



Wind Power Evolution



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Where it started – 1st Generation

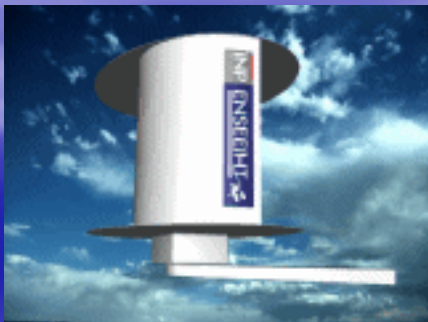
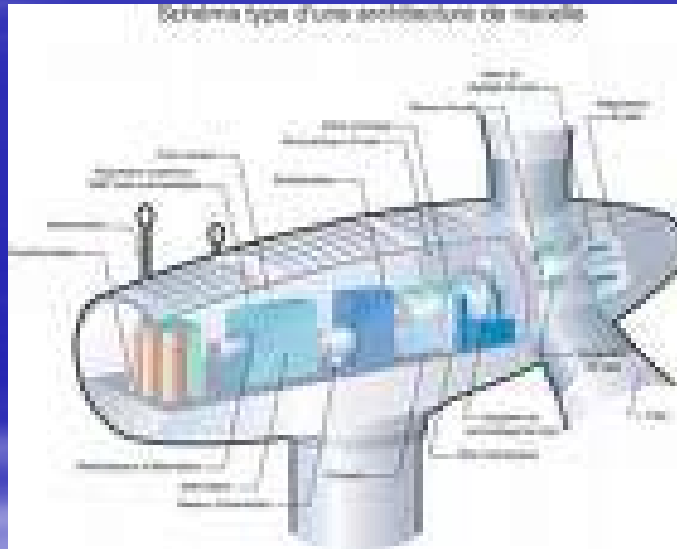


