Energy for Sustainable Development 22 (2014) 74–84

Contents lists available at ScienceDirect

Energy for Sustainable Development

Gradualist best practice in wind power policy

Scott Victor Valentine [1]

Department of Public Policy and The School of Energy and Environment, City University of Hong Kong, Hong Kong

ARTICLE INFO

Article history:
Received 18 January 2013
Revised 12 November 2013
Accepted 12 November 2013
Available online 9 December 2013

Keywords:
Denmark
Energy policy
Best practice
Gradualism

ABSTRACT

This paper introduces and examines a conceptual dialectic between best practice and gradualism in regard to wind power policymaking strategy. It attempts to ascertain the extent to which either of these two strategies is evident in actual applied policy experience. To do so, the study presents an overview of wind power policy in Denmark from the inception of its modern day program to the present time. It concludes that both best practice and gradualist strategies were evident during the evolution of Denmark's wind power development and that the concept of "gradualist best practice" better explains the Danish wind power policymaking strategy. This article concludes with a discussion of how this reconceptualization helps improve an understanding of policymaking and helps overcome weaknesses of best practice or gradualist strategies applied in isolation of each other.

Introduction

A man who uses an imaginary map, thinking it a true one, is likely to be worse off than someone with no map at all; for he will fail to inquire wherever he can, to observe every detail on his way, and to search continuously with all his senses and all his intelligence for indications of where he should go (Schumacher, 2010/1973).

Over 40 years ago, E.F. Schumacher penned the above observation in a critique of neo-classical economic theory. However, it can be said that the same sentiments apply to the challenge of designing and implementing policy for wind power diffusion. Wind power policy research is rife with studies that attempt to extract useful policy lessons from successful wind power development programs in leading wind power nations such as inter alia Denmark (Agnolucci, 2007; Szarka, 2006), Germany (Wüstenhagen and Bilharz, 2006; Zitzer, 2009), Spain (Montes et al., 2007; Rivier, 2010), China (Liu and Kokko, 2010; Xia and Song, 2009) and the United States (Fischlein et al., 2010; Wiser et al., 2007).

In many wind power policy studies, researchers have focused on one or two key factors which have seemingly catalyzed success. These studies have highlighted the importance of feed-in tariffs (Mendonca et al., 2009; Pembina Institute, 2008), green taxes (EWEA, 2005), management of public opinion (Firestone and Kempton, 2007), access to finances (Lüthi and Prässler, 2011), links to industrial development (Blanco and Rodrigues, 2009), strategic national planning (Toke et al., 2008), and technological learning (Smit et al., 2007), to name but a few topics.

In recognition that many of these are indeed influential, other researchers have attempted to draw these factors together to comprehensively enumerate the assorted challenges that policymakers face in designing an effective wind power diffusion program (cf. Komor, 2004; Saidur et al., 2010; Valentine, 2013; Wizelius, 2007). In the process, frameworks have been proposed to help policymakers understand the inter-relationships between many of the factors deemed important for driving successful wind power development. For example, as depicted in Table 1, Valentine presents findings from research which group factors that influence wind power development into a STEP framework marked by social, technological, economic and political categories (Valentine, 2010).

While Valentine's framework serves as a useful catalog of factors that influence wind power development, it is inadequate for guiding the development of prescriptive policy. As Valentine acknowledges, "understanding the relative influence of each variable is a necessary exercise if policymakers are to identify forces which will have the strongest potential for catalyzing electricity regime change…given the numerous inter-relationships between the STEP forces, attempts must also be made to understand the nature of these connections and explicate how the forces which inhibit wind power development respond to changes occurring to other factors within the complex adaptive policy system (Valentine, 2010)". In short, Valentine's point is that although these influences have been documented, current limitations in understanding the relative influence of the variables and the causal relationships between the variables render the STEP framework hard to apply for guiding prescriptive policy.

Recently, a parallel track of research attempts to overcome this challenge by enumerating a list of "best practice" principles that have proven to be successful in a number of markets. The premise being that policies that have been effective in a number of markets exhibit a certain degree of transferability. They exhibit resilience in the face of contextual influences that might otherwise cause a policy that was successful in one nation to be unsuccessful in another nation.

E-mail address: scott.valentine@cityu.edu.hk.
[1] Tel.: +852 3442 8922; fax: +852 3442 0413.

