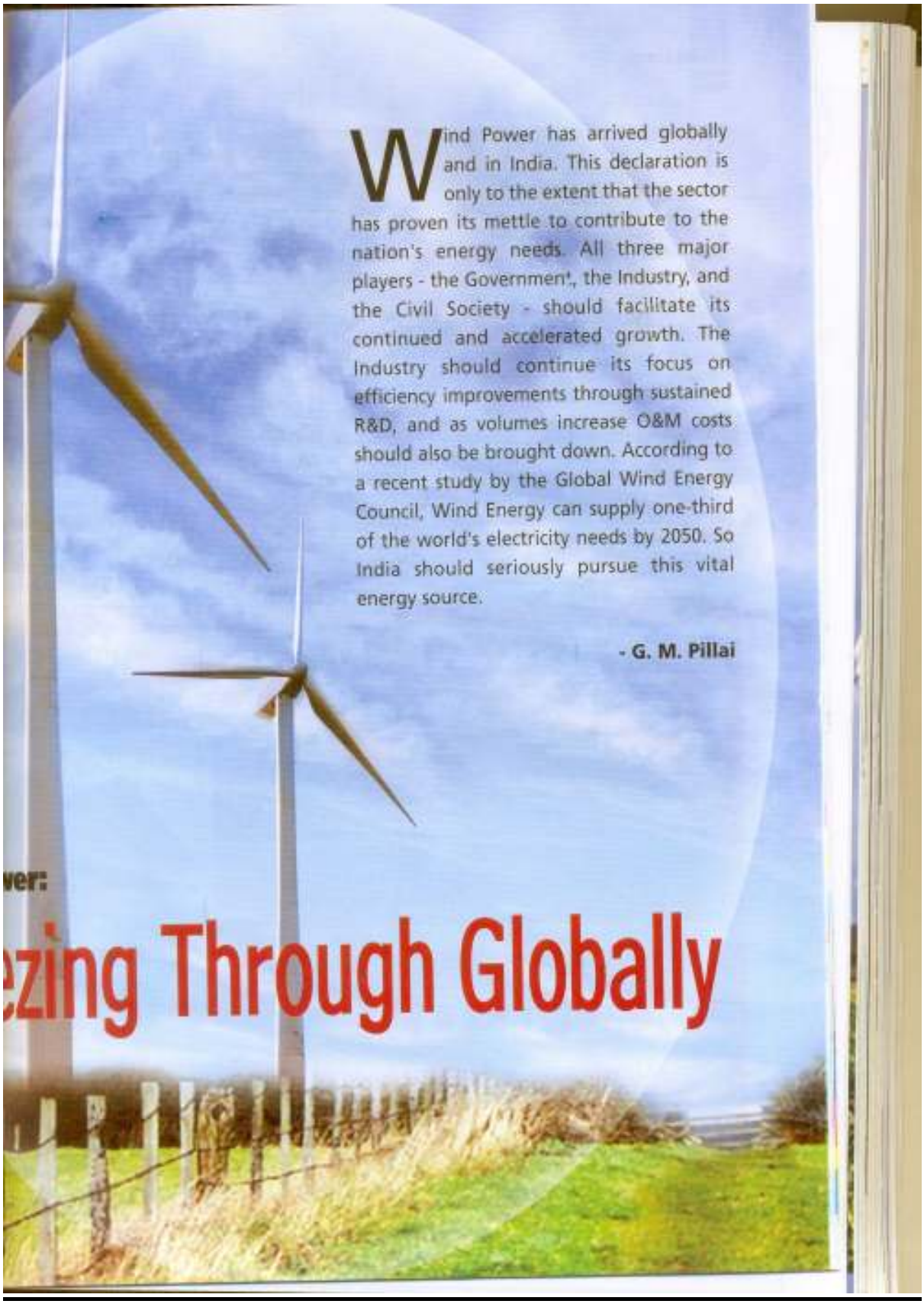

Wind Power has arrived globally and in India. This declaration is only to the extent that the sector has proven its mettle to contribute to the nation's energy needs. All three major players - the Government, the Industry, and the Civil Society - should facilitate its continued and accelerated growth. The Industry should continue its focus on efficiency improvements through sustained R&D, and as volumes increase O&M costs should also be brought down. According to a recent study by the Global Wind Energy Council, Wind Energy can supply one-third of the world's electricity needs by 2050. So India should seriously pursue this vital energy source.

