GOVERNMENT OF INDIA
MINISTRY OF NEW AND RENEWABLE ENERGY

नीवे NIWE

NISE

# Role of CFD and Aerodynamics in micrositing of SWES.

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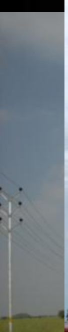
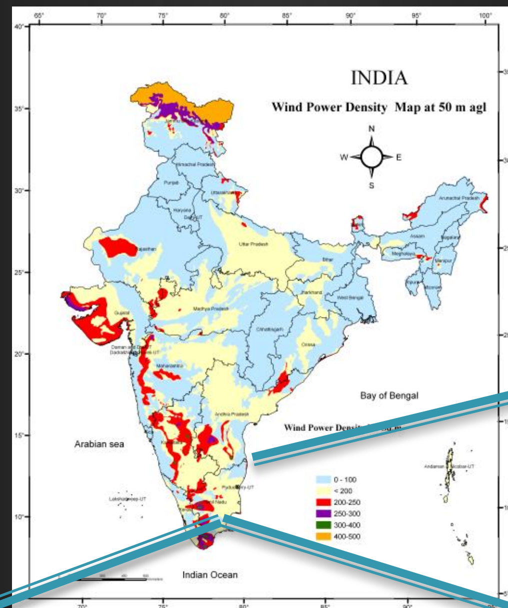
Director General , dg.niwe@gov.in
Niwe.res.in

NIWE is using 0.35MU units per year

Generates from Wind alone 20 times 7MU in 5-8 months

9 x 200kW
1x 600 kW
1x 2000kW
7 Million units (MU) to TNEB





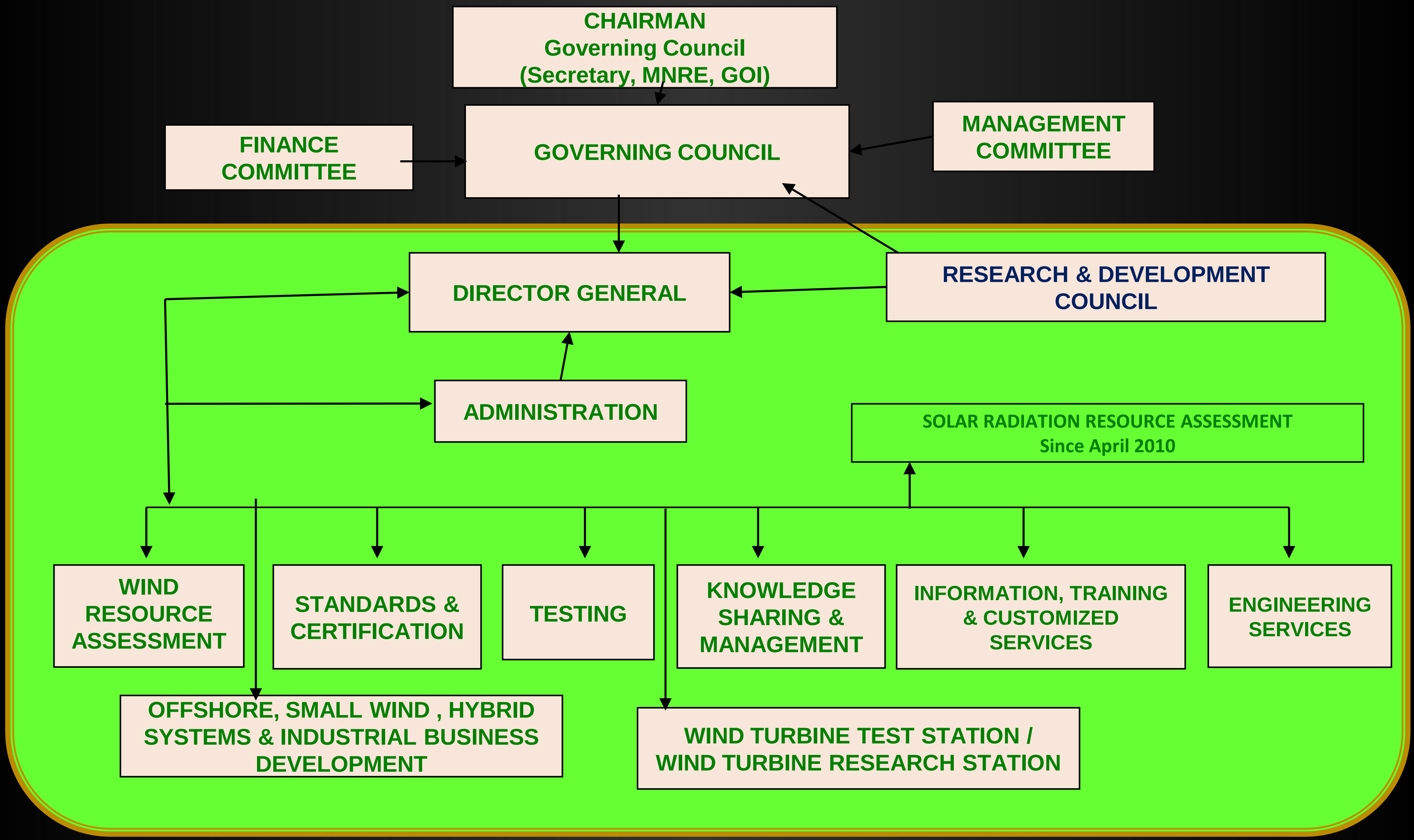

5 acres

ASSETS-NIWE

55 acres

72 WRA

121 SRRA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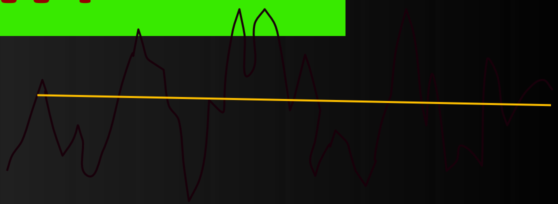
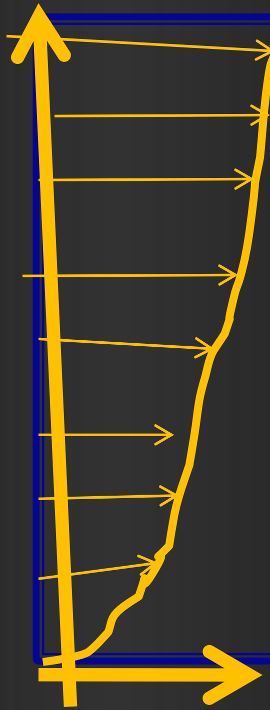
SOLAR RADIATION RESOURCE ASSESSMENT
Since April 2010
WIND RESOURCE ASSESSMENT
STANDARDS & CERTIFICATION
TESTING
KNOWLEDGE SHARING & MANAGEMENT
INFORMATION, TRAINING & CUSTOMIZED SERVICES
ENGINEERING SERVICES
OFFSHORE, SMALL WIND , HYBRID SYSTEMS & INDUSTRIAL BUSINESS DEVELOPMENT
WIND TURBINE TEST STATION /
WIND TURBINE RESEARCH STATION