0973-0826/$ – see front matter
http://dx.doi.org/10.1016/j.esd.2013.11.003

Table 1
STEP framework of factors influencing wind power development.
Source: Valentine (2010).

Social	Technical	Economic	Political
NIMBY concerns	Stochastic nature of wind power	Externalities not internalized	Political conflict over optimal electricity mix
Level of civic activism	Multi-stakeholder grid management	Other competing alternative technologies	Level of fossil fuel industry opposition
Geographic hurdles	Logistical "bother"	Subsidies to traditional technologies	Diffused alternative energy support
Market information asymmetry	Distance to grid	Insufficient renewable energy subsidies	Energy efficiency initiatives prioritized
Social complacency	Inadequate R&D to improve storage	Long-term fossil fuel purchase commitments	Complacency regarding CO_2 reductions
Electricity price sensitivities	Underestimated potential	Market players lack investment incentives	Vertically integrated utility monopoly
Concerns over community impact		Government budget limitations	Weak adjoining grid coordination
		National advantage in other energy resources	Lack of R&D support for wind power

In regard to wind power policy, what exactly constitutes best practice? In a 2011 article published in *Energy Policy*, Clara Garcia posits an interesting interpretation wherein "best practice" in grid-connected renewable energy (GCRE) is defined as the adoption of six policy and five institutional principles (see Table 2).

These two streams of research give rise to the creation of a conceptual dialectic that has some interesting ramifications for the advancement of wind power policymaking strategy. On one side of this dialectic is the notion of "best practice", which is premised upon the tenet that prescriptive policy can be successful in guiding wind power development. Best practice, in its purest form, represents a proactive, well-structured approach to wind power policymaking, wherein its success is contingent on the resilience of best practice principles to contextual influences that may confound transferability (IRENA, 2012). On the other side of this dialectic is the notion of "gradualist policymaking", which represents a reactive, malleable approach to wind power policymaking. It is premised on the observation that wind power development occurs within a complex adaptive market environment where the dynamics and interplay of numerous influential variables render market developments hard to predict. Under such conditions, proponents of this perspective argue that successful policymaking is contingent on understanding the nature of the influences of policy, monitoring market development and ensuring "gradual" reactive response (Valentine, 2013). This dialectic is summarized in Fig. 1.

For policymakers in any nation, it is important to determine which perspective holds most credence to avoid ineffective policy. On one hand, if one embraces the notion that best practice principles can be imported and employed successfully in a given national context but this assumption proves invalid, the result will likely be policy that fails to catalyze desired performance. On the other hand, if one embraces the notion that a gradualist approach to wind power policy is more conducive to facilitating development but this assumption proves invalid, the result will similarly lead to sub-optimal performance. Indeed, Garcia introduces her best practice framework in a paper which argues that China's adoption of a gradualist approach to renewable energy policy potentially leads to suboptimal market development (García, 2011).

Therefore, this paper attempts to ascertain the extent to which either of these two perspectives accurately describes actual applied policy experience. The next section will outline the methodology employed for this study and provides the justification for focusing on wind power development in Denmark, the nation chosen as the core case study.

Methodology

In order to make a contribution to determining whether best practice or gradualism represents the more effective approach to encouraging wind power diffusion, a decision was made to adopt a case study approach employing historical critical analysis. The intent was to comprehensively document wind power policy in a nation with a successful track record in wind power diffusion, in order to provide the pool of evidence necessary to assess whether the nation's policies epitomized best practice or gradualism.

A decision was made to focus on only one nation because of the current absence of studies which attempt to qualify a nation's wind power policymaking strategy. This decision is in keeping with studies which suggest that single case studies facilitate a greater depth of understanding, thereby yielding more useful insights into little known phenomenon (Dyer and Wilkins, 1991; Eisenhardt, 1991). The need to understand how contextual and temporal influences impinge on policy strategies suggested that employing historical cause and effect analysis would also help explain why a given strategy (if evident) was preferred.

There are pitfalls associated with applying this methodology. First, it can be argued that a study which incorporates numerous nations would produce a higher degree of external validity (Eisenhardt, 1989). However, the need for depth of understanding outweighed the benefits to be derived from expanding the sample size. Second, it can be argued that historical cause-and-effect analysis exposes the study to experimenter and interpretative biases that confound the findings (Cook and Campbell, 1979). However, one could counter this challenge by arguing that this stage of research would be best classified as discovery (Blaikie, 2000) – not empirical validation –and that this study in general is a first attempt to describe policymaking strategy in wind power. Refinement,

Table 2
Garcia's best practice principles.
Source: García (2011).