2nd Generation Wind Mills

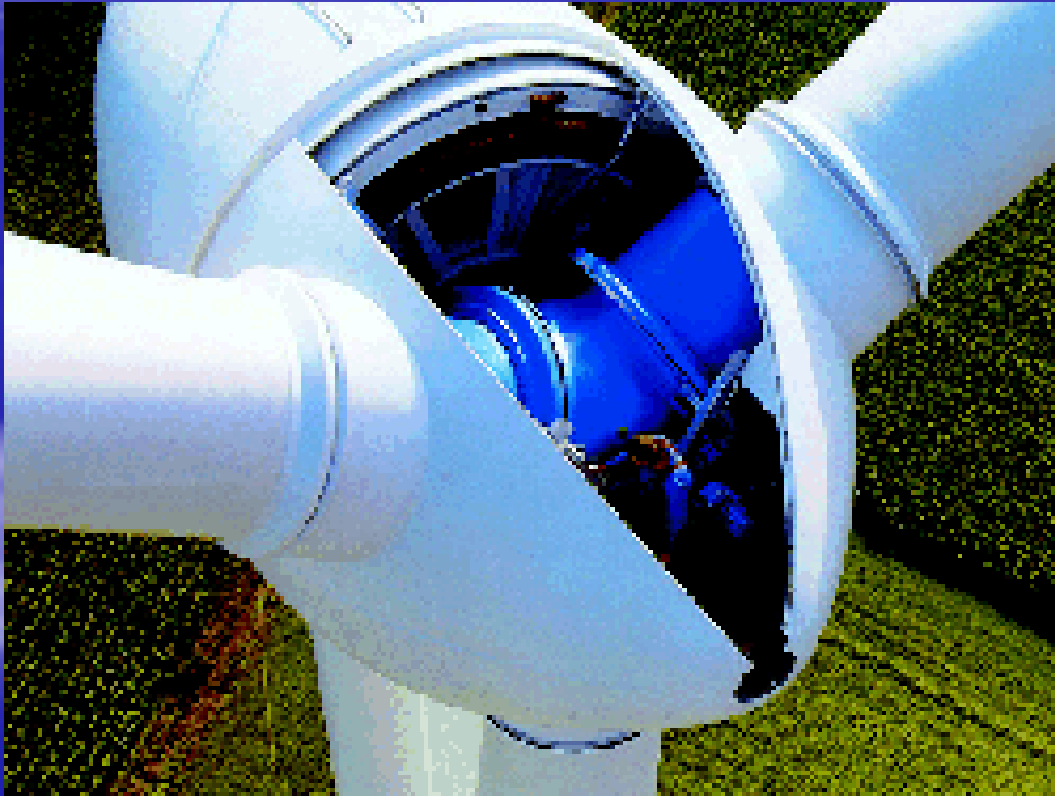


3rd Generation Wind Power

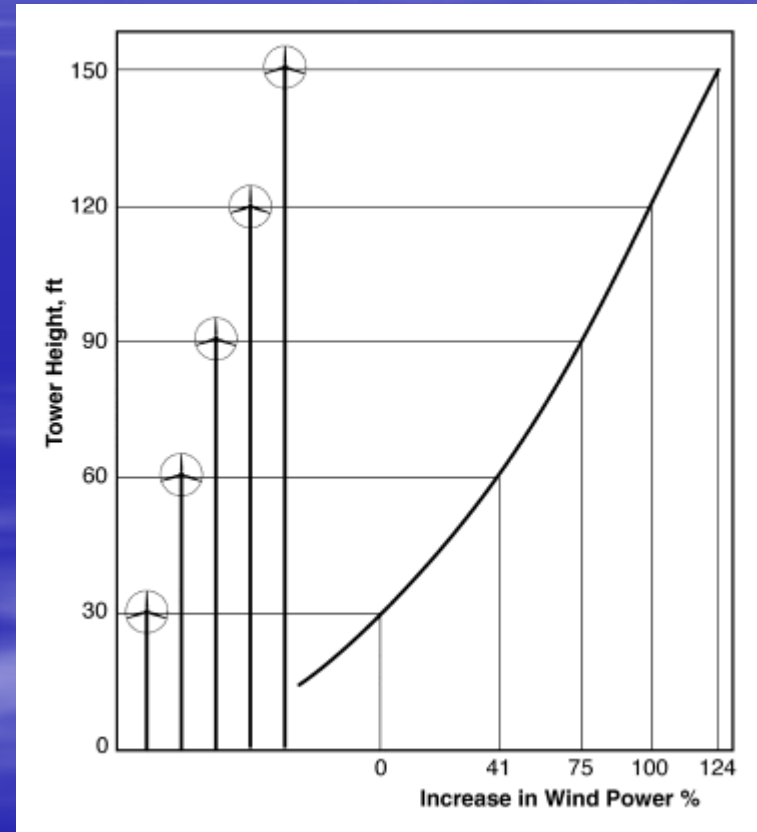
