Dutch Small Wind Turbines

Wind turbines for rural electrification

DSWT

Small and medium wind for mini grids

Club ER, December 2012

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Todays Content

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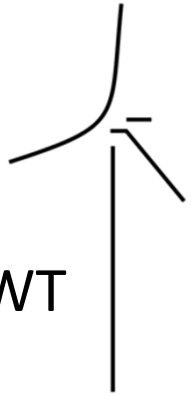
- What is small and medium wind
- Why wind energy
- Project examples
- Conclusions

Different sizes of wind turbines



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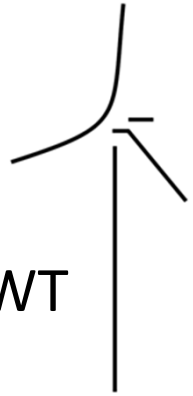
- Small is less than 15m diameter or 50 kW
- Medium is 15-55m or 50-1000 kW
- Large is bigger than 1 MW

Average wind speed and output



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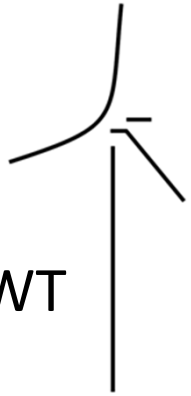
Wind speed [m/s]	Energy output [kWh/m2]
4	150
5	300
6	500
7	750

Conclusion: more wind is much more energy

Size matters



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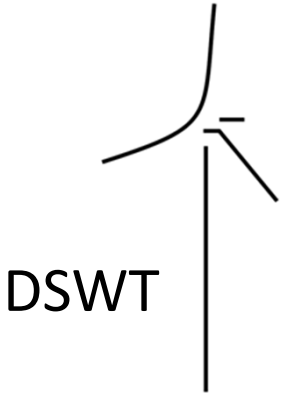
Size [kW]	Size [m2]	Annual kWh at 6 m/s
1	8	4000
5	20	10000
250	700	350,000

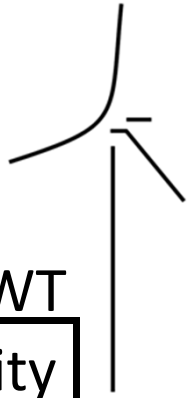
Conclusion: bigger turbines means much more energy

Why choose small and medium wind?

- Cost competitiveness and quick cost break-even in favourable natural conditions.
- Easy to integrate in (existing) mini-grids fed with diesel. Hybrid wind-diesel systems provide higher quality, lower costs, and are a more reliable and sustainable solution than diesel-only systems.
- Allow, in combination with such applications as solar to develop a 'whole-year-round' solution.
- The perfect solution not only to generate enough power for feeding and developing small businesses, but also to increase the synergies with growing sectors like telecommunications.
- Contrary to most other sources of energy supply, wind energy is not subject to theft and is less vulnerable to vandalism.



Why wind ?



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Size [kW]	FOB price [€/W]	Installed price [€/W]	Electricity price [€/kWh]
1	5	10	0,40
5	3	5	0,25
250	1,5	2,5	0,1