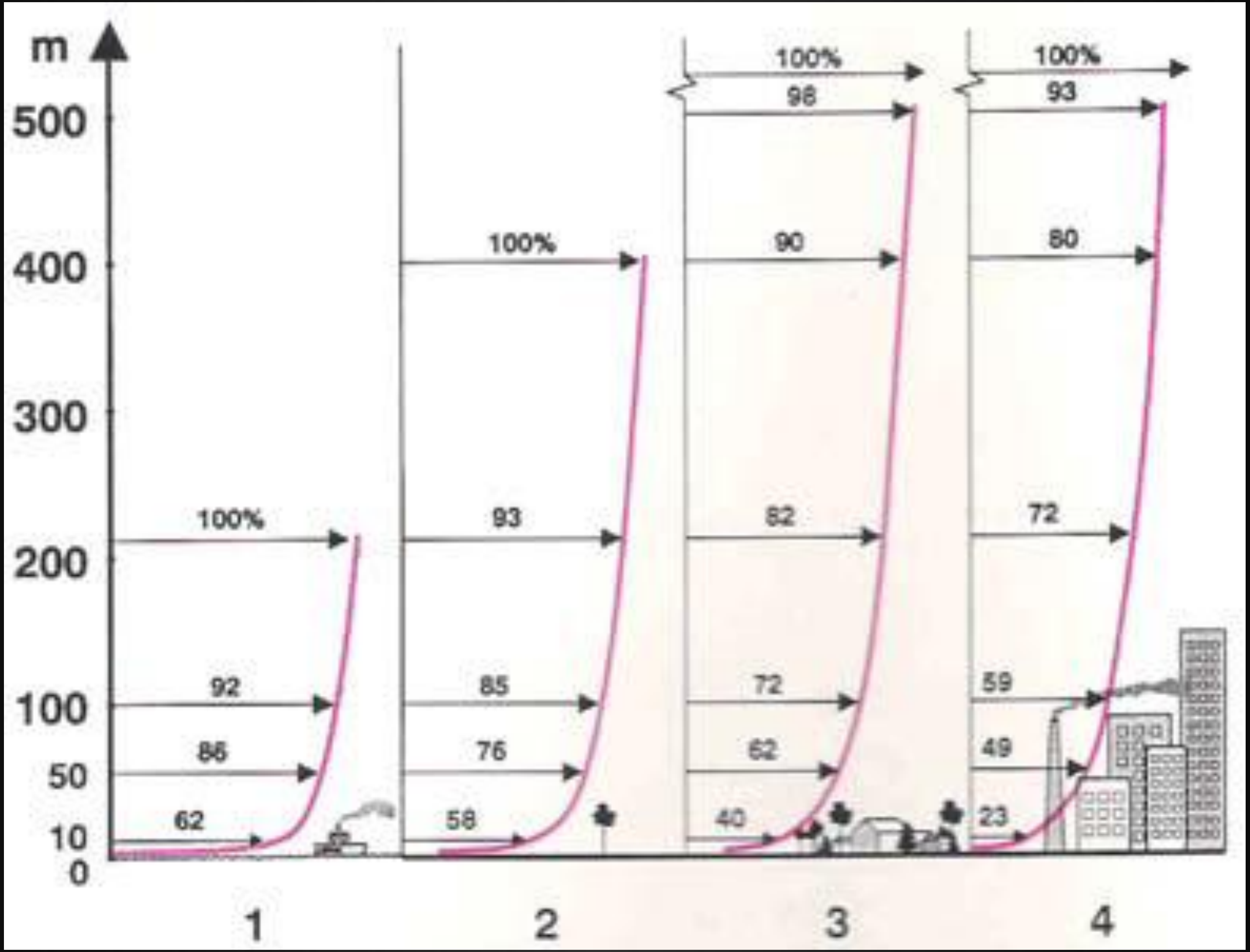
# Types of Wind turbines

**VAWT & HAWT**

$$P_{wind} = C_p \, 1/2 \, \rho A V^3$$







m
500
400
300
200
100
50
10
0
100%
92
86
62
100%
93
85
76
58
100%
98
90
82
72
62
40
100%
93
80
72
59
49
23
1
2
3
4