	Policies and institutions for renewables in the "best practice" model
Policies to overcome economic barriers	i. Elimination of coal subsidies
	ii. Compensation for the negative externalities of fossil fuels (pollution, etc.)
	iii. Remuneration for the positive externalities of renewables
	iv. Compensation for higher initial costs (mandated market policies): quantity-based and price-based schemes
	v. Increased access to capital: fiscal and financial aids
	vi. Ensuring sufficient demand (PPAs)
Institutions to overcome non-economic barriers	i. General legal security
	ii. Capable bureaucracy: coordination and cutting of red-tape
	iii. Quality of regulations in renewables: specific, legally binding targets and predictable instruments
	iv. Competition and technology-friendly policies in generation: unbundling, absence of oligopolies, openness to FDI
	v. Competition and technology-friendly policies in manufacturing: openness to external trade and FDI

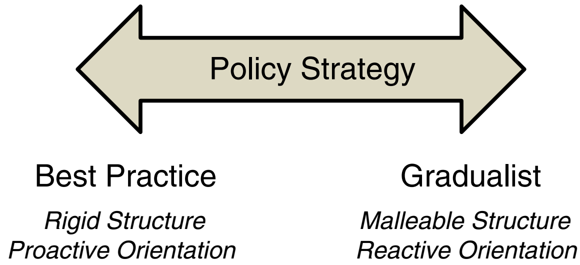

Fig. 1. The best practice/gradualist policy dialectic.

quantification and expansion of the findings, therefore, represent fodder for future studies.

Denmark was chosen as the centerpiece of this study. In 2011, Denmark boasted the world's highest contribution of wind power to electricity consumption — 28% (Danish Energy Agency, 2012). Clearly, if principles of "best practice" exist in regard to wind power diffusion policy, Denmark's approach to wind power development should exemplify many of these principles and provide insight into the contextual factors influencing the application of best practice. If best practice principles do not exist, a comprehensive study should reveal insight into how and why wind power policy evolved over time. The study extends from the inception of Denmark's wind power program to the present time and therefore, also provides a useful summary of wind power policy in a highly successful wind power market.

Information on the evolution of Denmark's wind power program was extracted from a review of government documents and an extensive literature review of peer-reviewed articles pertaining to wind power development, which were accessed through Science Direct® and SCOPUS® databases. Given that the article is a critical analysis study that employs historical evidence, it is believed that the lack of primary data collection does not significantly undermine the validity of the analysis.

In the next section, the history of wind power development in Denmark is summarized. Section 4 then analyzes evidence from the case study in relation to our research objective and attempts to synthesize what turn out to be inconclusive findings. Section 5 concludes with a discussion on avenues for further research in regard to honing best practice research.

History of wind power development in Denmark

In 1972, oil constituted a whopping 93% of Denmark's primary energy supply and being a nation of scant domestic fossil fuel resources, its dependence on oil imports was high (Carlman, 1988). Consequently, the inflationary impact of the 1973 oil embargo implemented by the Organization of Arab Petroleum Exporting Countries (OAPEC) precipitated economic havoc in Denmark (IRENA, 2012).

In 1976, with oil still lurking around the $60 US per barrel level (in 2010 adjusted prices), the Danish government announced a new energy policy that was geared toward reducing oil dependence. This plan included support for the development of nuclear power and alternative energy (Meyer, 2004b). In terms of alternative energy, wind power stood out as a forerunner for a number of reasons. The wind power industry had established deep roots in Denmark. As early as 1918, wind turbines in Denmark contributed up to 3% to the nation's electricity supply, a penetration rate that even today, few nations can boast (Meyer, 2004b). Denmark was also where the Gedser Mill was constructed in the mid-1950s, a prototype wind turbine that would come to serve as the fundamental model for most modern horizontal axis, three-blade turbines (Gipe, 2004). Technology roots aside, wind resource in Denmark is also superb. Denmark's 5000 miles of coastline, flat expanses of agricultural land and blustery North Sea location has prompted one wind power expert to liken Denmark's wind power potential to that of the American Great Plains (Gipe, 1991).