Conclusion: bigger turbines have lower energy price

Wind energy profile can mach load curve

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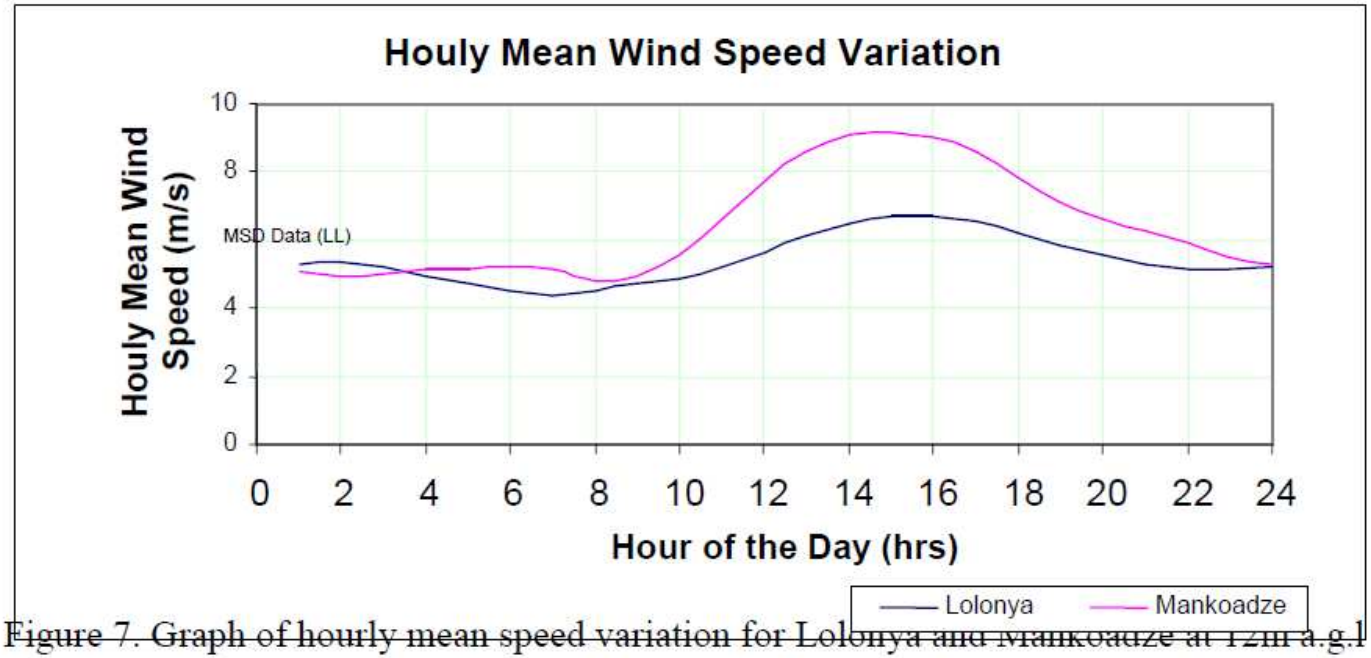

Figure 7. Graph of hourly mean speed variation for Lolonya and Mankoadze at 12m a.g.l

Conclusion: Energy available when needed most

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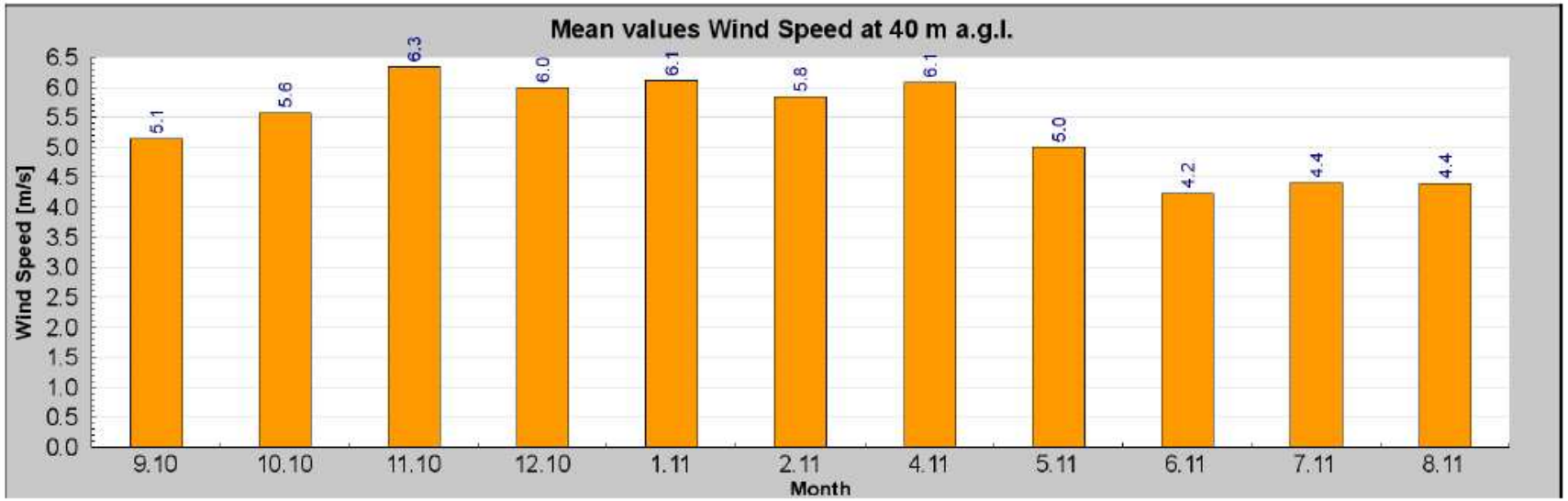
WINDYCATOR for Baragoi