50
10
0
62
58
40
23
1
2
3
4

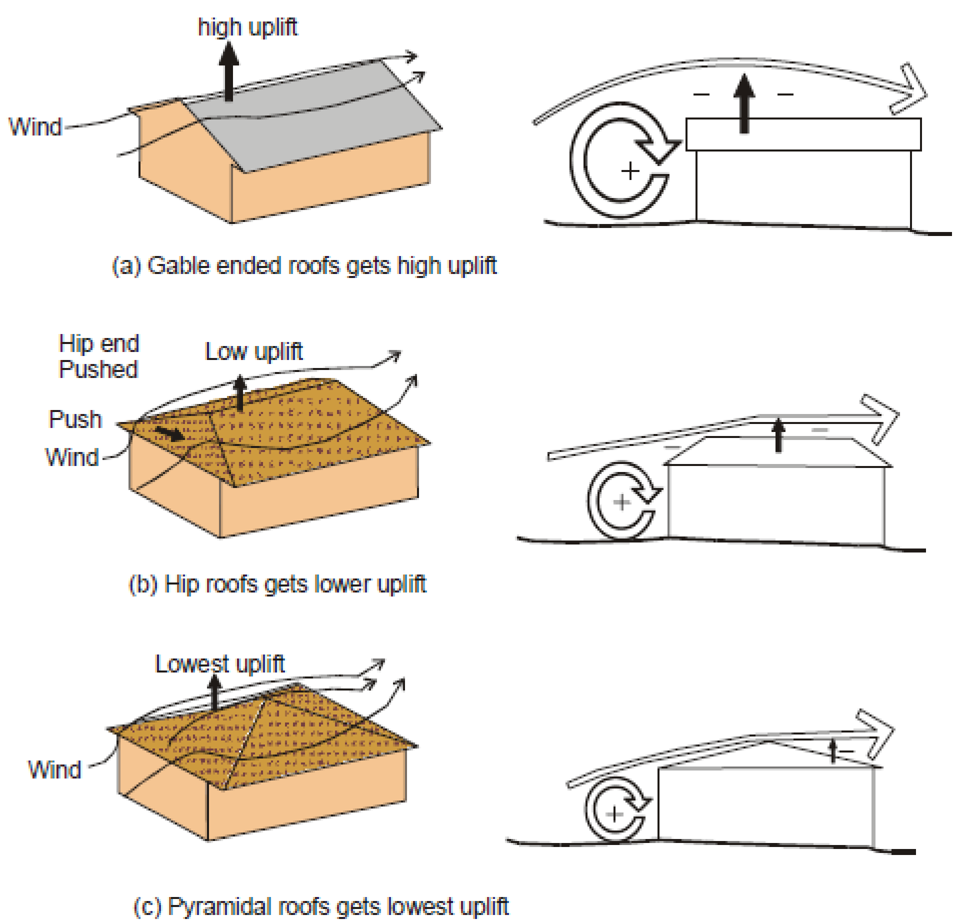



**Fig. C 5 : Effects of Roof Architecture on Uplifts**

# Power Co-efficients of Different Rotor

$$P_{wind} = C_p \, 1/2 \, \rho A V^3$$

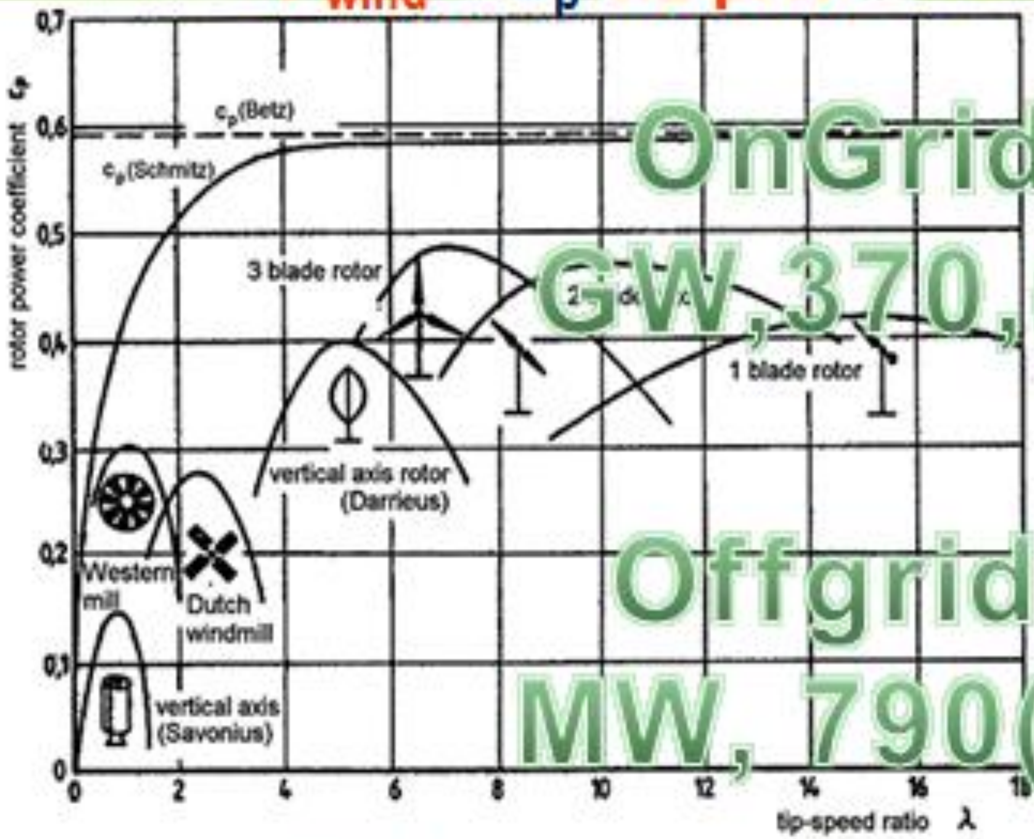
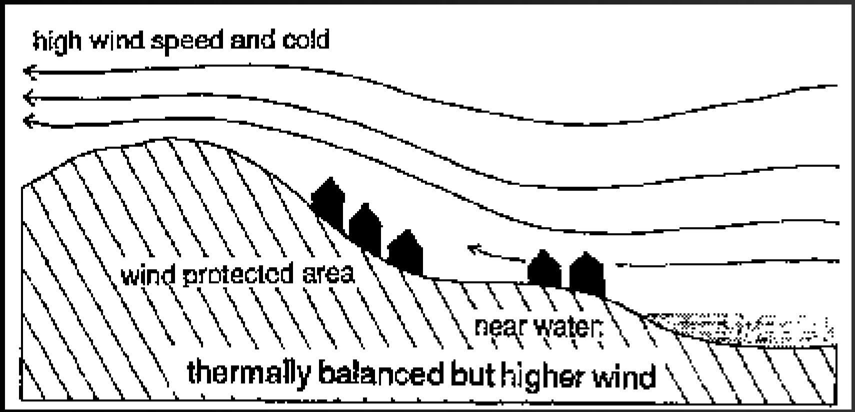
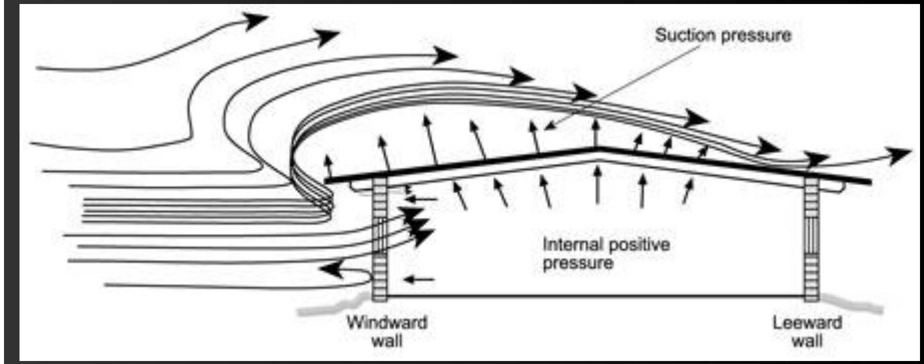


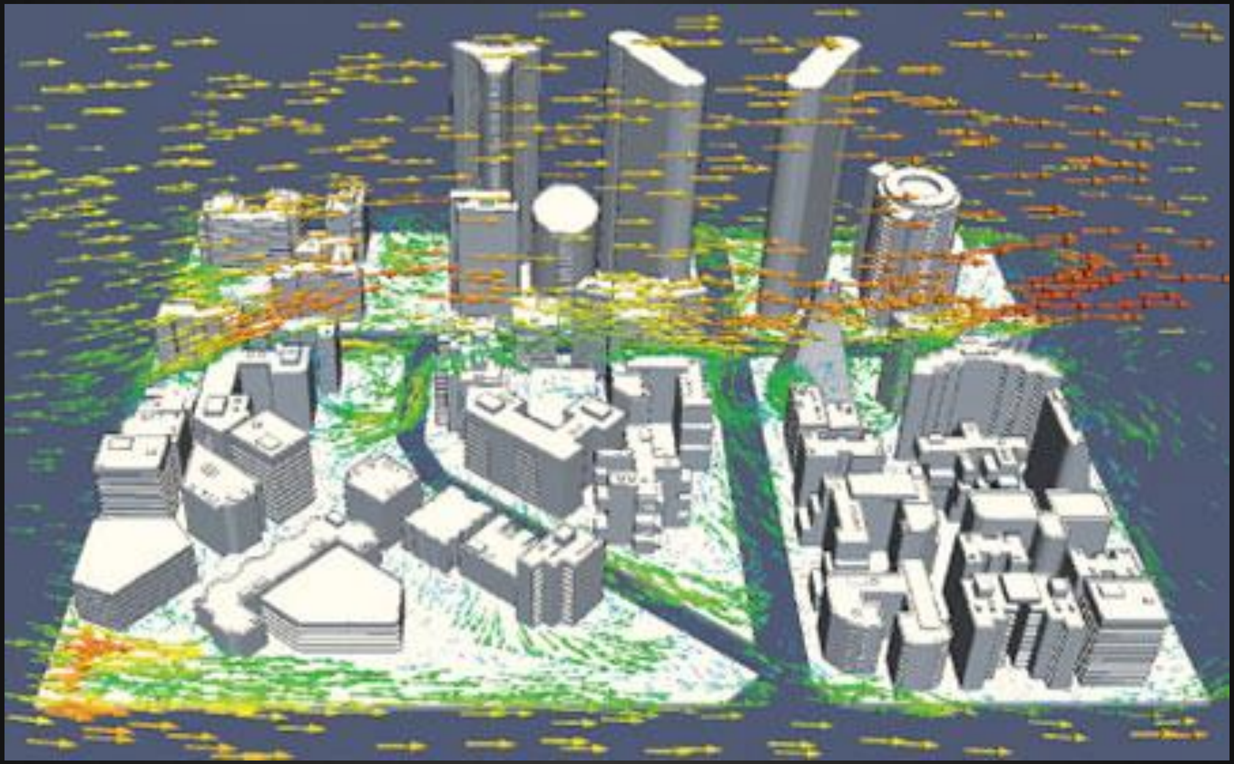

Fig. 2.2 Typical power coefficients of different rotor types over tip-speed ratio

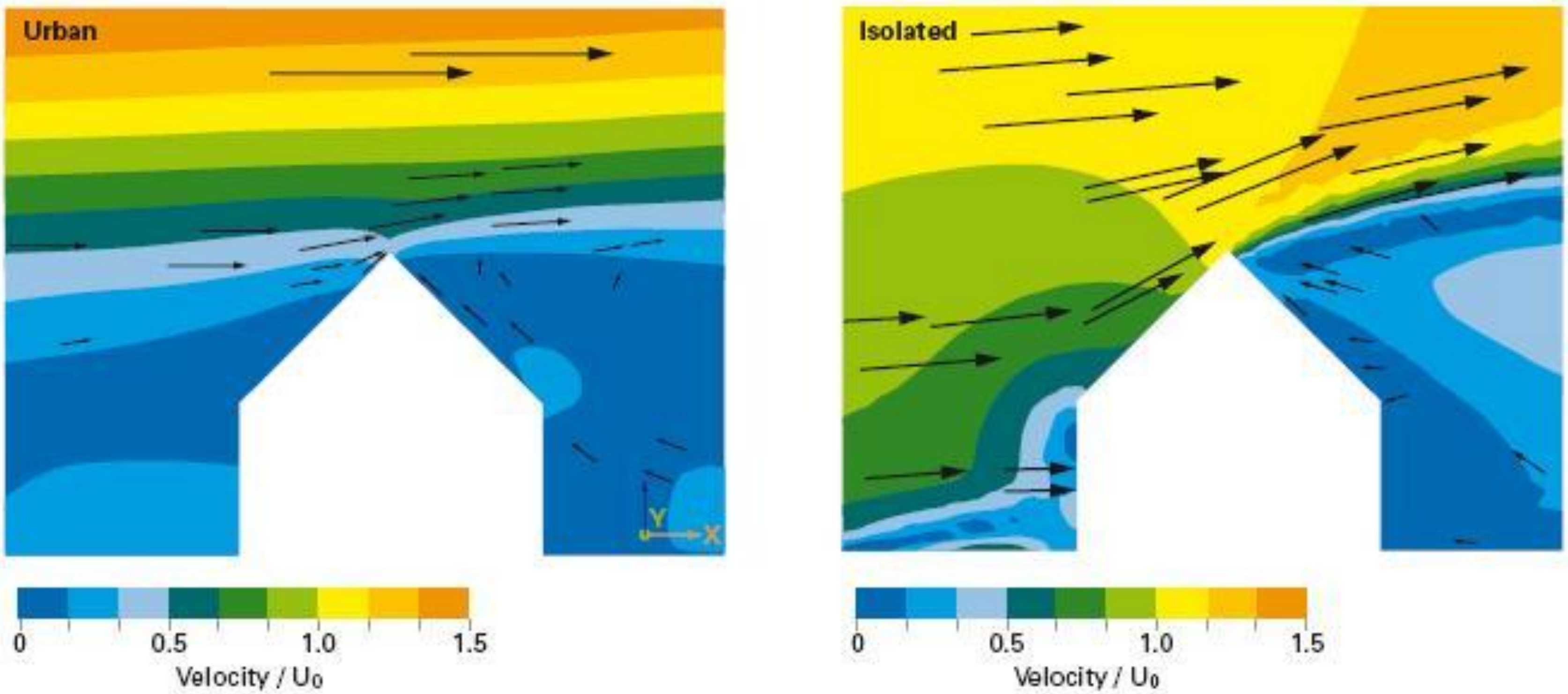
OnGrid in GW, 370, (24)