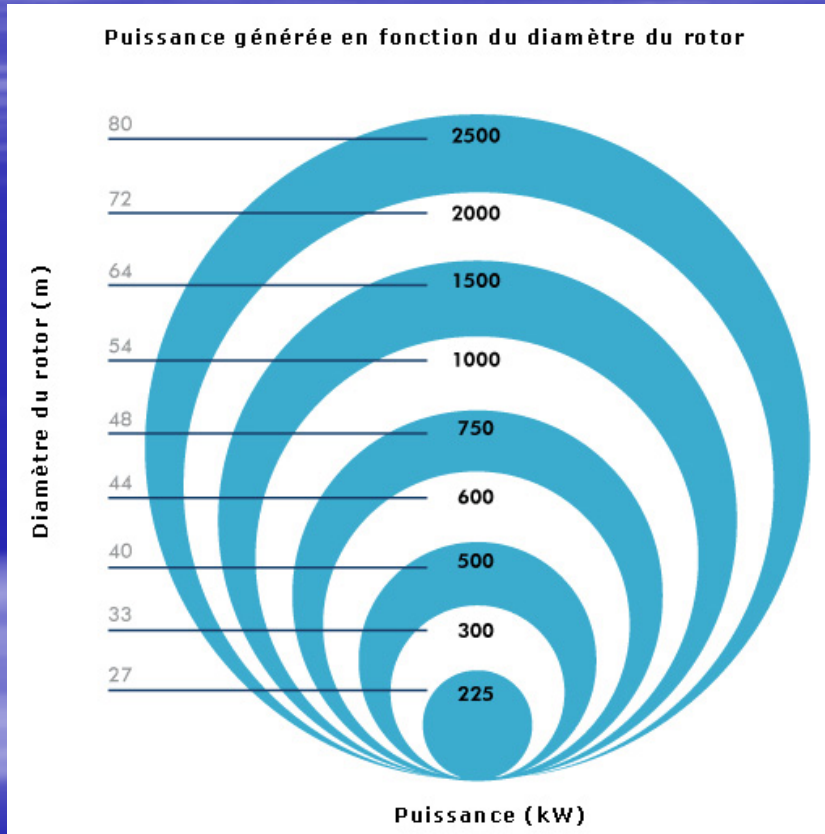
- Geared horizontal and vertical wind turbines
- Transition from stalled wind blades to pitch control