Summary of 11 months: Sep 2010 - Aug 2011

Monthly Mean Values



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Schoondijke test site

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Results Schoondijke test site

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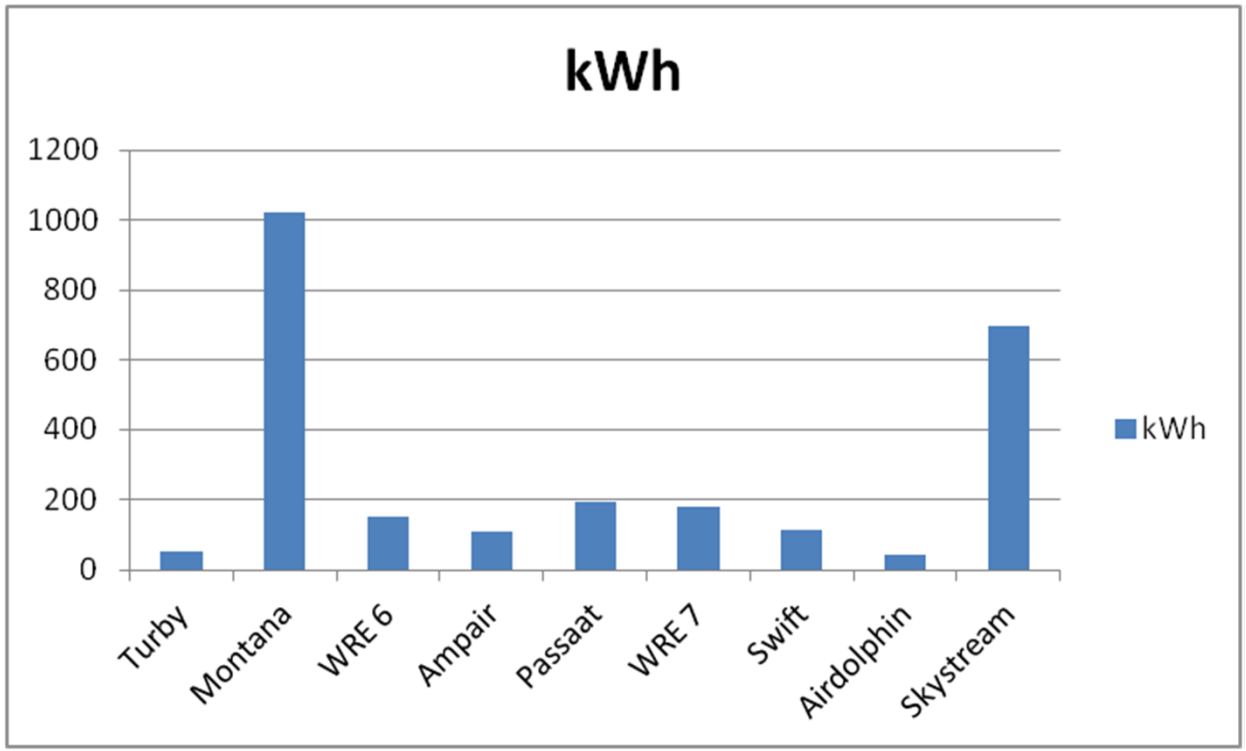
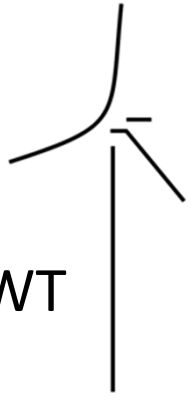


Conclusion: Big differences between small turbines

Check for certification!



Component	International standards and explanation
Turbine	IEC 61400-2: Design and safety requirements IEC 61400-11: Procedure for acoustic emission measurement techniques IEC 61400-12: Power performance measurements Other known and respected standards are designed by Microgeneration Certification Scheme (MCS) (UK, overall certification including factory inspection) and AWEA (American Wind Energy Association).

Table 3. International standards for small wind turbines. Source: ARE, 2011

Example small wind turbine 1

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Rural electrification by the use of a 1 kW wind turbine for battery charging in Mauretania

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Example small wind turbine 2

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Telecom electrification with a Airdolphin 1 kW wind turbine. Hybrid wind/PV site, AC connected.