- G. M. Pillai

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WIND POWER: BREEZING THROUGH GLOBALLY

G.M. Pillai

Introduction:

The amazing growth of wind power in the last ten years is attributed to a multiplicity of enabling factors, including the evolution of conducive policy and regulatory frameworks. We are re-inventing an old, reliable, and green energy source in the run-up to a post-fossil-fuel world. Even after solid evidence of their impending extinction before mid-21st century, many pseudoscientific and superstitious optimists continue to believe in the cornucopian presence of fossil fuels on earth. Even if, for argument's sake, such never-ending availability is agreed upon, their continued burning will suffocate all life on earth to death and devastation. Hence a transition to renewables has become imperative. The findings of the 2006 Worldwatch Institute report presented below is a testimony to this transition:

- Investment in renewables totalled $38 billion in 2005, up from $30 billion in 2004.
- Wind power capacity grew 24% in 2005 to reach 59000 MW and ten counties added over 300 MW of wind power, up from 5 countries that had done so in 2004.
- Biomass power production has increased by 50% to 100% in several countries.
- The United States produced record amounts of ethanol fuel for cars, and three new EU countries became ethanol producers.
- Biodiesel production grew by 85% in 2005 and nine new EU countries became producers.
- Grid-tied solar power grew by 55%, led by Germany, now with more than 200 000 solar rooftops.
- Solar hot water capacity grew by 23% in China and reached record levels across Europe.
- The renewable industry has captured investors' attention in the past year, more than ever before.
- At least 85 renewable energy companies or divisions have market valuations greater than $40 million, up from 60 companies or divisions in 2004. The estimated total market valuation of companies in this category is $50 billion, double the 2004 estimate, as several high profile initial public offerings have recently taken place. The best Indian example is the recent IPO of Suzlon Energy Ltd, which received overwhelming response from the public. The solar PV industry invested record amounts in new plants and equipment (about $6 billion), as did the biofules industry (more than $1 billion).

- Many new policies to support renewable energy were adopted over the past year, and many more were extended, revised, or discussed. Besides the EU and the United States, more than 16 developing countries including Brazil, China, Egypt, India, Mexico, Thailand, and Uganda actively supported renewable energy.
- Most notable was the fact that a number of countries dramatically stepped up targets and mandates for biofuels, i.e. ethanol and biodiesel mixed with conventional fuels.
- The number of countries with so-called 'feed-in' policies for the purchase of power from renewable sources increased to 41, and the number of countries with future targets for the share of energy from renewables increased to at least 49.
- Initiatives for grid-tied solar power multiplied, including new initiatives in the EU, California and other US states, Australia, and China.

The good news is that the transition to renewable has begun, and this transition is being led by wind power.

Eclipsing nuclear power: the phenomenal growth of wind

Globally, installed capacity of wind power reached 60 000 MW by December 2005. India, which is ranked as the fourth largest producer of power from wind, reached an installed capacity of 5340 MW by March 2006. Installations in India (1430 MW) accounted for 12.2% of the 11 769 MW installed in 2005 worldwide. In India, wind power has outpaced nuclear power (3360 MW) in terms of installed capacity and will soon surpass it in terms of generation also. The total installed capacity of nuclear power in the world in 2005 was 370 000 MW, i.e. approximately 440 nuclear power reactors producing 2600 TWh per year. This is roughly 16% of world electricity demand. About one-third of this capacity is found in North America, and one-third in the European Union. The fossil fuel crisis has generated a clamour for the worldwide revival of the stagnant nuclear power industry, whearas wind power could be the real alternative. According to a very authoritative report depicting future growth scenario for wind power, published by the European Wind Energy Association and Greenpeace, wind power stations are projected to generate 3000 TWh/year by 2020. By then, globally also, wind will eclipse nuclear power. This optimism is based on the analysis of past performance and continued sustained growth (Figure1).