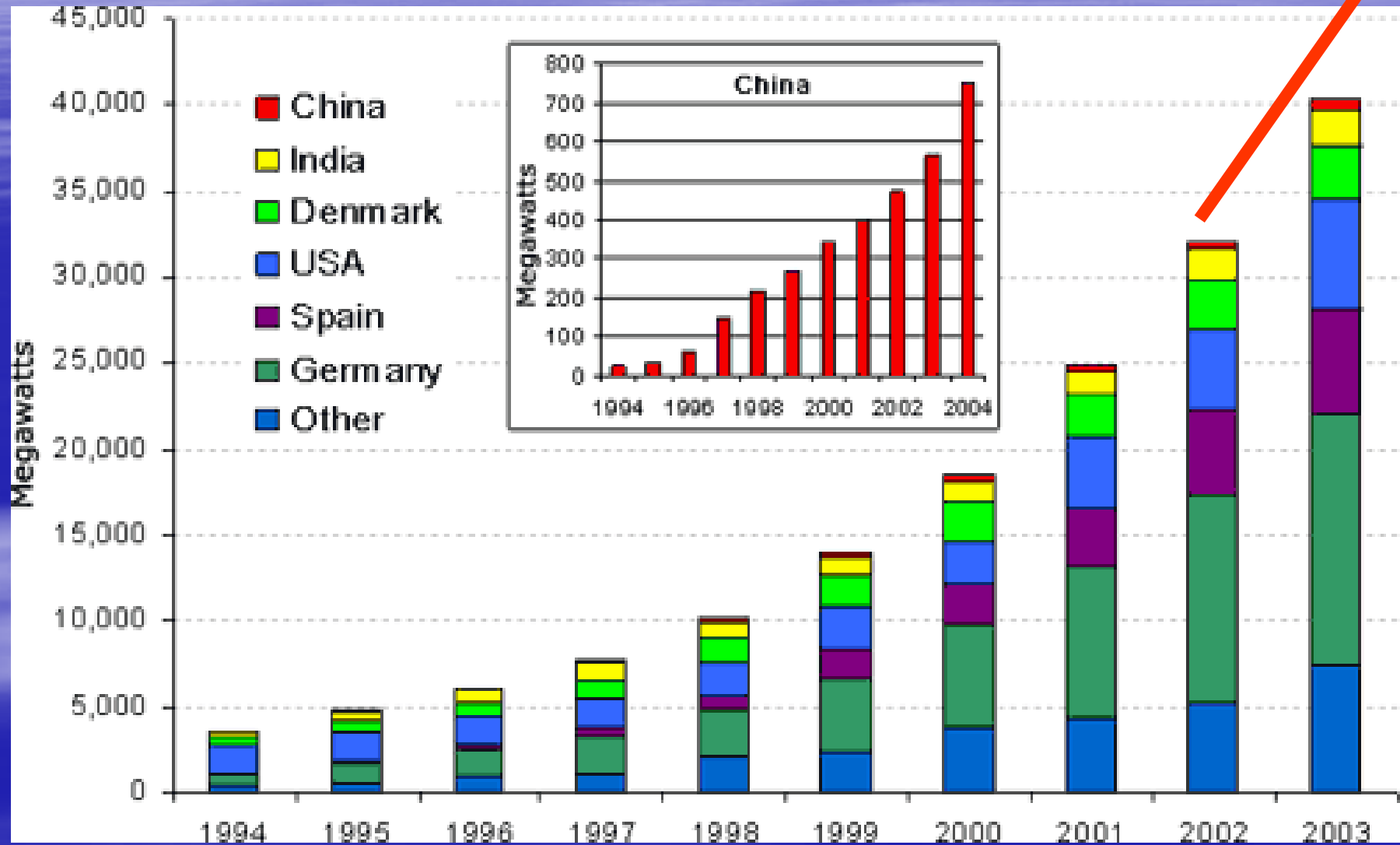
3rd Generation advanced gearless but auxiliary excitement and still too high logistics & crane cost