Example small wind turbine 3

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Water desalination and purification by the use of a 5 kW wind turbine. This unit makes 3000-4000 liter of clean drinking water per day.

Example small wind turbine 4

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Telecom electrification with Bergey 10 kW wind turbine in Kenya.

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Example Medium size turbine 1

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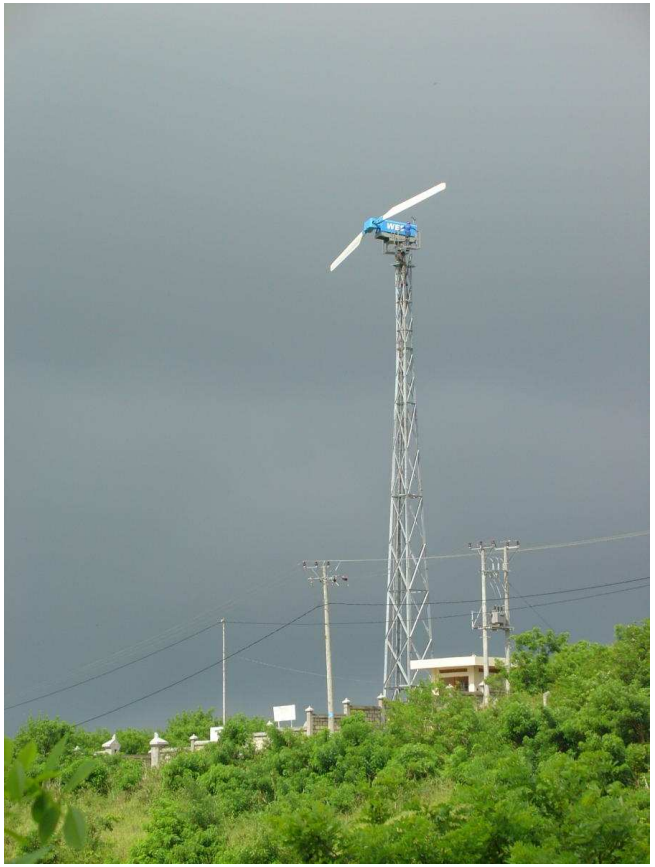
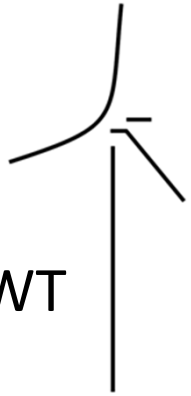
Rural electrification with wind/diesel system of WES 80 kW in Indonesia.





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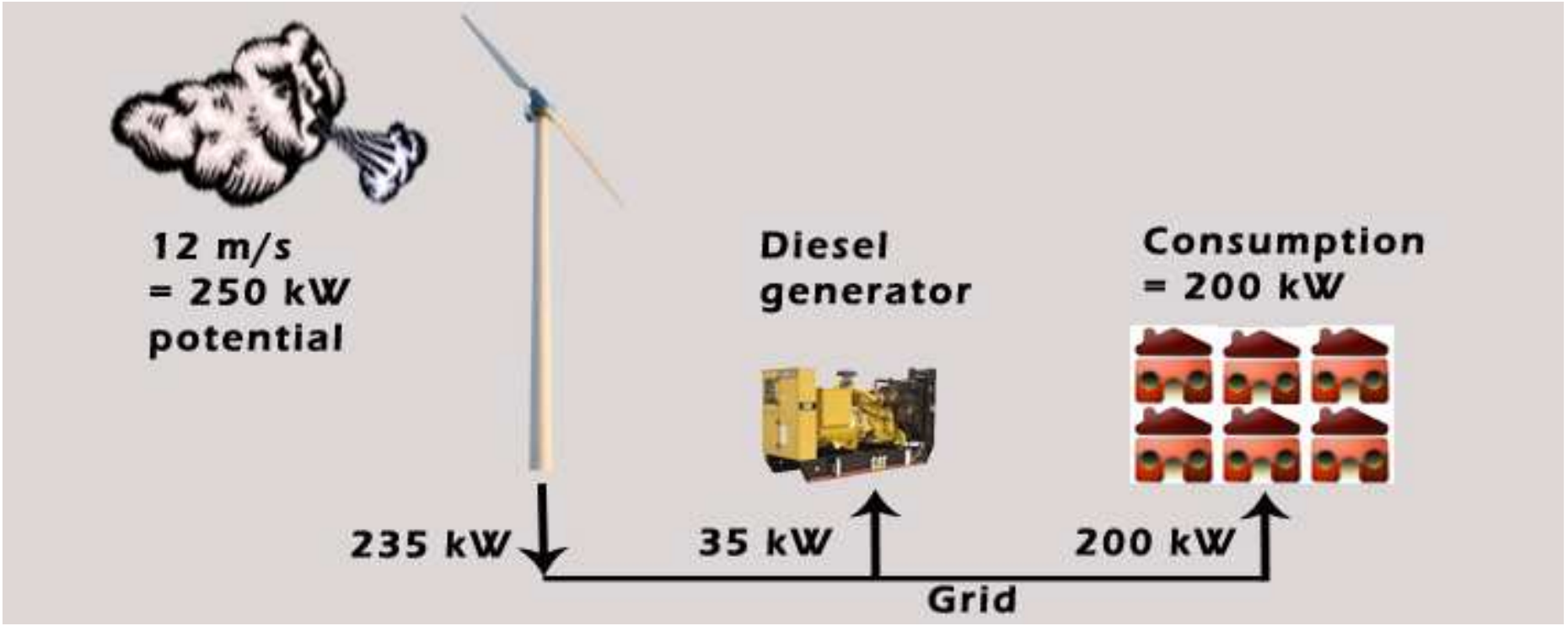
12 m/s
= 250 kW
potential
Diesel
generator
Consumption
= 200 kW
235 kW
35 kW
200 kW
Grid