Offgrid in MW, 790(2.7)


high wind speed and cold
wind protected area
near water
thermally balanced but higher wind

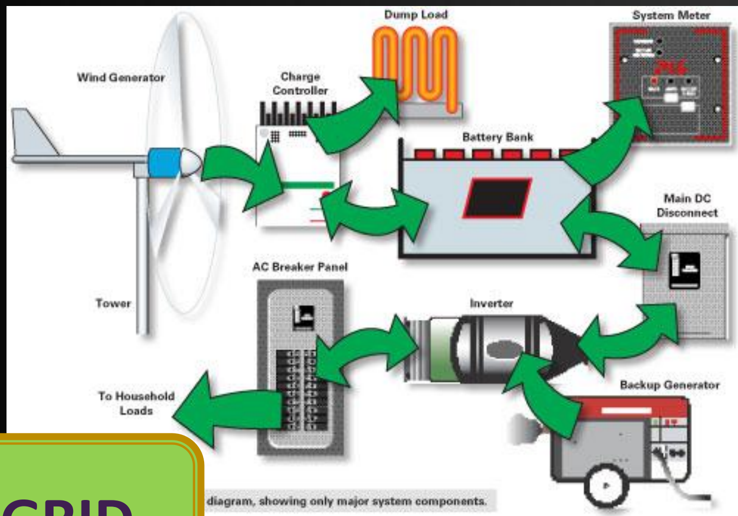

Suction pressure
Internal positive pressure
Windward wall
Leeward wall



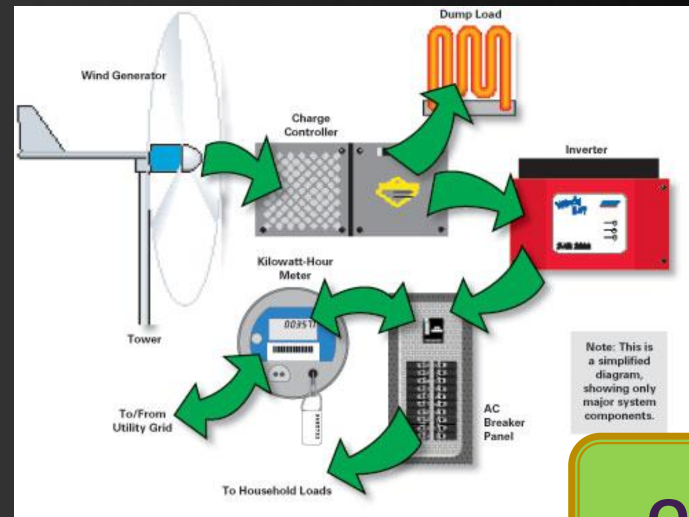



The warmer the colour and longer the arrow, the greater the wind speed. The 'Isolated' case is equivalent to a rural setting in context of this report, while the 'Urban' case depicts a building in an urban environment with other buildings nearby on either side (not shown).

Source: Centre for Renewable Energy Systems Technology (CREST) at Loughborough University.