In support of this new energy strategy, a national wind energy program was unveiled, featuring plans to build a test center for small wind turbines at the Risø National Laboratory for Sustainable Energy (Risø Laboratories). The objectives of this program were to centralize R&D to support aspiring manufacturers and to provide a standardized system for certifying the quality of Danish-made wind turbines, thereby providing investors with a higher degree of quality assurance (Carlman, 1988).

The initial research strategy championed by the national government was to create technologically advanced wind turbines designed by consortiums of large Danish firms for placement in large wind farms that would be owned and operated by utilities (Kamp, 2004). However, such commitment never materialized. Instead, by 1978, there were still only a score of small wind turbines manufacturers and the new entrants were mostly manufacturers of agricultural equipment looking for ways to diversify product lines for agricultural consumers. With technical assistance provided by Risø Laboratories and other government-sponsored wind power R&D programs, companies such as Vestas – which was established in 1898 as a blacksmith foundry – began to produce uncomplicated, yet reliable turbines based more on accumulated manufacturing knowledge than aerodynamic principles (Kamp, 2004; Wüstenhagen, 2003). However, with no real government support, wind power development was predominantly relegated to decentralized, off-grid applications. This was about to change due to another external energy market shock.

The 1979 energy crisis that emerged as a consequence of the Iran Revolution consolidated political will to proactively drive wind power development (Carlman, 1988). That year, a Ministry of Energy was established in order to proactively direct national energy strategy (Meyer, 2004b) and two subsidies were introduced that would alter the course of wind power development in Denmark. The first subsidy allowed investors in wind turbines to claim up to 30% of total investment costs, including installation and connection costs (Kristinsson and Rao, 2008); however only turbines approved by the Risø Laboratories were eligible. Once wind turbines were operational, a second subsidy permitted a tax-deduction on the sale of surplus wind power to the utilities, which were required to purchase all such surplus (Meyer, 2004b).

There was a special stipulation attached to the 1979 policy initiatives that would prove to be instrumental in facilitating public support for wind power development. Only individuals (or cooperative groups of individuals) living within 3 km of a given project were eligible for the investment subsidy (Buen, 2006). This condition ensured that project investors and host communities were often one and the same — significantly mitigating community opposition to these new projects. However, uncertainty over revenue flows prevented broader scale investment; and as Fig. 2 illustrates, it wasn't until the mid-1980s that wind power really took off.

Although market development was limited, the government-led initiatives undertaken between 1979 and 1984, laid the foundation for supporting larger scale efforts. A national wind power potential study confirmed the contribution that wind power could make to domestic energy security (Meyer, 2004b). The development of a wind atlas project enabled developers to target the most profitable sites. The establishment of a wind energy department at the Risø Laboratories provided a one-stop shop of technical support for aspiring wind turbine manufacturers. Announcement of the development subsidies gave the government insight into what it would take to catalyze investment and gave host communities a chance to evaluate the pros and cons of small scale wind power projects. In fact, the only glaring omission from this array of support initiatives was the creation of a domestic wind power market to nurture globally competitive wind turbine manufacturers. In the absence of other opportunities, the slow market build-up exhibited in Denmark between 1979 and 1985 would not have been sufficient to support the

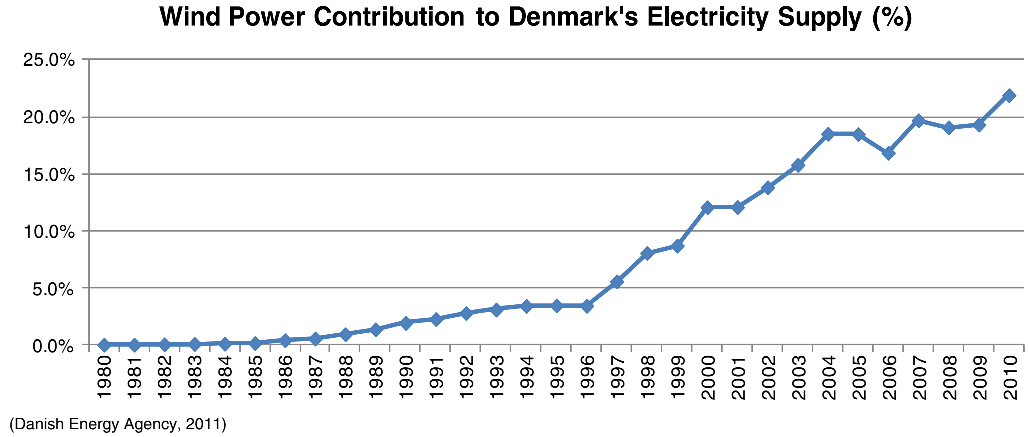

Fig. 2. Wind power development in Denmark.
Danish Energy Agency (2011).