Example Medium size turbine 2

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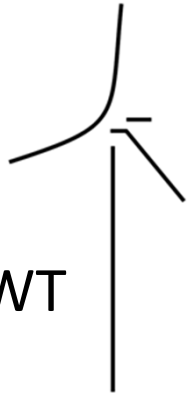
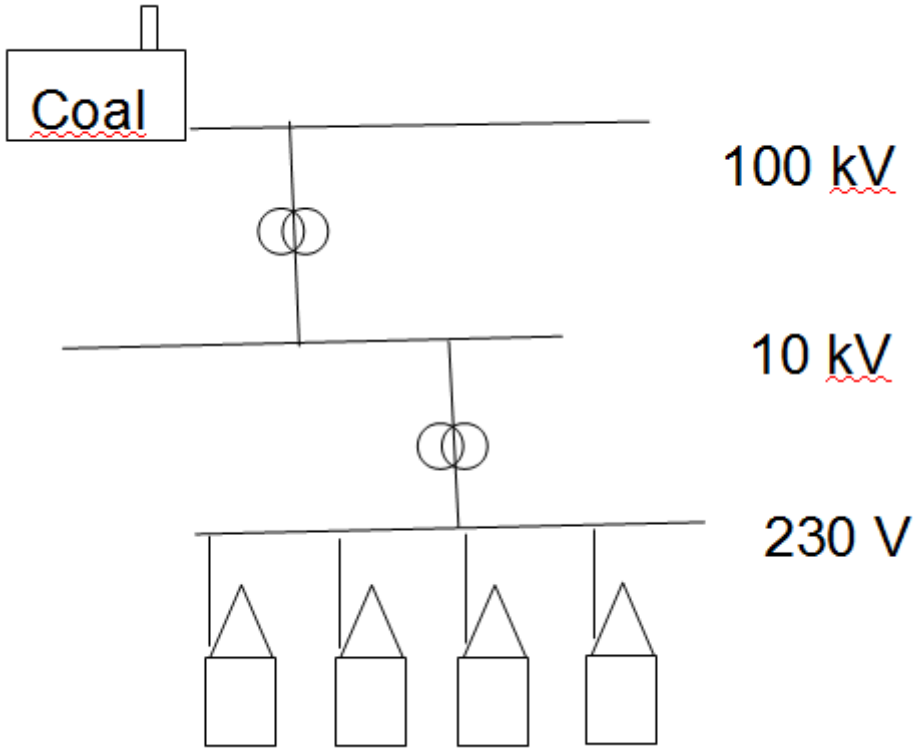
Rural electrification in Australia with Vergnet
275 kW wind turbine.