**OFF-GRID**




**ON-GRID**

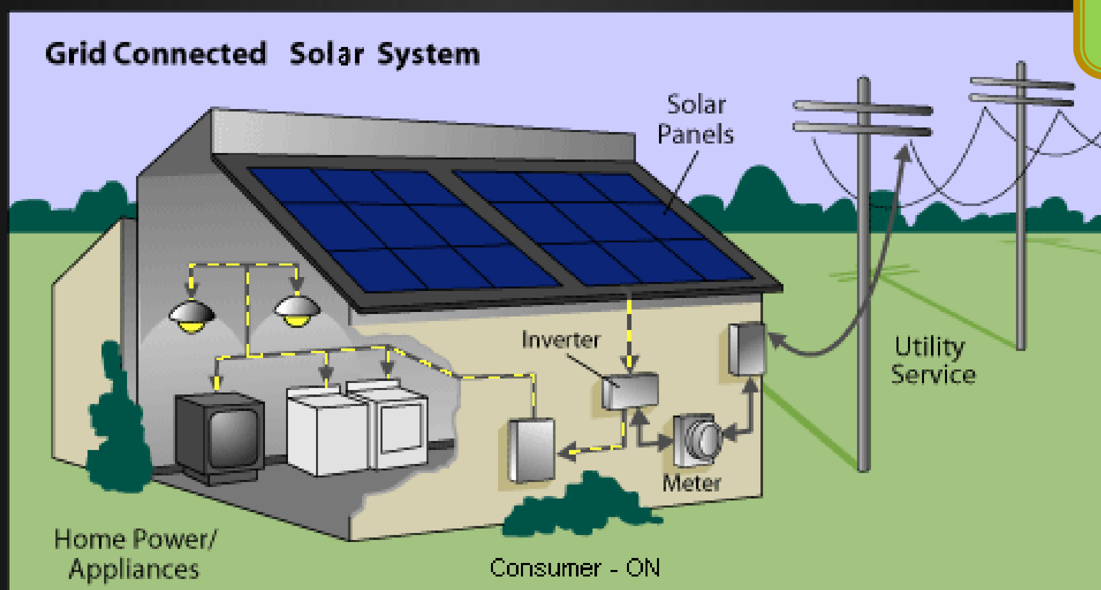
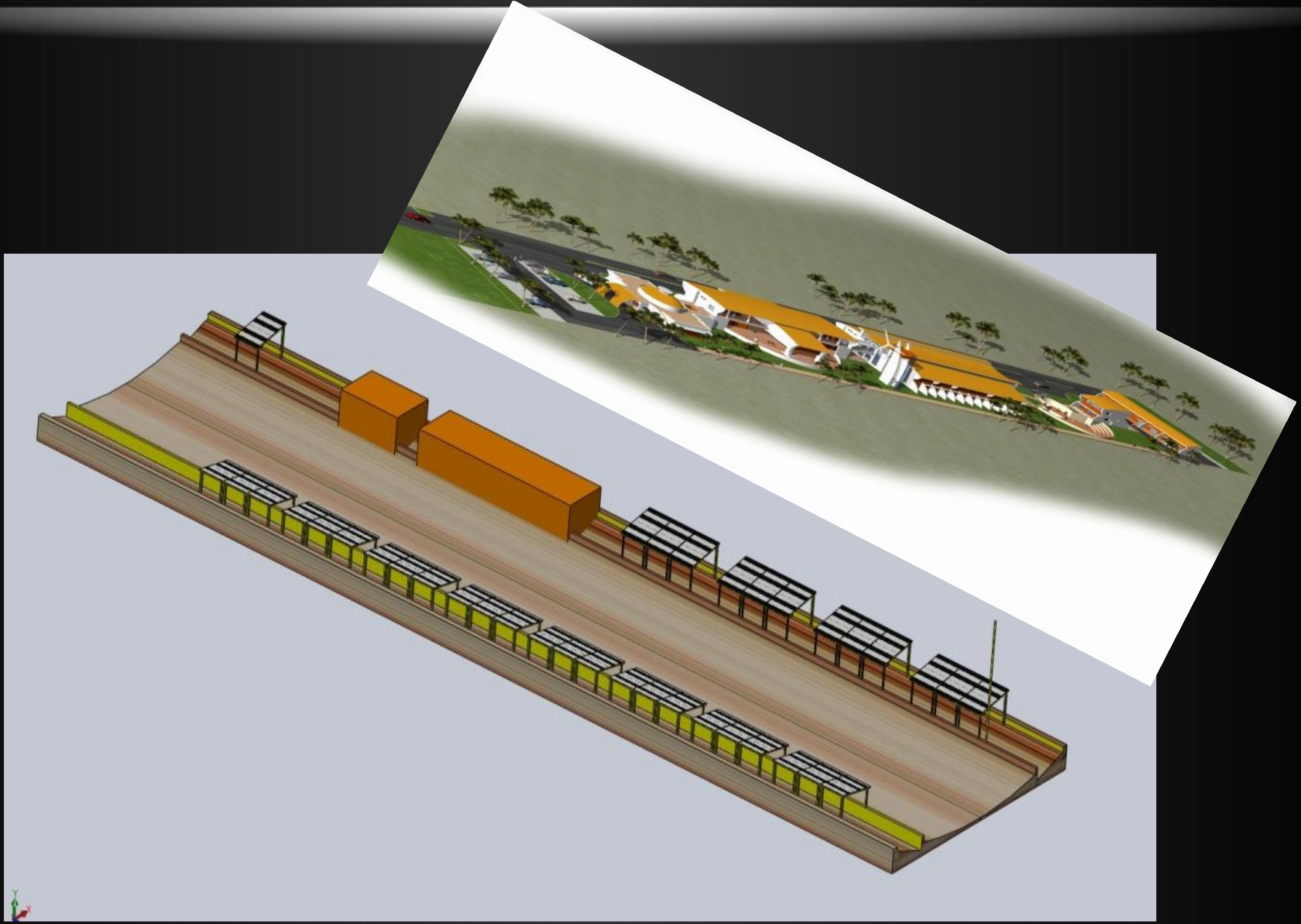
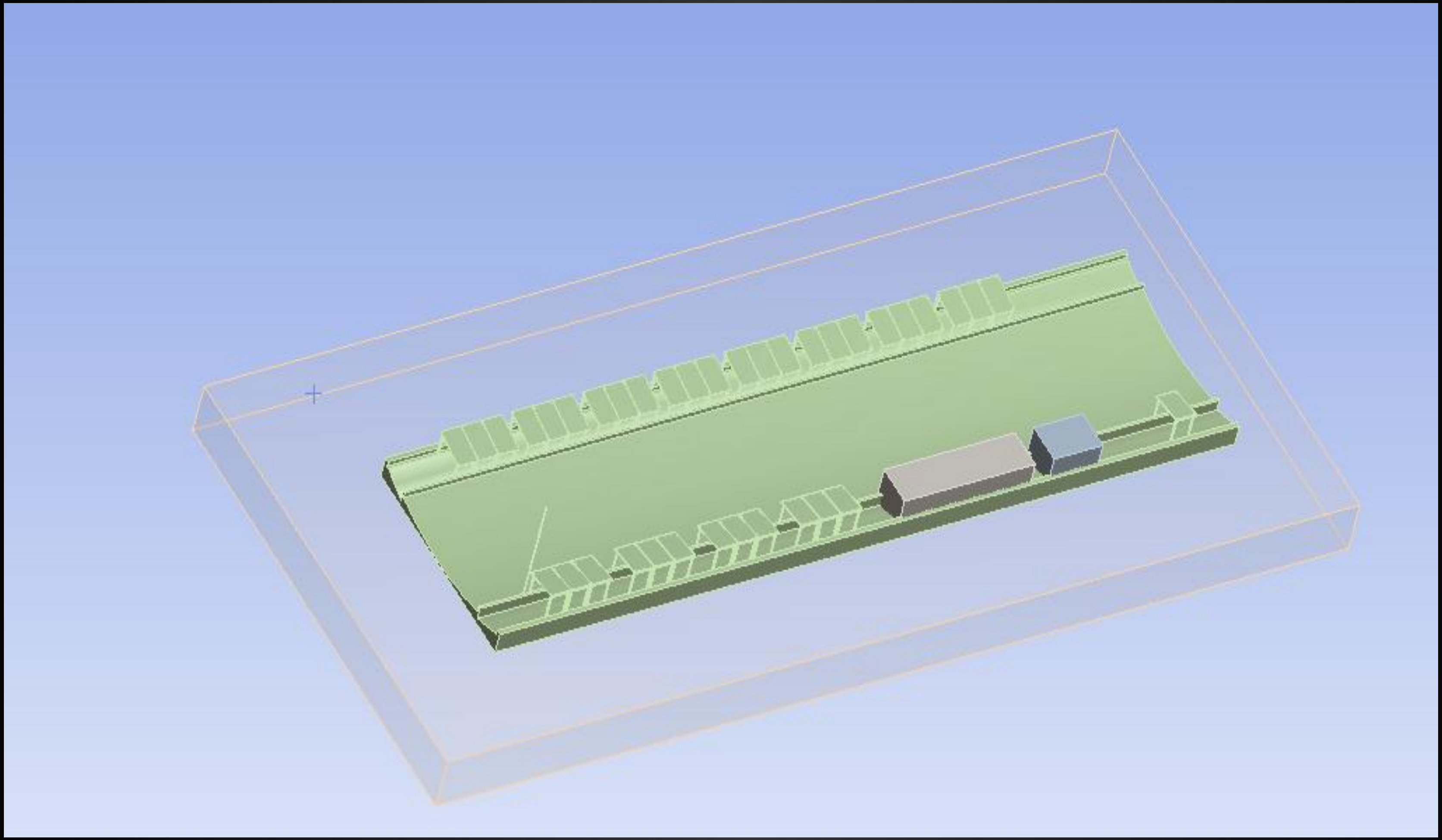
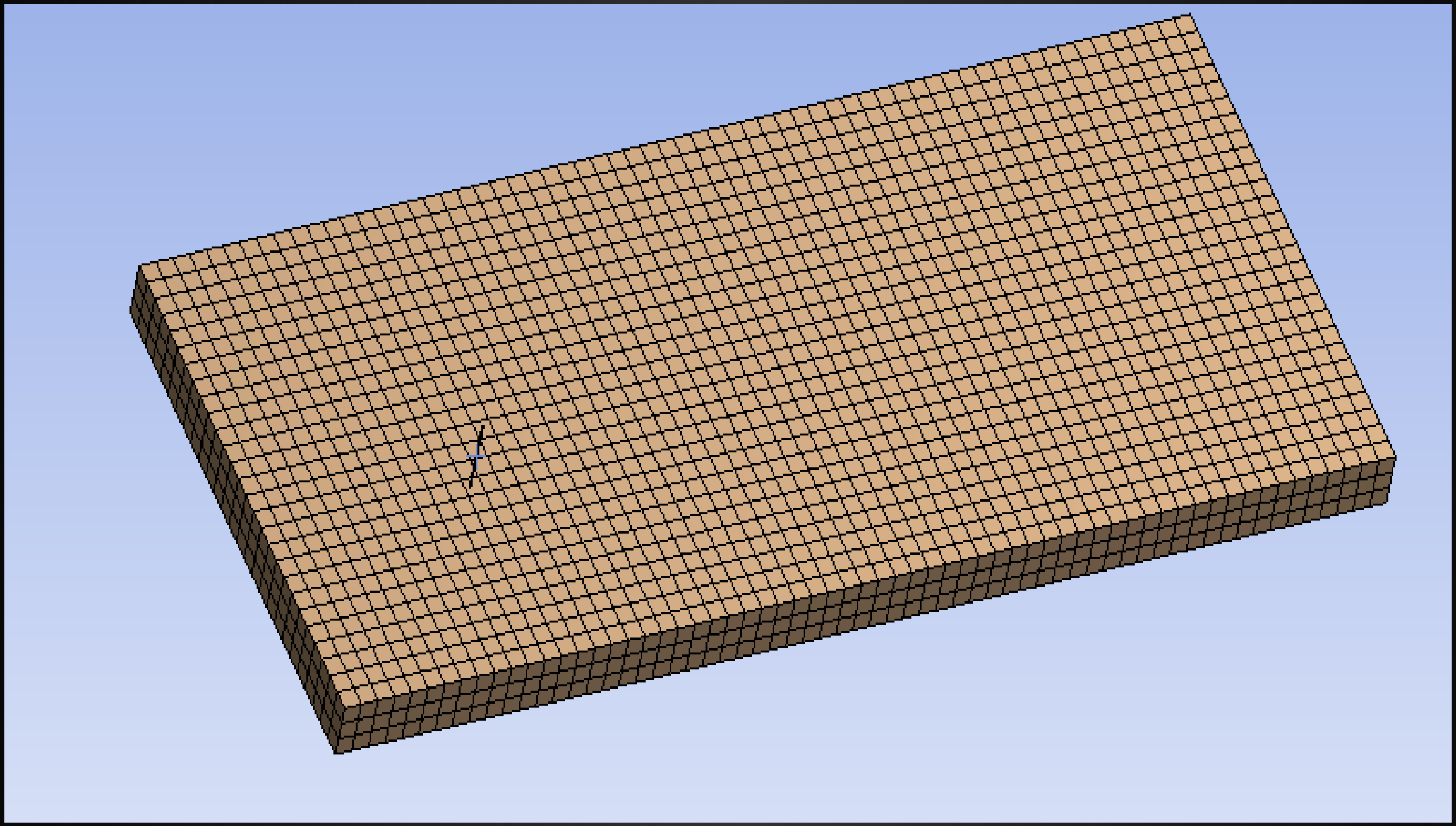



