Dutch Small Wind Turbines

Wind turbines for rural electrification

DSWT

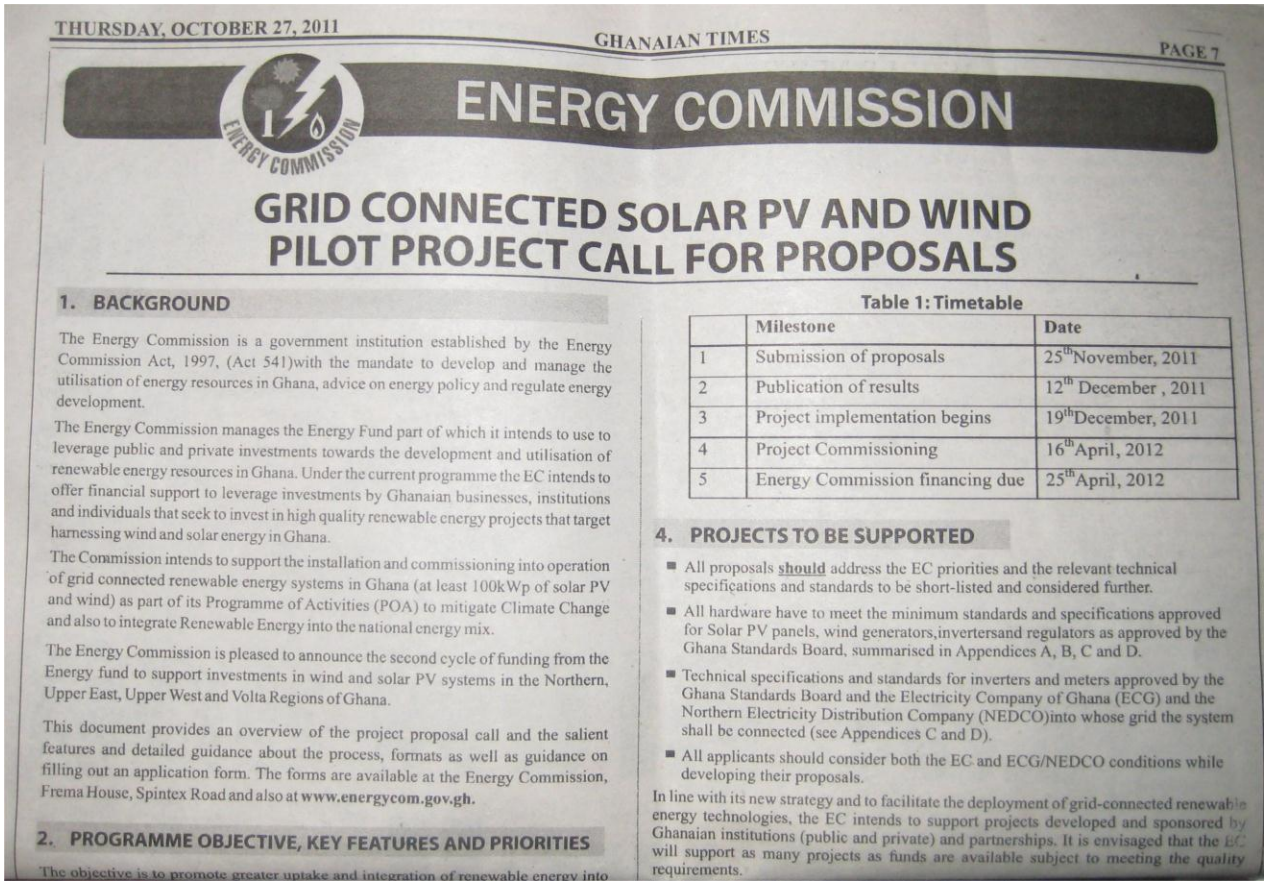
Small and medium wind for off grid electrification

IOREC, November 2nd 2012

Balthasar Klimbie

At the Embassy in The Hague:

DSWT



THURSDAY, OCTOBER 27, 2011 GHANAIAN TIMES PAGE 7

ENERGY COMMISSION

GRID CONNECTED SOLAR PV AND WIND PILOT PROJECT CALL FOR PROPOSALS

1. BACKGROUND

The Energy Commission is a government institution established by the Energy Commission Act, 1997, (Act 541)with the mandate to develop and manage the utilisation of energy resources in Ghana, advice on energy policy and regulate energy development.