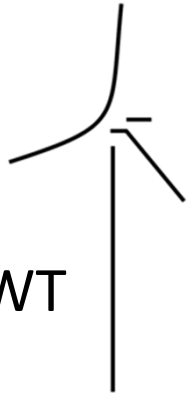
Decentralised RES vs centralized 1/3



Classical Situation



Decentralised RES vs centralized 2/3



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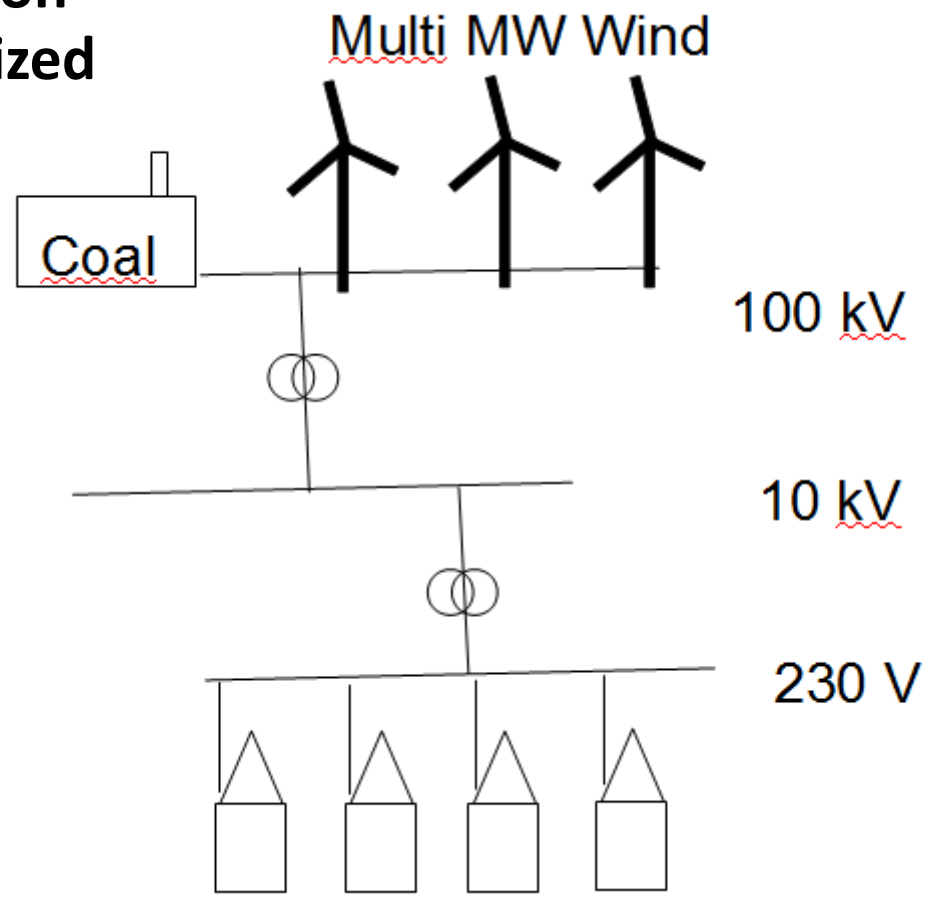
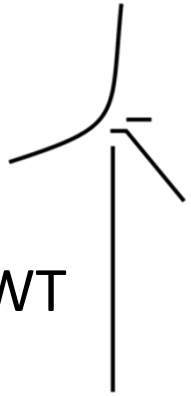
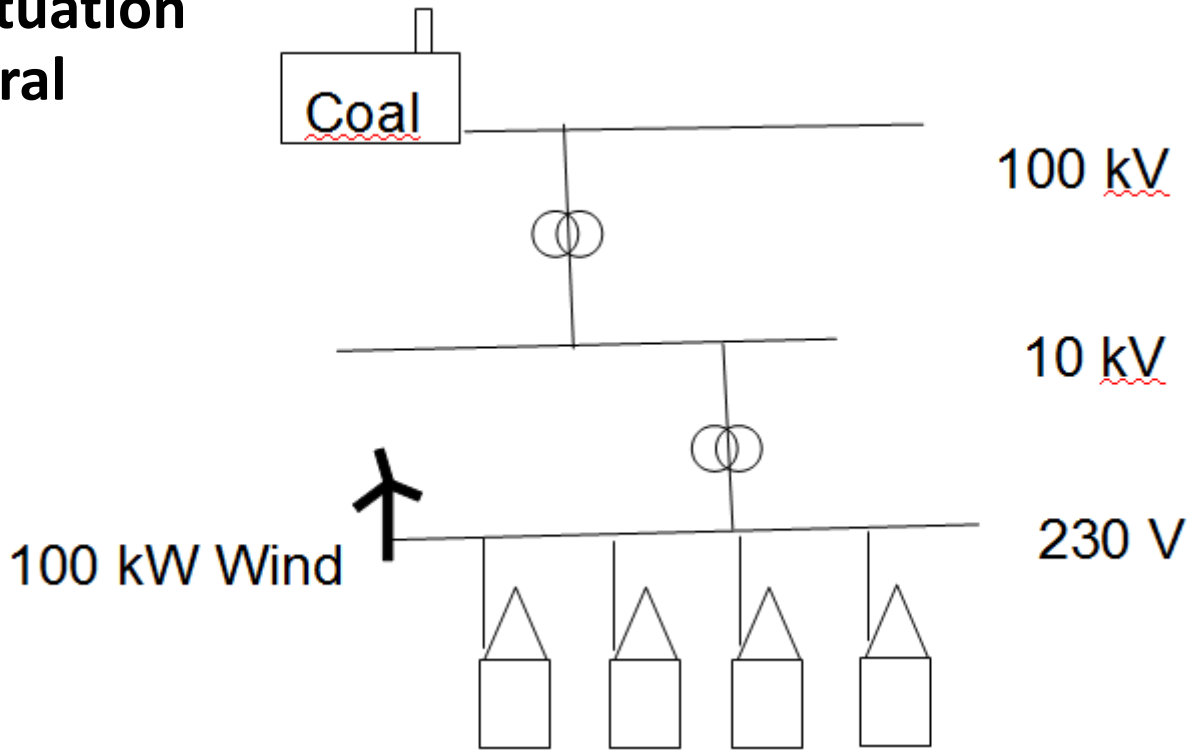
New Situation
Still centralized