emergence of global wind turbine manufacturing giants such as Vestas and Bonus. Fortunately, fate had a role to play in rectifying this omission.

In 1978, the combination of oil prices oil prices that were twice as high as 5 years previously and national and state renewable energy development incentives catalyzed a wind power boom in California and Danish wind power turbines emerged as the preferred choice for fulfilling this demand thanks to quality assurances provided by Risø's certification system (Mallon, 2006; Wizelius, 2007). Although policies changed in the United States (and California) and the bottom fell out of the US wind power market in 1985, this 5-year period of market prosperity proved to be instrumental in nurturing the rise of Denmark's wind power industry.

Meanwhile back in Denmark, it was apparent that stronger market incentives would be required if wind power was to reach a level of commercialization that would enhance domestic energy security. Therefore, in 1984, legislation was announced wherein private wind power producers were permitted a tax refund of €0.037/kWh (Meyer, 2004b).[2] Wind power generators that wished to sell power into the grid were to be guaranteed access, with utilities committing to contracts of at least ten years in duration to purchase wind power at a price equal to 85% of the retail price. Utilities were also compelled to pay 35% of any grid connection costs (Buen, 2006; Kristinsson and Rao, 2008). In aggregate, these policies amounted to payments to wind power providers of approximately €0.08/kWh, ensuring a substantial return on investment (Morthorst, 1999). As Table 3 illustrates, by 1985, these incentives catalyzed unprecedented market growth.

With hundreds of wind power turbines springing up around the country, concerns over the adverse aesthetic impacts of these turbines were beginning to emerge (Madsen, 1988). Consequently, the government decided to take steps to encourage concentrated development through wind farms. To support private wind farm development, an enhanced subsidy was announced that provided up to 50% of the capital costs for approved wind power projects (Madsen, 1988). Furthermore, an agreement between Denmark's utilities and the Danish Ministry of Energy that had been under negotiation since the late 1970s was concluded in 1985. It compelled utilities to develop 100 MW of wind power between 1986 and 1990, effectively tripling installed capacity in Denmark (Meyer, 2004a). This voluntary agreement which received no financial support from the government (Madsen, 1988) underpinned an expectation that the government envisaged utilities playing a greater role in supporting wind power development (Mitchell, 1995). There was incentive for utilities to cooperate in this manner in order to stave-off formal government mandates; and given that the majority of Denmark's utilities were not-for-profit entities owned by municipalities and communities, there was a degree of reluctant acquiescence because the adverse financial impact of premium-priced wind power would eventually be passed along to the end-consumer.

In 1986, with the pace of wind power development heating up, the government introduced two curious initiatives that seemed directed at reining in the pace of development. First, it reduced the tax credit subsidy that was initiated in 1979 for wind power investment from 20% to 15% for both individual projects and wind farms (Carlman, 1988; Madsen, 1988). Second, it introduced revised legislation that narrowed the eligibility criteria for these downsized subsidies. A wind turbine owner was required to live close to the turbine site and could only receive tax credit for electricity generated from the person's investment that was equal to 150% of the person's annual consumption or 9000 kWh (Frandsen and Andensen, 1996). In hindsight, these new restrictions can be considered to be a manifestation of policy learning. The government was responding to the realization that it was more effective to provide incentives for electricity generation (the 1984 subsidies) than to simply construct a wind turbine (the 1979 subsidies).

The repercussions of these seemingly minor policy adjustments illustrate the precarious nature of policy setting in multi-stakeholder networks. The combined impact of the expiration of California's wind power developments support scheme, the declining cost of oil (which adversely influenced the wind power tariff by reducing the retail price of electricity) and the reduced investment subsidy tempered development prospects for Denmark's wind turbine manufacturers. By the end of 1986, many Danish wind turbine manufacturers had either declared bankruptcy or merged with other firms. Even Vestas filed for bankruptcy in October 1986 and was only saved through a restructuring program (Wüstenhagen, 2003).