Fig.2  Wind Energy devices in built environment [Source Courtesy:PhD, Sander MERTENS, T.U Delft 2006]

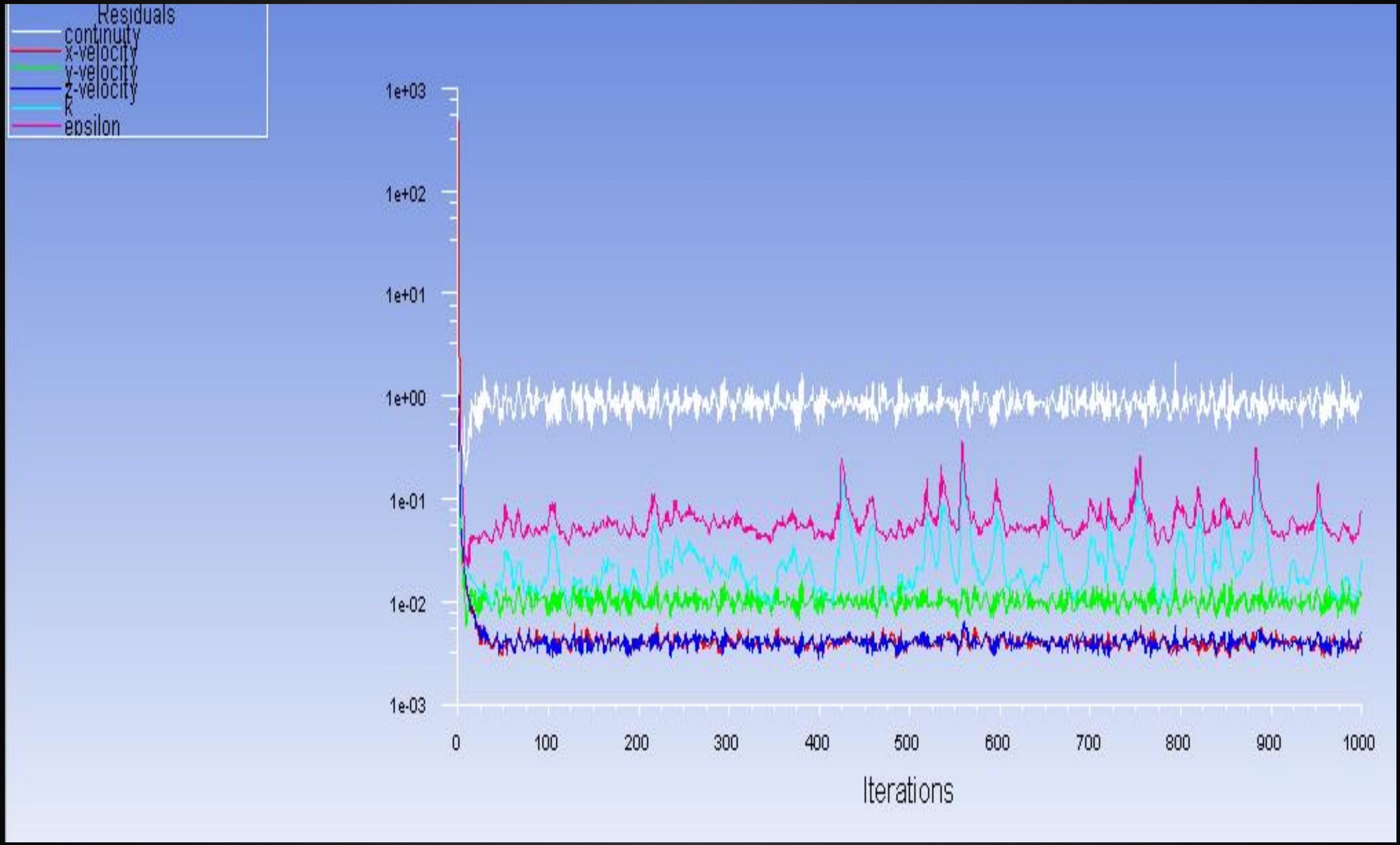
National Renewable Energy Laboratory of USA
which
[http://www.nrel.gov/docs/fy13osti/50499.pdf]