The Energy Commission manages the Energy Fund part of which it intends to use to leverage public and private investments towards the development and utilisation of renewable energy resources in Ghana. Under the current programme the EC intends to offer financial support to leverage investments by Ghanaian businesses, institutions and individuals that seek to invest in high quality renewable energy projects that target harnessing wind and solar energy in Ghana.

The Commission intends to support the installation and commissioning into operation of grid connected renewable energy systems in Ghana (at least 100kWp of solar PV and wind) as part of its Programme of Activities (POA) to mitigate Climate Change and also to integrate Renewable Energy into the national energy mix.

The Energy Commission is pleased to announce the second cycle of funding from the Energy fund to support investments in wind and solar PV systems in the Northern, Upper East, Upper West and Volta Regions of Ghana.

This document provides an overview of the project proposal call and the salient features and detailed guidance about the process, formats as well as guidance on filling out an application form. The forms are available at the Energy Commission, Frema House, Spintex Road and also at **www.energycom.gov.gh.**

2. PROGRAMME OBJECTIVE, KEY FEATURES AND PRIORITIES

The objective is to promote greater uptake and integration of renewable energy into

Table 1: Timetable

	Milestone	Date
1	Submission of proposals	25th November, 2011
2	Publication of results	12th December , 2011
3	Project implementation begins	19th December, 2011
4	Project Commissioning	16th April, 2012
5	Energy Commission financing due	25th April, 2012

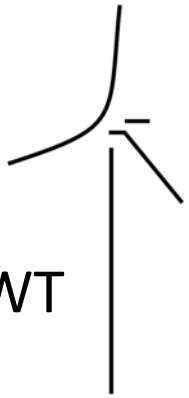
4. PROJECTS TO BE SUPPORTED

- All proposals **should** address the EC priorities and the relevant technical specifications and standards to be short-listed and considered further.
- All hardware have to meet the minimum standards and specifications approved for Solar PV panels, wind generators,invertersand regulators as approved by the Ghana Standards Board, summarised in Appendices A, B, C and D.
- Technical specifications and standards for inverters and meters approved by the Ghana Standards Board and the Electricity Company of Ghana (ECG) and the Northern Electricity Distribution Company (NEDCO)into whose grid the system shall be connected (see Appendices C and D).
- All applicants should consider both the EC and ECG/NEDCO conditions while developing their proposals.

In line with its new strategy and to facilitate the deployment of grid-connected renewable energy technologies, the EC intends to support projects developed and sponsored by Ghanaian institutions (public and private) and partnerships. It is envisaged that the EC will support as many projects as funds are available subject to meeting the quality requirements.

Alliance for Rural Electrification

Focus DSWT



- Offer reliable small and medium sized (5-500 kW) wind turbines
- Focus on decentral and/or hybrid systems
- Start of the DSWT franchise
- Consulting services

Todays Content

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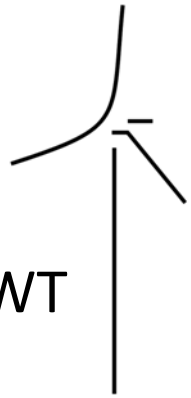
- Micro course wind energy
- What is small and medium wind
- Project examples
- Advantages
- Challenges

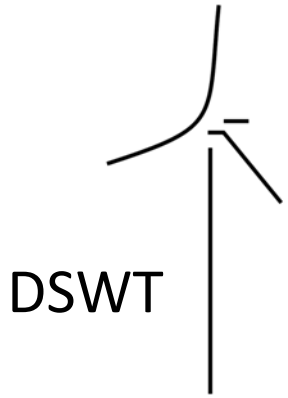
- Order intake

Different sizes of wind turbines



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

Power in the wind



$$P = \frac{1}{2} * rho * A * V^3$$

- P: power
- Rho: air density (depending on Temp & altitude)
- A: rotor surface (1/2 * pi * R^2)
- V: wind speed (in meters/second)