The government's response to this was to establish a “Wind Turbine Guarantee Company”, which guaranteed long-term financing to large export projects provided the turbines met rigid government standards for quality (Kamp, 2004). This type of policy riposte – responding to emergent problems with policy adjustments – would become a regular feature of Danish wind power policy in subsequent years.

The following year, the government continued to send seemingly mixed messages in regard to wind power development intentions. On one hand, the central government ordered regional authorities to develop regional plans for the siting of prospective wind farms (Christensen and Lund, 1998). On the other hand, the government further reduced the 1979 capital investment subsidy from 15% to 10% (Buen, 2006). This further reduction was met with a degree of understandable angst in wind power development circles.

In hindsight though, these actions reflected a shift in developmental focus, wherein a policy preference was emerging which favored larger wind farms over small community developments. It is understandable

[2] For consistency and comparability, subsidies that were provided in Danish Krone prior to the introduction of the Euro have been translated into Euro using a 10-year average rate of DKK7.45 to 1 Euro.

Table 3
Wind power development in Denmark.
Danish Energy Agency (2011).

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Wind power onshore capacity, MW	3	6	11	14	20	47	72	112	190	247
Wind power offshore capacity, MW	0	0	0	0	0	0	0	0	0	0
Wind power's share of domestic electricity supply, %	0.0%	0.0%	0.1%	0.1%	0.1%	0.2%	0.4%	0.6%	1.0%	1.4%

that a reduction in front-end subsidizes would be viewed as a valid strategy for reigning in excessive subsidization of larger wind power projects, given that larger wind farms were capable of more cost effective electricity generation. It also bears emphasizing that despite criticism that the tightening of subsides to wind power generators undermined market confidence (Buen, 2006), installed capacity grew five-fold between 1986 and 1989.

In 1989, government policy continued to transition toward support for wind farms over single turbines. The investment subsidy for wind turbines that began in 1979 at 20% and was reduced to 15% and 10% in 1986 and 1987 respectively, was eliminated altogether in 1989. This made the pursuit of economies of scale a critical factor for wind power profitability. However, there was also clear evidence that the government was aware that concentrated development of wind turbines would challenge community support for wind power. It responded by establishing standards designed to minimize the social impact associated with larger wind power developments. Standards mandated the construction of tubular wind turbine towers instead of lattice towers to minimize the impact on birdlife. Standards were also set to minimize the adverse aesthetic impact of rotor blades by requiring them to be coated with non-reflective paints and to rotate in a uniform clockwise pattern. For wind farms, standards were established to prescribe size, appearance and placement of turbines (Christensen and Lund, 1998).

In 1990, with installed wind power capacity at 326 MW, the Ministry of Energy published Energy 2000 which announced intentions to meet a goal of 1500 MW of installed wind power capacity by 2005, equating to 10% of Denmark's projected electricity consumption (Danielsen, 1995). In pursuit of this goal, the government announced a second agreement with Denmark's utilities compelling utilities to build another 100 MW of wind power capacity over the subsequent five-year period (Danielsen, 1995). This was despite the fact that utilities were still striving to fulfill the first 100 MW target (which eventually would be met two years later than planned — 1992). As Table 4 illustrates, the 1500 MW target would eventually be surpassed by 1999; however, meeting this goal would not be without new challenges, necessitating new riposte strategies.

For starters, the government strategy of restricting cooperative investment in wind turbines, while encouraging utility-led wind farm projects, engendered an unanticipated degree of social dissonance. By 1990, community resistance resulted in more than 10% of wind power project approvals being rescinded after public appeals to the Ministry of Environment (Christensen and Lund, 1998). Moreover, social opposition was a key factor behind the two-year delay in utilities meeting the first 100 MW wind power installation obligation (Buen, 2006). In response, rather than reviving policy to encourage further community-led wind power development, the government shifted strategic focus to offshore wind farm development, culminating in the development of the world's first offshore wind farm, consisting of eleven 450 kW turbines located near Vindeby (Breton and Moe, 2009; Meyer, 2004b).