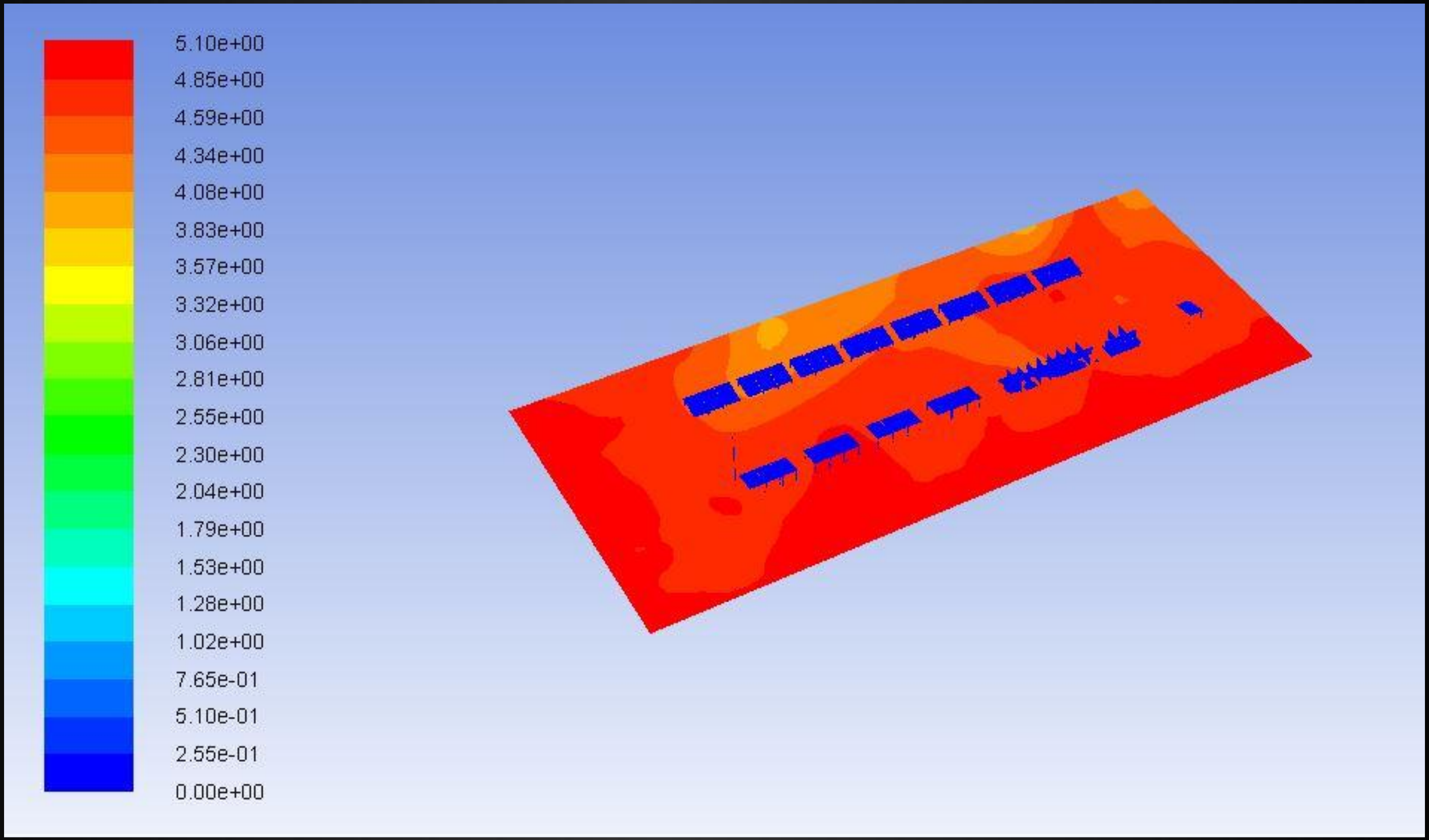




| Type | No. of Nodes | No. of Elements |
| --- | --- | --- |
| Un-Structured mesh | 38297 | 139161 |



Residuals
continuity
x-velocity
y-velocity
z-velocity
k
epsilon
1e+03
1e+02
1e+01
1e+00
1e-01
1e-02
1e-03
0
100
200
300
400
500
600
700
800
900
1000
Iterations


5.10e+00
4.85e+00
4.59e+00
4.34e+00
4.08e+00
3.83e+00
3.57e+00
3.32e+00
3.06e+00
2.81e+00
2.55e+00
2.30e+00
2.04e+00
1.79e+00
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7.65e-01
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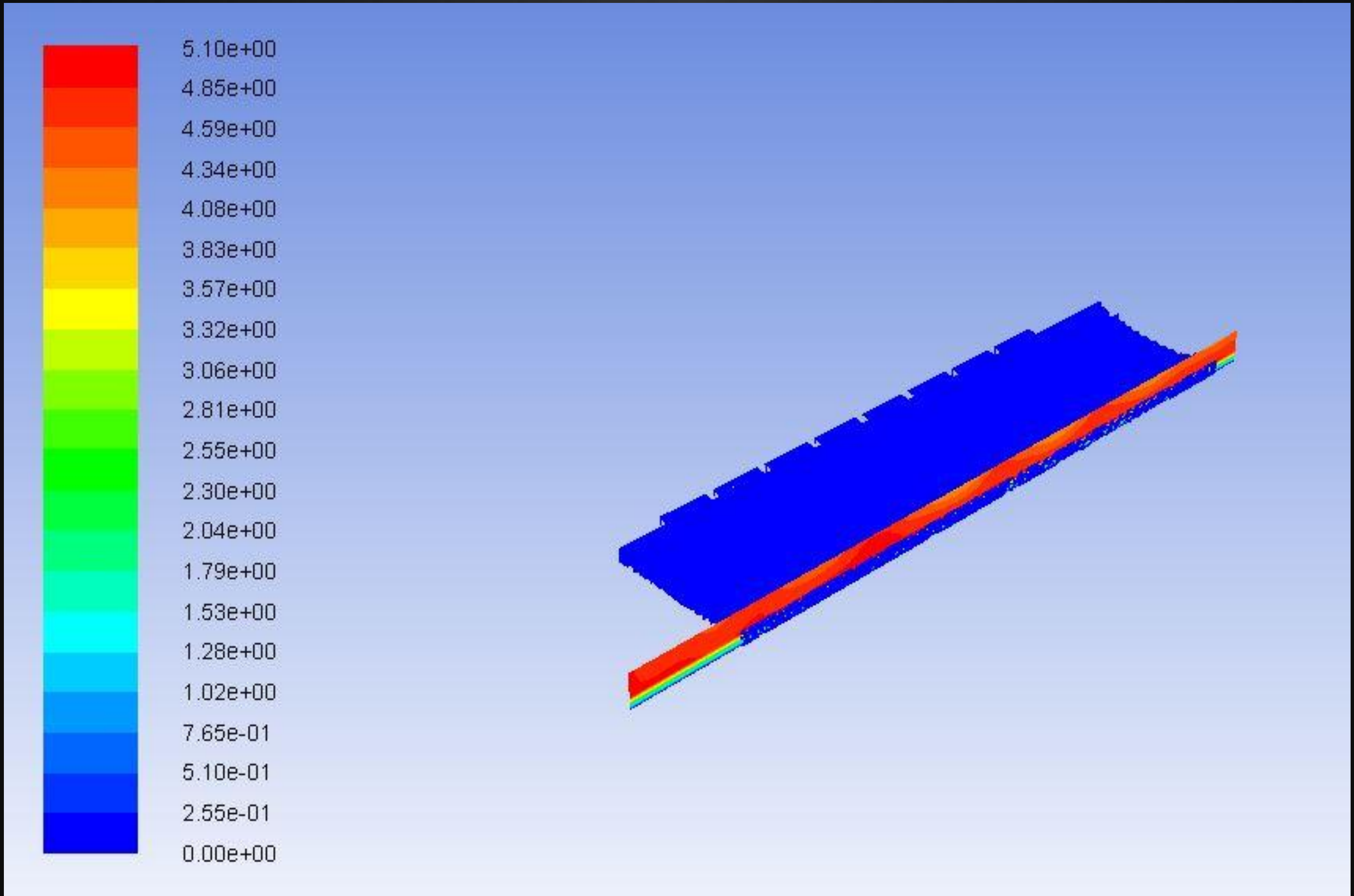
2.55e-01
0.00e+00


5.10e+00
4.85e+00
4.59e+00
4.34e+00
4.08e+00
3.83e+00
3.57e+00
3.32e+00
3.06e+00
2.81e+00
2.55e+00
2.30e+00
2.04e+00
1.79e+00
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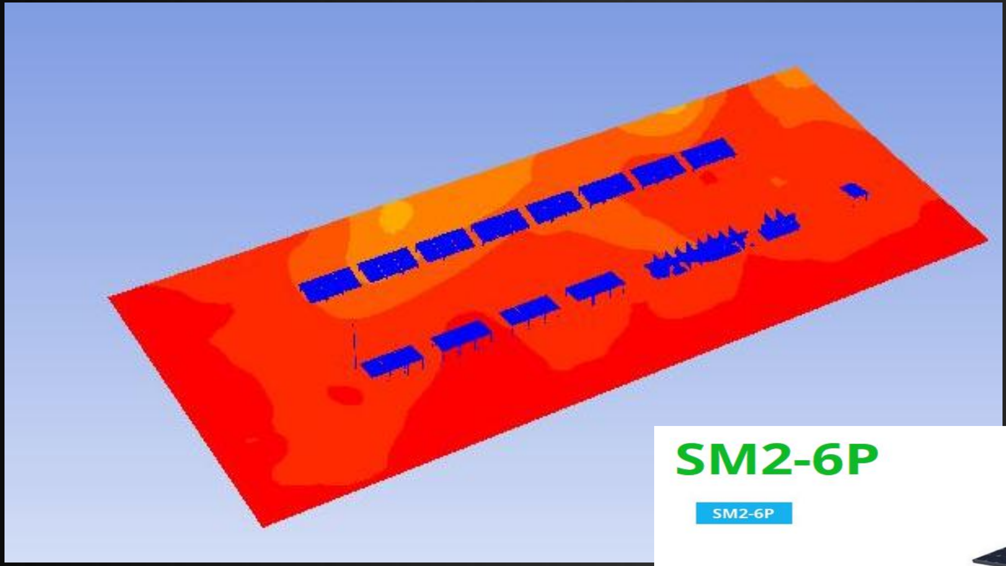
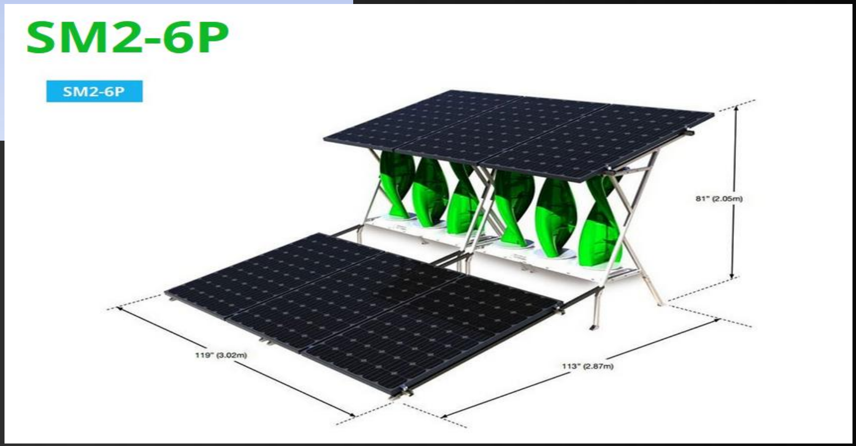
2.55e-01
0.00e+00