Trend to bigger generators



Growing Wind Power Market

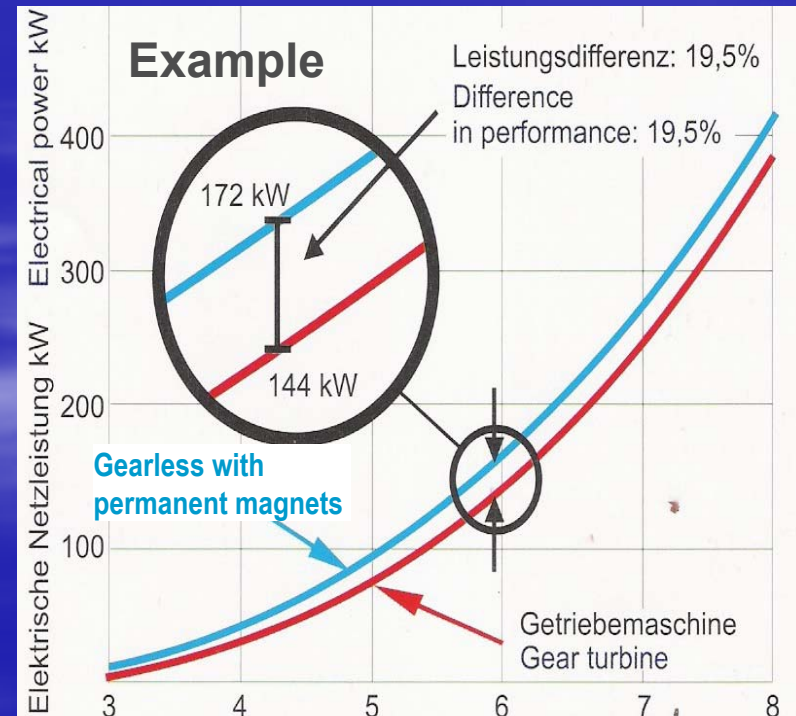


4th Generation STARWIND

Gearless, permanent magnets, pitch controlled

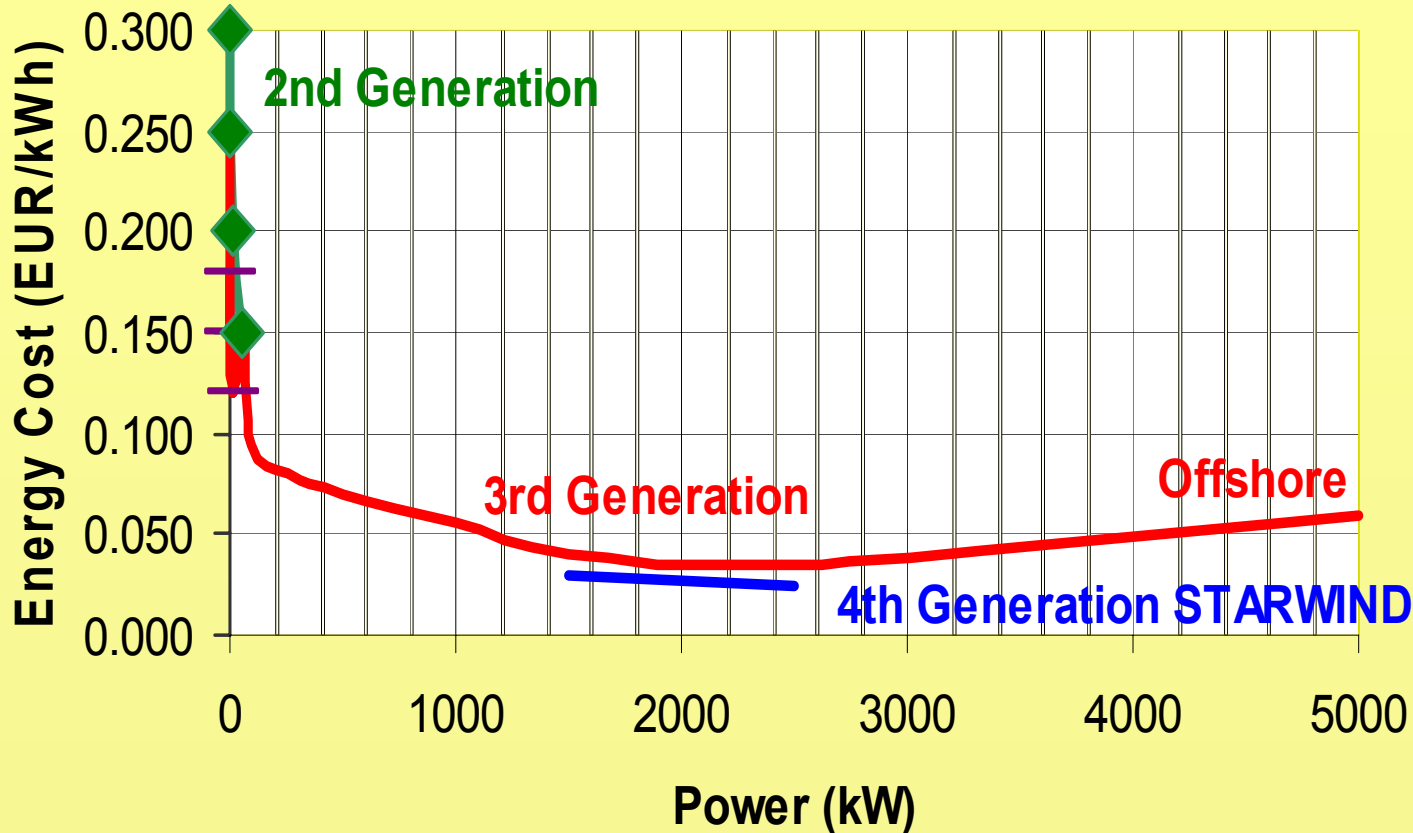
Advanced concrete tower, highest efficiency