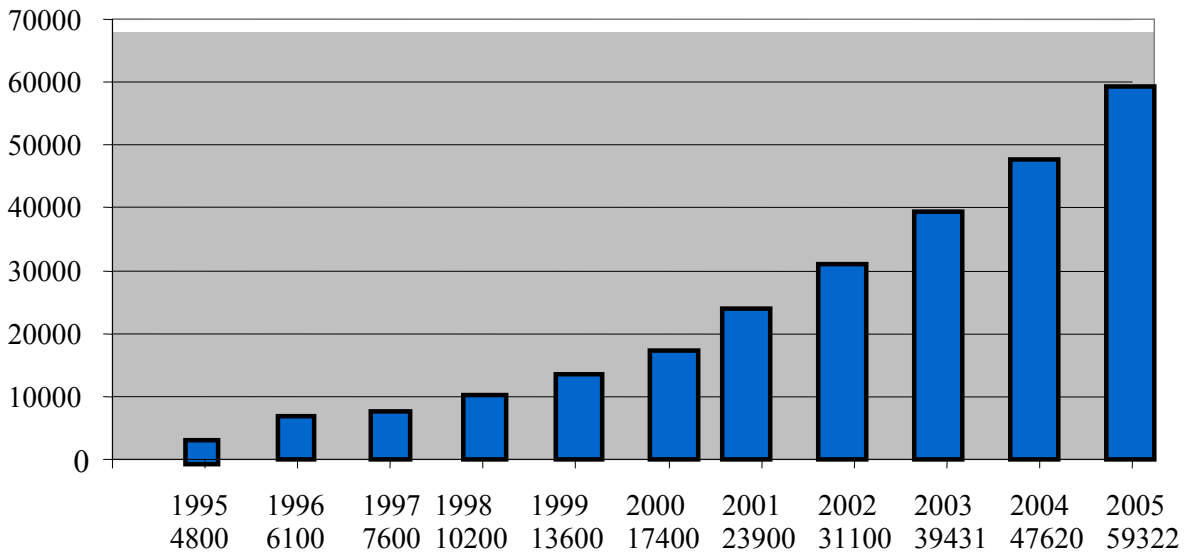


Figure 1: Global Cumulative Installed Capacity (MW): 1995 - 2005

(Source: Wind Directions, March/April 2006)

In the decade from 1995 to 2005, global wind power grew from 4800 MW to 59 322 MW. The average annual cumulative growth rate was 28% during the period 2000-2005. The latest global statistics as of July 2006 show that Wind power has reached 63 745 MW and continues its healthy growth (Table 1). The experience so far is that the growth has surpassed predictions.

Table 1

GLOBAL OPERATING WIND POWER CAPACITY

	START 2006 ▼ MW	CURRENT TOTAL ▼ MW
EUROPE		
Germany	18 427	19140
Spain	10028	10 728
Denmark	3127	3138
Italy	1717	1820
UK	1342	1695
Netherlands	1219	1394
Portugal	1024	1260
Austria	819	961
France	770	908

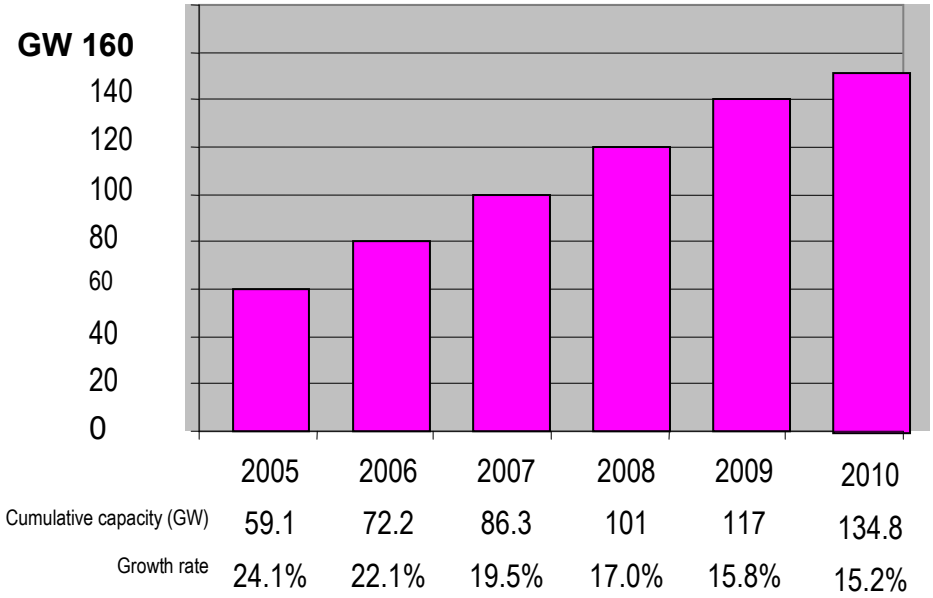
	START 2006 ▼ MW	CURRENT TOTAL ▼ MW
USA		
California	2150	2300
Texas	1990	2082
Iowa	834	836
Minnesota	744	750
Oklahoma	474	475
New Mexico	406	407
Washington	393	390
Oregon	336	338
Colorado	229	289