SM2-6P
SM2-6P
81" (2.05m)
119" (3.02m)
113" (2.87m)

Now Small wind is becoming popular across the world, in both developed and emerging economies.”  expected to touch US$1.89billion

Hybrid power plants applications in both rural and urban electrification,
for street lighting, mountain power,
water pumps,
mobile phone and communication towers.
displace diesel in remote locations
Defence in border areas

ISSUES OF LOW DEMAND-, LACK OF STANDARDISATION,

HIGH CAPEX & SUPPLY CHAIN issues ?

AWARENESS TO TECHNOLOGY AND " DIY" literacy

BUILDING / SITE SPECIFIC AERDYNAMICS WIND FLOW -CFD

MOSTLY LOW WIND & COMPLEX TERRAIN

ADVANCED CONTROLS MAKE MORE COSTLY

LOW EFFICIENCIES

SMALL COMPANIES WITH INADEQUATE O&M

CHICKEN AND EGG ??????????

VOLUME OF BUSINESS VS. COST REDUCTION R&D..FOCUS

**MARKET FOR SWES ?**

**Telecom towers - Battery storage is already present**

**Railway gates, Railway stations , Railway Bridges, Railway signal posts**

**Urban Roof top (net-metered )**

**Institutional roof tops (net-metered )**

**Pedestrian Wind locations near high rise buildings**

**Rural microgrids or minigrids, Coastal village powering**

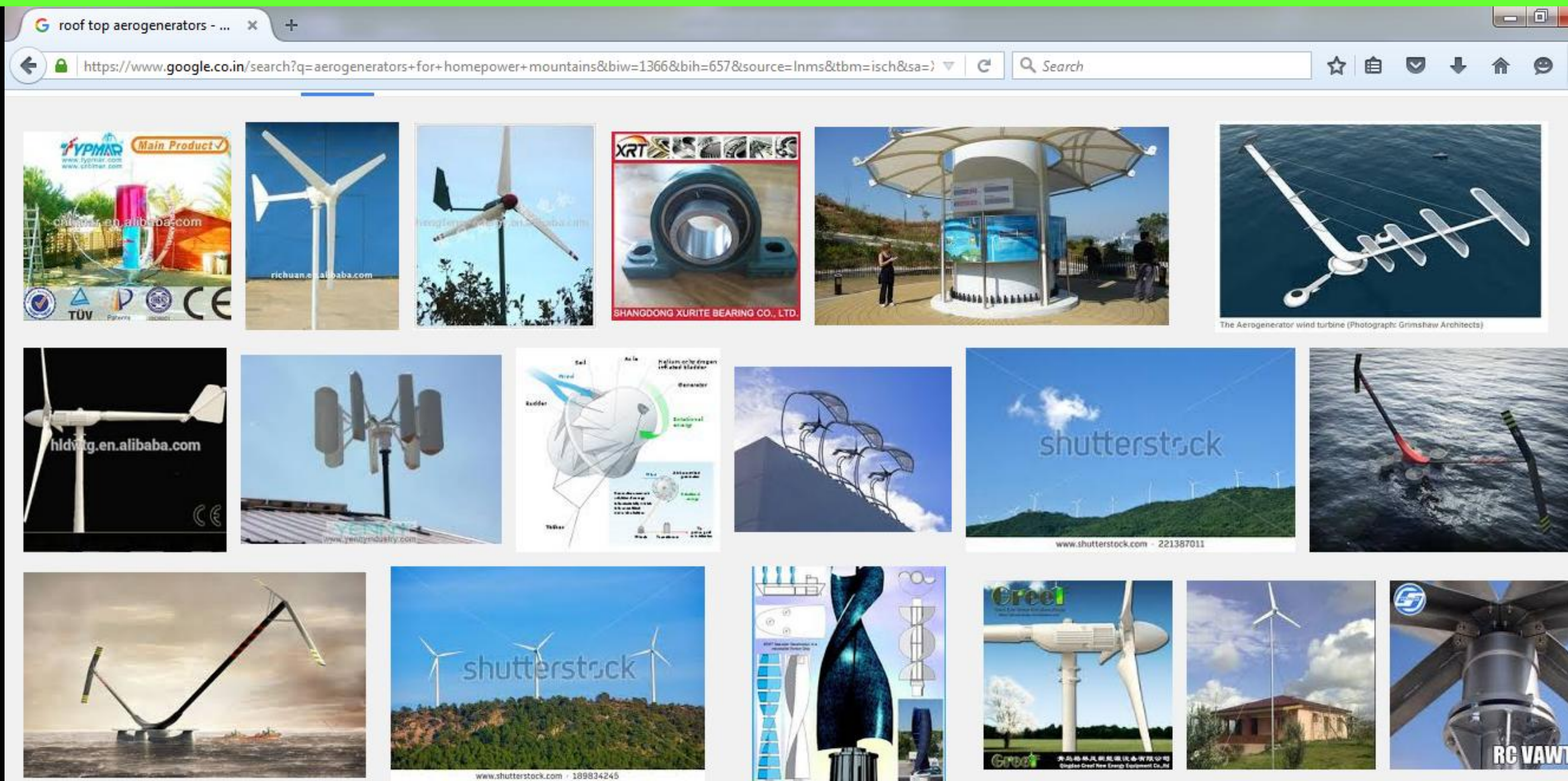
**De-centralised desalination of water**

**Production of hydrogen for use with fuel cells in EoVs**

**Highway sign boards , Self powered sign boards**

**Infinite ……………. Possibilities with innovative forms for each windy site…………**

# 5 countries manufacture, SWCC , NIWE, IEC61400-2



**THANK YOU FOR YOUR KIND ATTENTION**

राष्ट्रीय पवन ऊर्जा संस्थान NATIONAL INSTITUTE OF WIND ENERGY

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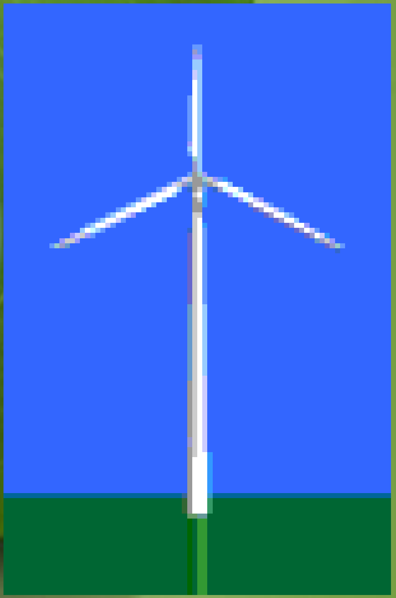

# WIN WITH WIND ......................