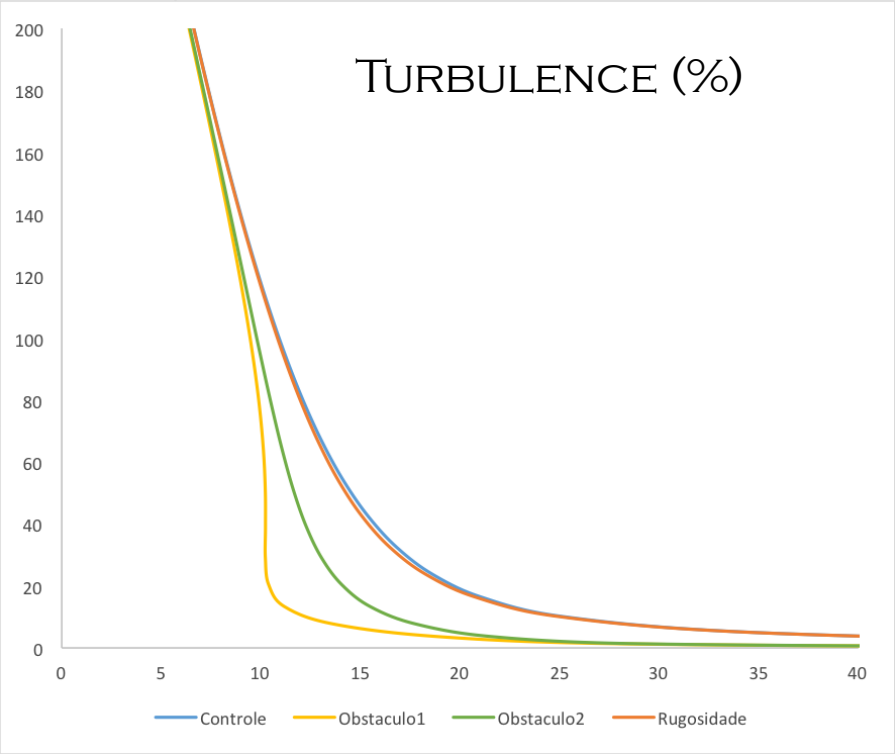
RESULTS





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RESULTS

Scenarios	Hub (m)	wind speed (m/s)	power density (W/m**2)	gross AEP (MWh/y)	Gain/ Loss (%)
Without obstacle	89	8,17	333,5	15.493,0	-
Without obstacle with r=0.2 for 24ha	89	8,18	334,6	15.536,7	0,28
Obstacle 1	89	8,32	352,9	16.205,8	4,60
Obstacle 2	89	8,14	330,9	15.395,4	3,55

Without obstacle	**119**	**8,68**	**400,0**	**17.832,1**	**-**
Without obstacle with r=0.2 for 24ha	119	8,68	400,4	17.843,6	0,06
Obstacle 1	119	8,66	397,5	17.747,8	0,86
Obstacle 2	119	8,71	404,7	17.986,0	0,66

Without obstacle	**139**	**8,96**	**440,1**	**19.118,3**	**-**
Without obstacle with r=0.2 for 24ha	139	8,96	440,1	19.118,9	0,00
Obstacle 1	139	8,93	436,0	18.988,7	-0,31
Obstacle 2	139	8,94	438,2	19.058,2	-0,27

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Real case: features

- Goal: install 130 MW in solar Plant
- WIND FARM of 432MW
- STAGE: Finalizing Construction
- 7 Met Mast – 4 year data
- 154 Wind turbines (ECO122 and GE)
- 500m distance between panels and turbines
- Roughness Map - 30 metros – GL30+Aeroespacial
- PVSyst to simulate the Solar energy production

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TAKEAWAYS

Hybrid farms is a new trend in Brazil

Solar capacity will increase significantly next years

Challenges to simulate hybrid farms

Windsim might play an important role, simulating the panels as obstacles, and providing special reports on the impacts on AEP

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Thank You!

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Transforming Science into Solutions

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