Measuring wind speed is not always difficult

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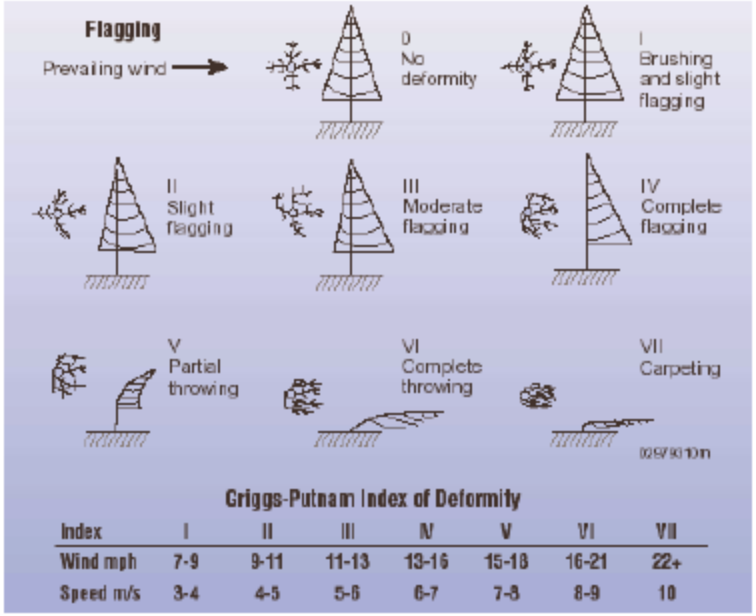

Griggs-Putnam Index of Deformity

Index	I	II	III	IV	V	VI	VII
Wind mph	7-9	9-11	11-13	13-16	15-18	16-21	22+
Speed m/s	3-4	4-5	5-6	6-7	7-8	8-9	10

Figure 14 Griggs-Putnam Index of Deformity (from US Dept of Energy)

Look for good sites

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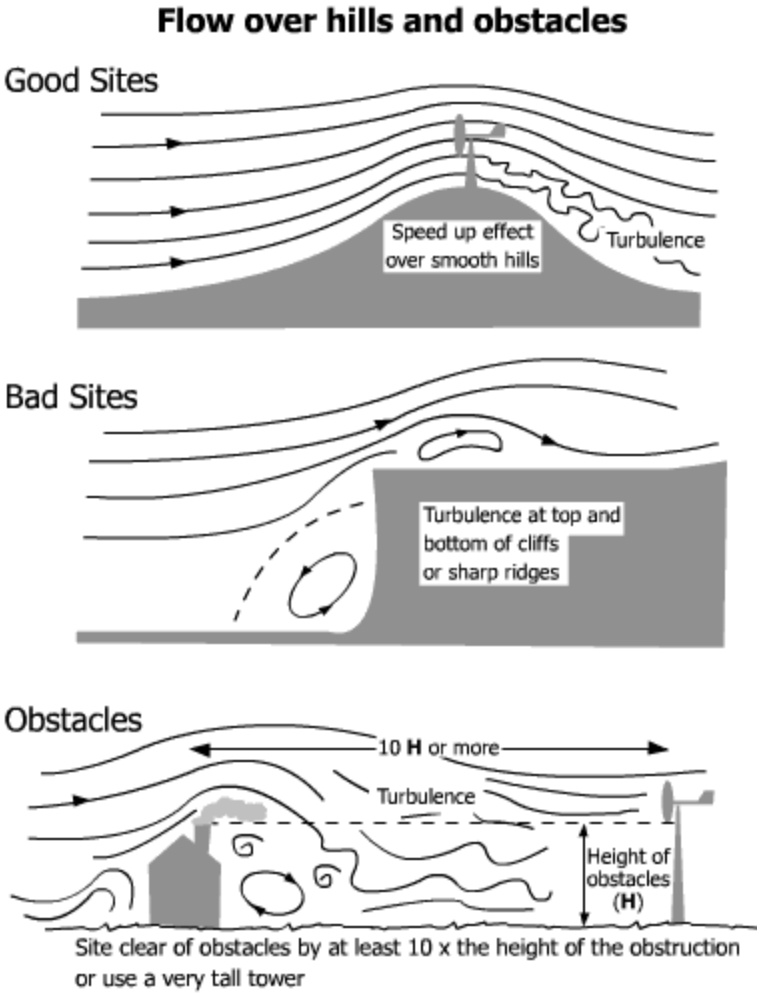
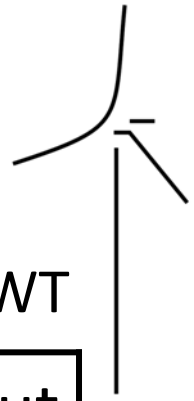


Average wind speed and output



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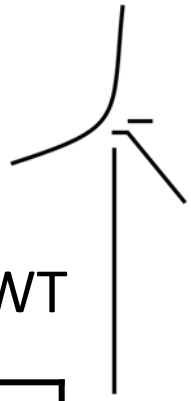
Wind speed [m/s]	Energy output [kWh/m2]
4	150
5	300
6	500
7	750