Lower maintenance cost and very long life



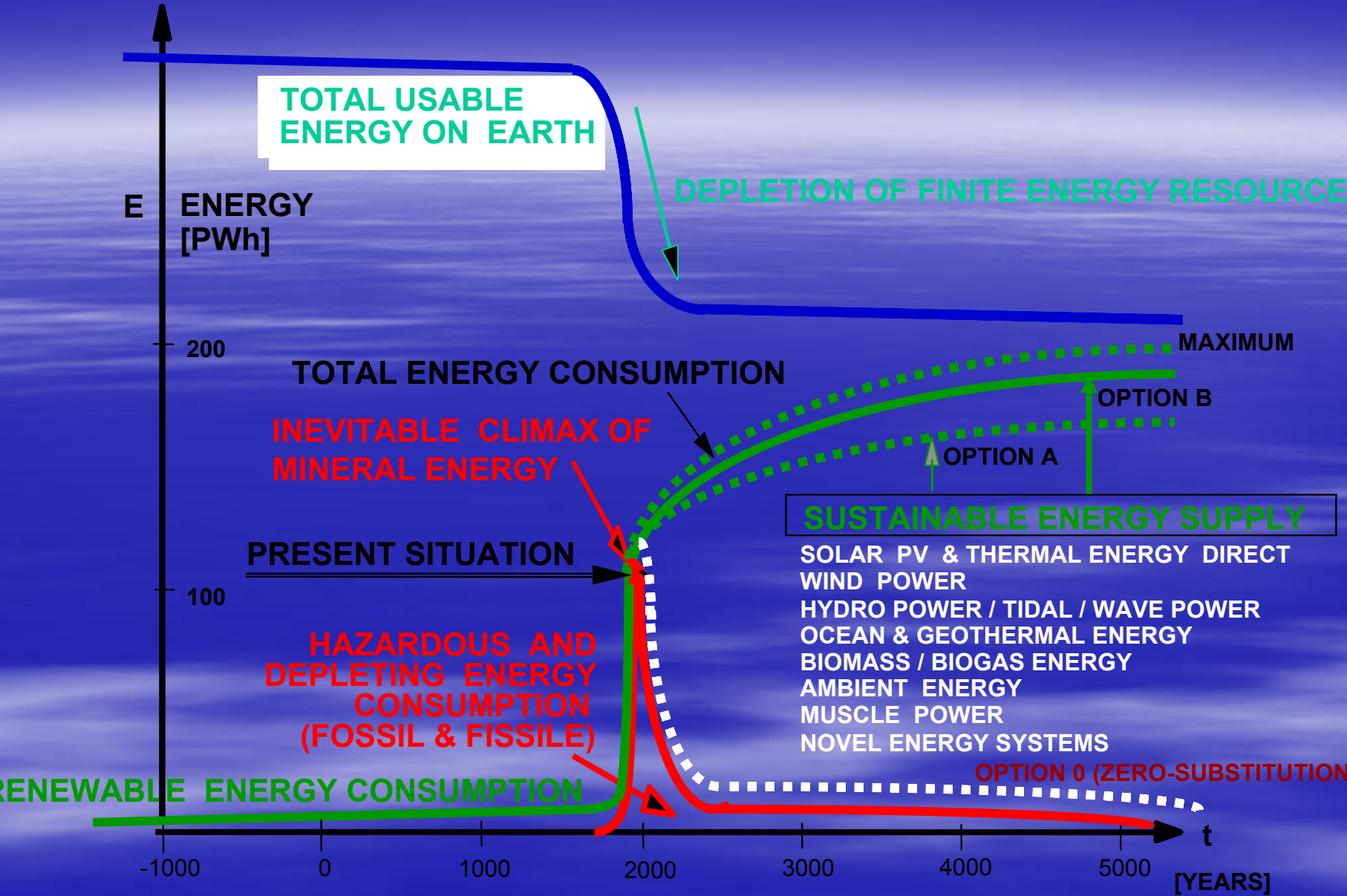
4th Generation Wind Power

Wind Power Cost



The Evolution of Wind Power to the 4th Generation

	1st Generation	2nd Generation	3rd Generation	4th Generation	Remarks
Time Period	4000 BC-1800	19th Century	20th Century	21st Century	
Uses	Water Pumping	Power Generation	Power Generation	Power Generation	STARWIND supports the grid in blackouts
	Grain Mills	Mills			
Types	Mechanical	Electric	Electric	Electric	The STARWIND generator performs about 5 % better than any competitor
			Geared & Gearless	Gearless Generators	
			Generators	Permanent Magnets	
			Auxiliary Excitation	(no slip rings)	
Wind Blades	Wood & Cloth	Wood / Metal	Plastics (PE)	Plastics (Epoxy)	STARWIND is using the most advanced wind blade design
	hand-adjusted	stalled	pitch control	or Bio-Plastics	
	or stalled			fail safe pitch control	
Towers	Wood	Wood	Steel or	Extruded Concrete	patented STARWIND long-life concrete tower
	(carpentry)	(handycraft)	Concrete	(self-mounting)	
Erection	Manual	Manual	High-rise Crane	No High-rise Crane	STARWIND transport and crane savings huge
				(self-erecting)	