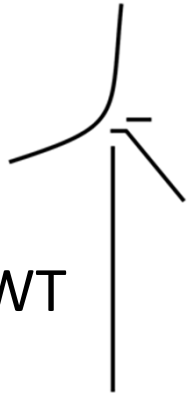
Decentralised RES vs centralized 3/3



New Situation
Decentral



Technical conclusions



- Wind speed data, daily and monthly patterns
- Choosing the right size and type of turbine
- Certification is the road to sustainable projects

General Conclusions

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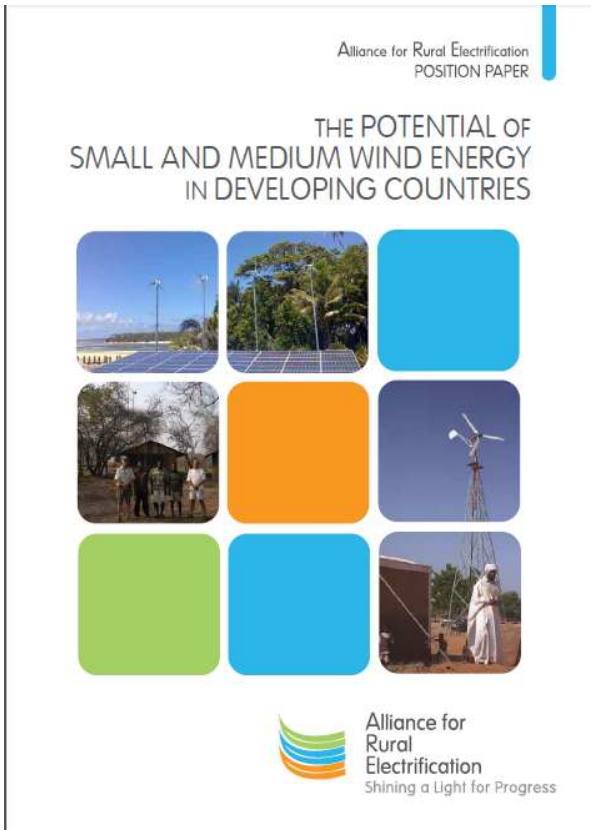
- Wind energy can be a low cost source of electricity
- Requires different knowledge than solar
- Different sizes for different applications
- Also potential for national grid support



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Thank you for your kind attention.

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