Size matters



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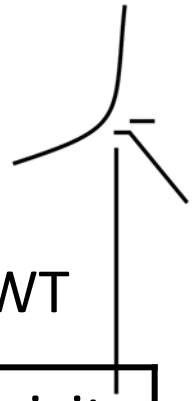
Size [kW]	Size [m2]	kWh at 6 m/s
1	8	4000
5	20	10000
250	700	350,000



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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

Schoondijke test site

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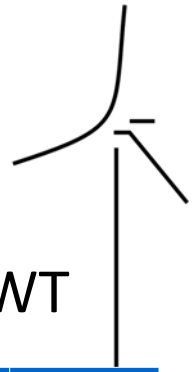
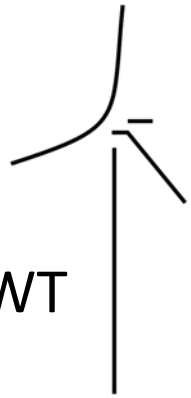
Results Schoondijke test site



Maand	Windsnelheid	Turby	Montana	WRE060	Ampair	Passaat	WRE007	Swift	Airdolphin	Skystream
maart	3,6	4.522	46.405	7.798	4.726	9.837	9.966	6.442	2.583	37.218
april	4,1	29.641	232.741	36.112	24.350	44.312	40.572	13.669	11.767	163.178
mei	3,8	20.841	298.417	49.198	32.310	58.927	58.512	30.511	14.077	207.540
juni	3,3	0	224.056	29.526	25.842	41.404	34.878	31.123	7.729	144.160
juli	3,5	0	219.836	32.146	23.534	42.270	36.756	32.334	7.546	142.692
		55.004	**1.021.455**	**154.780**	**110.762**	**196.750**	**180.684**	**114.079**	**43.702**	**694.788**

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

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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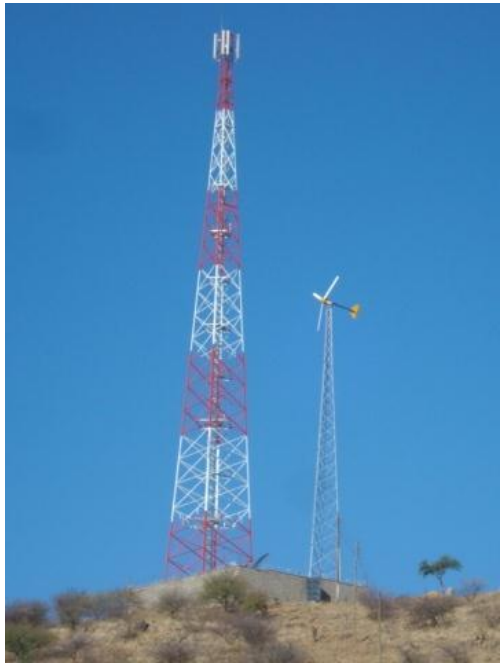
Telecom electrification with Bergey 10 kW wind turbine in Kenya.



Example Medium size turbine 1

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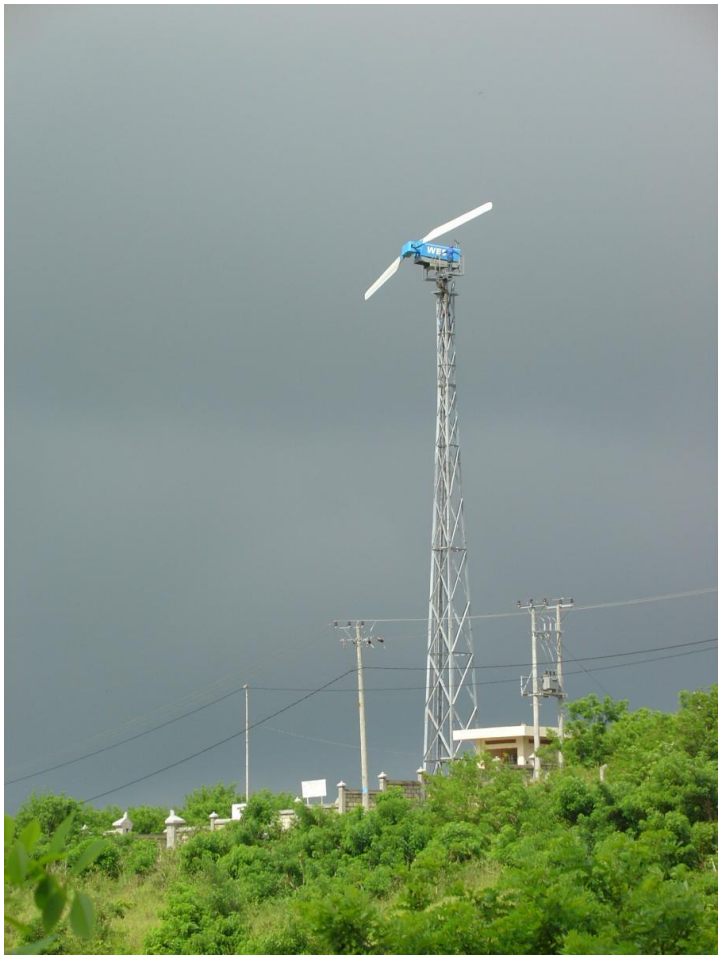
Rural electrification with wind/diesel system of WES 80 kW in Indonesia.