Greece	573	590
Ireland	525	525
Sweden	492	504
Norway	281	281
Belgium	160	167
Poland	58	108
Finland	83	83
Ukraine	70	70
Turkey	19	49
Luxembourg	35	35
Estonia	32	32
Czech Republic	28	28
Latvia	25	25
Croatia	6	17
Hungary	14	14
Other Countries	**32**	**32**
Total	**40 906**	**43 604**
PACIFIC REGION		
Japan	1150	1078
Australia	746	746
New Zealand	168	168
Philippines	25	25
Pacific Islands	15	24
Total	**2104**	**2041**
Egypt	145	157
Morocco	64	64
Iran	11	47
Tunisia	20	20
Reunion (France)	0	10

Wyoming	288	288
Kansas	263	264
New York	186	247
Pennsylvania	128	153
Montana	136	138
North Dakota	98	116
Illinois	107	107
15 other states	**380**	**420**
Total	**9142**	**9600**
CANADA		
Canada	684	943
Total	**684**	**943**
LATIN AMERICA		
Brazil	48	97
Costa Rica	71	71
Caribbean	55	57
Argentina	26	26
Colombia	20	20
Cuba	5	5
Mexico	5	5
Other countries	2	3
Total	**232**	**284**
ASIA		
India	4434	5200
China	1260	1260
South Korea	119	119
Taiwan	106	106
Other countries	4	4
Total	**5923**	**6689**
	Current World Total	**63475**

Source: Wind Power Monthly, July 2006

According to a status report produced by the Global Wind Energy Council (GWEC), the global wind power market is expected to more than double its capacity by 2000 (Figure 2). About 40 countries have visible amounts of wind power and ten of them exceed 1000 MW installed capacity. Denmark already produces 20% of its electricity from wind, northern Germany 35% and Spain 8%. Wind power has truly arrived!



(Figure 2: Global Forecast 2005-2010—Wind Power Cumulative Capacity

(Source: Global Wind Energy Council)

An industry rising: the future beckons

The global turnover of the wind industry in 2005 was about $12 billion, out of which $1.8 billion (about Rs. 9000 crore) was in India alone. From 1995 (1290 MW) to 2005 (11176 MW), the industry grew tenfold. A recent report points out that this growth had its huge impact on the nature of the companies operating in this sector. The huge market growth resulted in a concentration of the industry in two phases, namely from 1997 to 1998 and from 2002 to 2004. This report predicts that the ongoing consolidation and consequent reshaping of the industry is likely to result in a new status quo, with a few major global players, smaller regional contenders, and remaining niche market suppliers taking what is left.

After its takeover of NEG Micon, Vestas Windsystems A/s of Denmark has emerged as the single largest manufacturer of wind turbines in the world, with a market share (27.07% in 2005) far ahead of its competitors. Vestas's consolidation emerged as the fifth largest manufacturer having a market share of 5.9% and multinational presence in India, China, Australia, the United States and Europe. The Japanese multinational Mitsubishi has emerged as the other company of Asian origin in this industry. The recent takeover of the Indian Company NEPC by the Reliance Anil Dhirubhai Ambani Group may, in the longterm, have some implications for Indian industry.