An additional challenge was that the overall pace of wind power development in Denmark was decidedly declining. As Table 4 illustrates, in 1990, 79 MW of installed capacity was added. Between 1991, 1992 and 1993, the pace of growth declined to 62 MW, 43 MW and 32 MW, respectively. Regardless of whether this decline can be attributed to elimination of the investment subsidy (Buen, 2006), increased public opposition to wind power (Danielsen, 1995) or cheaper oil, this trend did not go unnoticed in government circles. Consequently, near the end of 1992, the government adopted a new policy riposte (Lemming, 1994).

Under the 1992 subsidy program, in addition to receiving 85% of the retail electricity price from utilities, wind power generators were entitled to receive €0.013/kWh as a "carbon tax" reimbursement and €0.023/kWh as a production incentive. Plants owned by electricity utilities were ineligible for the production incentive (Agnolucci, 2007). In retrospect, these additional subsidies represented an effort to replace the termination of the investment subsidy, which rewarded turbine construction with a policy tool (a production incentive) that would best encourage the desired goal of enhanced wind power production.

In 1993, a number of further initiatives emerged which indicated that government planners were beginning to anticipate large-scale wind power development. The Ministry of Environment and Energy ordered all Danish municipalities to undertake wind power potential studies, assigning a deadline of June 1995 (Meyer, 2004b). It also commissioned an updated economic survey of privately-owned wind turbines, a study into the external costs of wind power from a social perspective, an exercise charting conditions for offshore wind turbine installation, an evaluation of R&D effectiveness and a study investigating more effective ways to promote rural wind power development.

It merits note that 1993 was a mediocre year for wind power development in Denmark with only 32 MW added. Some have attributed the lack of market response to the policy reforms of 1992 to tax reforms that disrupted market dynamics (Buen, 2006). Although, there may have been a degree of truth to this, it is equally possible that 1993s flaccid performance can be explained by a lag in market response to the policy change in late 1992 (Moran et al., 2006).

Responding to recommendations of a specially commissioned study released in February 1994 for bolstering rural wind power development, the government announced a new turbine replacement investment subsidy program in May 1994. The scheme offered a tax credit of up to 15% of the original investment cost for upgrading existing turbines to larger capacity models. In conjunction with the subsidies announced in 1992, this program would catalyze a widespread upgrade of existing turbines, although like the 1992 subsidies, the impact of

Table 4
Wind power development in Denmark in the 1990s.
Danish Energy Agency (2011).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Wind power onshore capacity, MW	326	388	431	463	516	590	804	1113	1428	1743
Wind power offshore capacity, MW	0	5	5	5	5	10	10	10	10	10
Wind power's share of domestic electricity supply, %	1.9%	2.3%	2.8%	3.1%	3.4%	3.5%	3.4%	5.6%	8.1%	8.7%

this new turbine replacement scheme exhibited a time lag and would not be fully seen until 1996. Meanwhile, there were signs that the 1992 subsidies were indeed catalyzing activity — 53 MW of wind power capacity was added in 1994, expanding national capacity by 11%.

Over the subsequent two year period – 1995 and 1996 – the catalytic effect of the new wind power policies became apparent. In 1995, a record 79 MW of wind power capacity was added. In 1996, an astonishing 214 MW of installed capacity was added, surpassing the cumulative total for the four previous years. As an illustration of the substantive impact of the turbine replacement scheme, the 416 wind turbines that were constructed in 1996, generated the same amount of electricity as the 3000 wind turbines constructed prior to 1990 (Christensen and Lund, 1998). By this stage, the pace of wind power development was brisk enough that the government was emboldened to reiterate its commitment to achieving 1500 MW of installed capacity by 2005 and announce a longer-term goal of meeting 50% of Denmark's electricity needs through wind power by 2030 – 4000 MW of onshore wind power and 1500 MW of offshore power – a threefold expansion from 1996 levels.

In subsequent years, market momentum continued to build; from 1997 to 1999, installed wind power capacity expanded by 309 MW, 315 MW and 315 MW, respectively. By the end of 1999, national wind power generation capacity stood at 1753 MW (including 10 MW in offshore capacity), surpassing the 2000-target of 1500 MW that was originally set in 1990. Moreover, thanks to a new agreement between the government and Denmark's utilities to install 750 MW offshore wind turbines before 2008, the dawn of a new era for offshore wind development appeared imminent (Agnolucci, 2007).