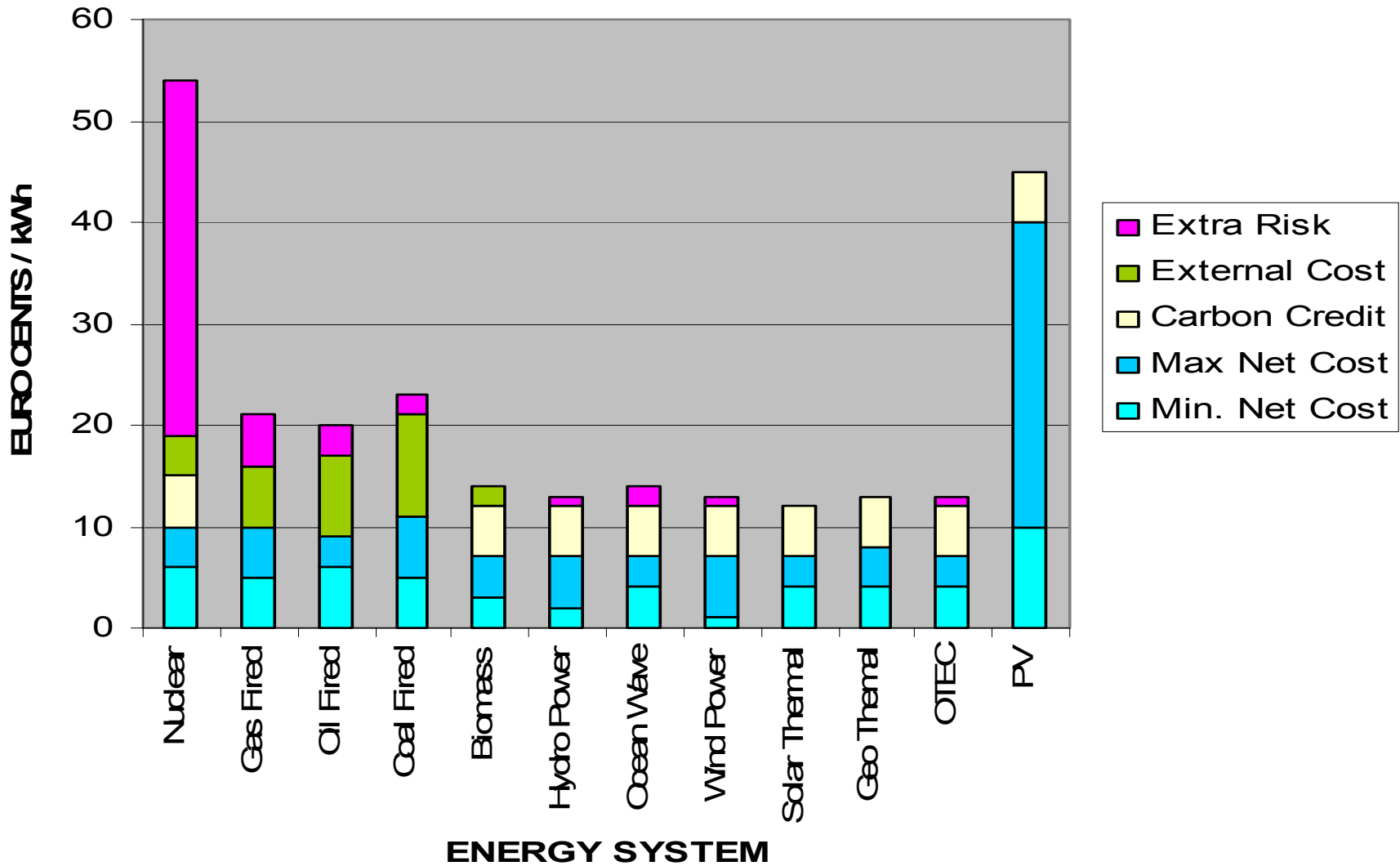


ENERGY HISTORY & FORECAST

SOURCE : ISEO

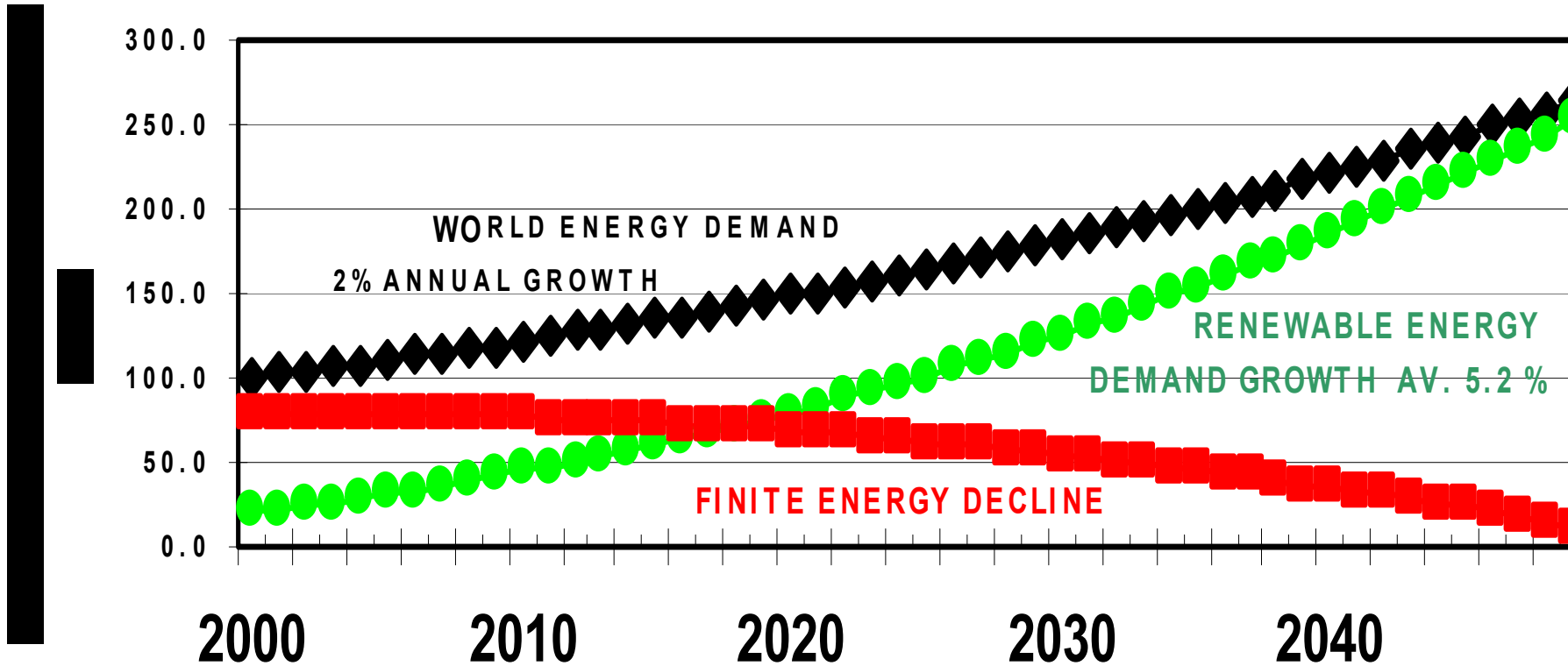
<u>Renewable Energy Option</u>	<u>Immediately Feasible</u>	<u>Theor. Potential</u>
- Bio energy	50	<u>PWh/year</u> 78
- Hydropower	8	14
- Geothermal Electricity Conventional	2	} 388
- Geothermal Electricity / Hot Dry Rock	20	
- Geothermal Heat	4	
- Wind Power	53	
- Solar PV Power	6	} 435
- Solar Thermal Power	40	
- Solar Active Heat	20	
- Solar Passive Heat (Buildings)	10	
- Ocean Energy (Waves and Tides)	15	202
- Heat Pumps	10	50
- Muscle Energy (Food Chain)	1	10
- Novel Energy Technologies (R&D)	<u>100</u>	<u>200</u>
Total RE potential	<u>339</u>	<u>PWh/year</u> 1537

TRUE ENERGY COST





WORLD ENERGY SCENARIO 2000 - 2050



Source for Finite Energy Data: ASPO at www.peakoil.net & Kyoto Protocol

International Sustainable Energy Organisation for Renewable Energy and Energy Efficiency



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Solar Energy	Ocean Power	Heat Pumps	Muscle Energy
Clean Transport	Statistics	Efficiency	Education
Architecture	Policy	Legal	Financing