Example Medium size turbine 2

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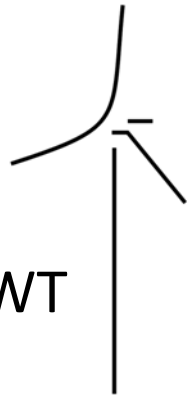
Rural electrification in Australia with Vergnet 275 kW wind turbine.

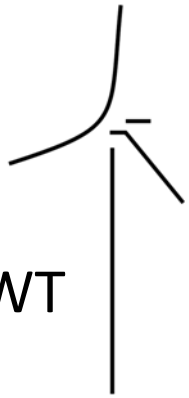
Advantages



Under good conditions low costs:

Technology	Typical Characteristics	Typical Energy Costs (U.S. cents/kWh)
Mini-hydro	Plant capacity: 100-1,000 kW	5-12
Micro-hydro	Plant capacity: 1-100 kW	7-30
Pico-hydro	Plant capacity: 0.1-1 kW	20-40
Biogas digester	Digester size: 6-8 cubic meters	n/a
Biomass gasifier	Size: 20-5,000 kW 8-12	
Small wind turbine	Turbine size: 3-100 kW	15-25
Household wind turbine	Turbine size: 0.1-3 kW	15-35
Village-scale mini-grid	System size: 10-1,000 kW	25-100
Solar home system	System size: 20-100 watts	40-60

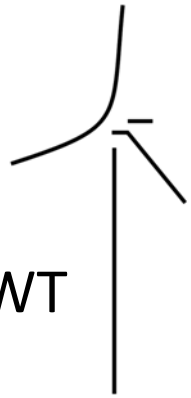
Table 1. Status of renewable technologies, characteristics and costs. Source: REN21, 2010



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.

Challenges



- Promoting the use of wind energy
- Getting wind data and finding the best spot
- System design, making synergy out of different technologies
- Building capacity, one project is not enough
- Certification is the road to sustainable projects

Conclusions

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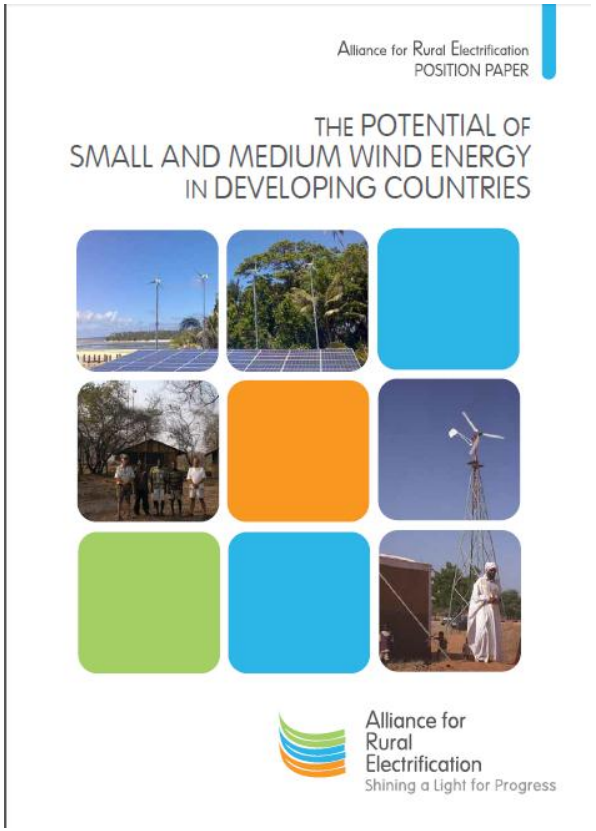
- Wind energy can be a low cost source of electricity
- Different sizes for different applications
- Needs more attention as an alternative



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Thank you for your kind attention.

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