Table 2 Market share of various manufacturers in'05

Manufacturers	MW	Share %
Vestas	3186	27.07
GE Wind	2025	17.2
Enercon	1505	12.8
Gemesa	1474	12.5
Suzlon	700	5.9
Siemens	629	5.4
RE power	353	3.03
Nordex	298	2.5
Ecotecnica	239	2.0
Mitsubishi	233	2.0
Others	1127	9.6
Total	**11769**	**100**

The growth in market volumes has been accompanied by technology growth also. Besides phenomenal improvements in efficiency and sophistication through R&D, the unit size of the turbines has also grown manifold. The average unit size has grown from 25 Kw in 1980 to 1MW+in 2005. Other parameters have also improved similarly (Table 3). Today most major global companies have turbines above 2 MW rating. Companies like Enercon (Germany) have already tested prototypes of a 6 MW turbine. The growth in unit size is driven mainly by the expansion of offshore wind in Europe. Technology upgrading in wind has just begun and the future may bring many pleasant surprises. However, technology breakthroughs in themselves are not enough to carry the sector forward.

Table 3 Phenomenal Improvement in Parametres

Parameter	**1980**	**2005**
Typical average size (MW)	0.025	1.000+
Availability factor (%)	60	99
Load factor (% average)	13	25.25
Self consumption rate (MW)	0.01	0.005
Construction time (years)	0.05	0.25
Economic lifetime (years)	10	20

India has made great strides in the development of renewables, especially grid connected wind-power. Today we can boast of being the 4th largest producer of power from wind in the world. But despite the existence of an early policy and institutional framework, the Indian wind power sector went through at least two boom—bust cycles (Figure 3).

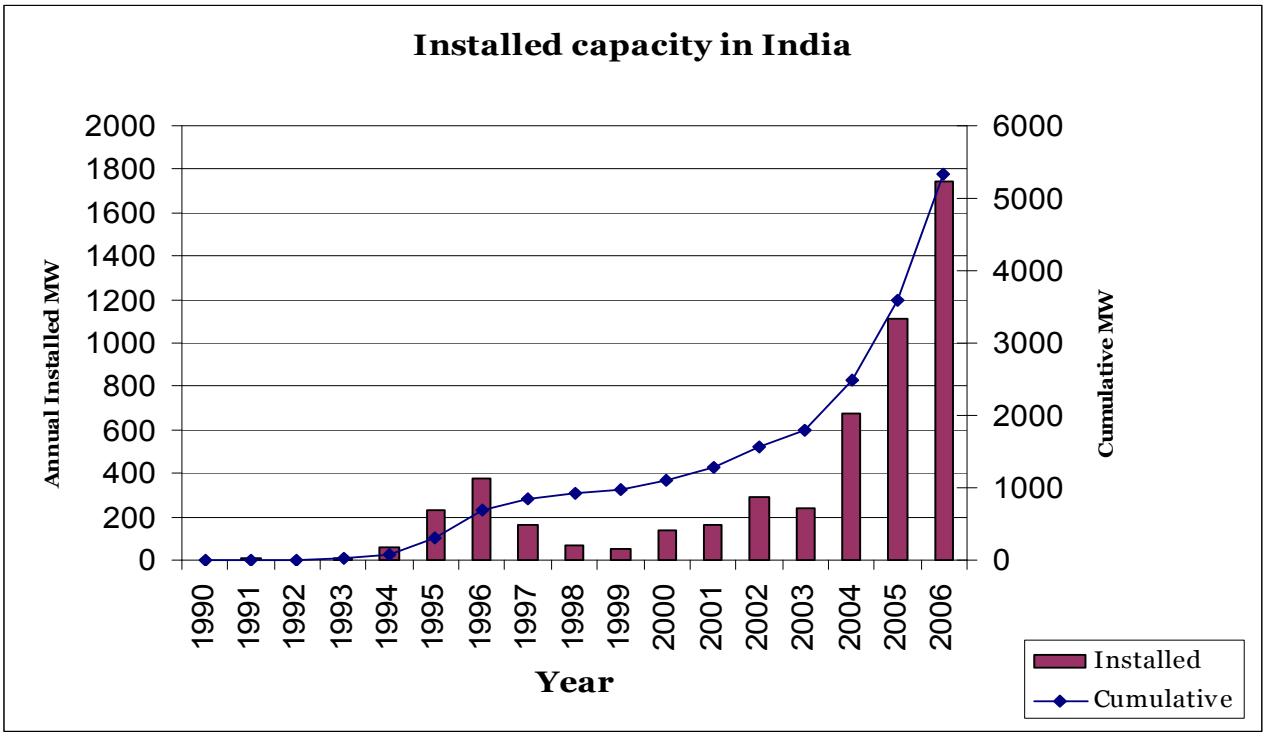


Figure 3 The boom-bust cycles of wind power growth in India

It is important to understand why the bust periods happened. Different people will have different views: the boom was generated by sales tax and income tax incentives and not genuine demand, when the sales tax incentives were withdrawn the

bust cycle was bound to follow; the industry was not ready to sustain the boom and hence the bust periods etc. But a close examination would show that the weaknesses in policy framework were mainly responsible for the boom—bust cycles. There was no policy planning framework for the **whole cycle** of this nascent industry's development. The Central/State Governments and the regulators in India need to pay serious attention to this issue.

Hurdles Galore

The growth of wind power has hardly been smooth, besides being bedevilled with hurdles – one after the other. Innumerable myths, superstitions, and pseudo-scientific shibboleths were peddled to block the growth of this green source of energy. These range from mundane, innocuous issues like noise and visual pollution of the landscape to apparently serious issues like intermittency of generation and its integration into the grid. Supporters of wind energy and wind power developers had to defend themselves against allegations that this technology will kill birds, cause deafening noise, prevent rains and lead to drought, interfere with military operations and aviation growth, destabilize the grid, and so on and so forth. We had seen this happening in India, aided by media largely uninformed about eco-technologies and the energy transition under way. However, this misinformation trend is global and still continues, although the support for such falsehoods has dwindled considerably.

The single biggest criticism is based on the issue of intermittency. In fact, conventional sources are also intermittent. Large power stations that go off-line, or grids that collapse whether by accident or design, do so instantaneously, causing immediate loss of power. When a fossil fuel or nuclear power plant trips unexpectedly, it takes a capacity of up to 1000 MW off the network. That is true intermittency. But power systems have always had to deal with these sudden output variations, as well as variable consumption. The recent blackout in New York city is the greatest example of the breakdown of the conventional power grid. In Queens, several thousand New Yorkers were without power for ten days. At one stage, 100 000 people were blacked out. In St. Louis, Missouri, at one point in the second week of July 2006, over one million people were without electricity. These blackouts started when several feeder lines suddenly failed; no one yet knows why. This has happened in the United States earlier also. In 2003 some 50 million people were left in the dark in the north-eastern parts of the United States at an estimated cost of $10 billion. In India also, in recent years we had major breakdowns of the national grid in central and western India resulting in blackouts in large areas of the country for more than two days. So it is unfair to isolate wind power on account of intermittency. The procedures put in place by network operators and new software can be effectively deployed to deal with variations in wind power production as well.

Conclusion:

Wind power has arrived globally and in India. The declaration of this arrival is only to the extent that the sector has proven its mettle to contribute to our energy needs. That should not be taken to assume that nothing now remains to be done to facilitate its continued and accelerated growth. All three major players – the government, the industry, and the civil society – should come forward earnestly to fulfill their roles. The industry should continue its focus on efficiency improvements through effective and sustained R&D. Measures for cost-cutting would also be needed. Effective operation and maintenance is the key to ensure maximum investor satisfaction. This is a priority area requiring the attention of the top management. As volumes increase, O&M costs should also be brought down. Creation of a service sector independent of manufacturers would be effective in generating competition. Recycling materials, reducing waste, and initiating search for new and renewable materials are keys to long-term growth and survival. In order to be truly 'green', companies should also work towards declaring themselves carbon-neutral, take up suo-moto environmental impact assessment at sites and undertake mitigation measures where necessary. Another critical area for societal acceptance is to ensure community participation through information dissemination, serious corporate social responsibility initiatives, and revenue-sharing measures (e.g. paying rent and leasing only the footprint of the turbine instead of purchasing the entire land). The industry can also effectively involve the media in aiding the sector's growth and development.

The civil society also has a major stake and role in ensuring this transition. After all, it is a question of building a safe, secure, clean, and healthy future for our children and grandchildren. It is unfortunate that even most of the environmental organizations have neglected this most critical area of energy transition. It is high time that they looked beyond protest strategies woven around biodiversity, wildlife, etc. and pushed for positive action for a transition to sustainable energy. According to a recent study by the Global Wind Energy Council, Wind Energy can supply one-third of the world's electricity needs by 2050. India should also serious pursue this vital energy source.

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