In 1999, two new pro-wind developments emerged. First, given the success of the 1994 turbine replacement scheme, the government was prompted to announce an updated subsidy that guaranteed a payment of €0.081 for the first 12,000 full-load hours of production (equating to approximately 5 years of operation) (Meyer and Koefoed, 2003). This scheme allowed existing turbines of less than 100 kW to be replaced by turbines of up to three times the discarded capacity, while turbines between 100 kW and 1500 kW could be replaced by twice the capacity until the end of 2003 (Meyer, 2004b). The offer was so attractive that most small turbines that were not replaced between 1994 and 1999 were replaced in the first two years of the new millennium. Second, the government announced a new short-term target of achieving 20% contribution to electricity generation from renewable sources by the end of 2003 — a lofty goal given that the contribution of wind power to Denmark's electricity grid had only reached 8.7% by 1999 and there were no other substantial renewable technologies contributing to electricity generation (Buen, 2006).

Lamentably, in the same year, the government made what would turn out to be a forced, ill-fated policy decision that was largely precipitated by a European Union (EU) led initiative to establish a common green certificate (carbon trading) market throughout the EU, which would eventually materialize in 2005 as the EU Emissions Trading Scheme In 1999, the Danish government announced an intention to replace the wildly successful feed-in tariff system with a carbon trading system. According to the proposed scheme, a national CO_2 emissions quota for 2000 would be set at 23 million tons and electricity utilities would then be delegated individual CO_2 emission quotas to contribute to achieving this target. The national CO_2 quota would be gradually lowered to 20 million tons in 2003. Utilities that exceeded assigned emission quotas would be fined €5.4 per ton of CO_2. Conversely, utilities that did not fully utilize their quotas could bank the credits for subsequent years or resell them on the open carbon market (Morthorst, 2000).

There were two sound justifications for such a change. First, a system was needed to encourage further reduction of CO_2 emissions in order to meet Denmark's commitment to reduce emissions of greenhouse gases by 21% of 1990 levels over the 2008 to 2012 Kyoto Protocol first commitment period. This meant that a policy was necessary to encourage utilities to reduce coal-fired electricity generation which contributed 52% of total electricity production in 1999. Ironically, the wind power feed-in tariff was adversely affecting this quest because utilities were continuing to utilize coal-fired plants in part to offset the premium cost of wind power. Second, the impending EU-wide carbon trading initiative represented financial opportunity for nations with high capacities in renewable energy so integrating policies in an expedient fashion was desirable. However, as will be detailed in the next paragraph, it was also obvious from the financial nature of the changes that the government felt a need to gradually pare back subsidization of wind power. In 1998 alone, over €77 million was purportedly paid to wind power generators in the form of production incentives (Agnolucci, 2007).

The proposed shift to a carbon trading scheme was initially supported by the Danish wind power lobby thanks to some favorable front-end benefits and prospects of an amplified EU wind power market. However, the attractiveness of the program came with risks. Initially, the subsidization of wind power in Denmark would not be drastically affected; but over time, the subsidies would be decreased, to be replaced by carbon credits that would vary in value depending on progress within the EU in achieving aggregate emission reduction commitments. According to this new policy, for turbines purchased before 1999, wind power generators would receive a feed-in tariff of €0.044/kWh and a production incentive of €0.036/kWh for up to 25,000 full-load hours. Turbines purchased between January 2000 and December 2002 would receive a feed in tariff of €0.044/kWh plus a reduced production incentive of €0.013/kWh (for up to 25,000 full-load hours). Turbines purchased after January 2003 would not receive any subsidies and instead receive market price for electricity generated plus €0.013–€0.036/kWh under the Danish carbon trading scheme (Agnolucci, 2007).

In order to ensure optimal market conditions for supporting carbon trading, the government also included a clause in an energy act amendment which deregulated electricity generation and forced the breakup of vertically-integrated utility activities. The amended act further stipulated that the high-voltage section of the power grid was to be transferred to a state-owned company (Meyer, 2004a).

The announcement of this policy change had predictable consequences on market activity. Wind power developers responded by fast tracking development plans to take advantage of the higher front-end incentives, and in conjunction with the new incentives for turbine replacement catalyzed the installation of a record 637 MW of wind power (including 40 MW of offshore wind power) in 2000, bringing total installed capacity up to 2390 MW (see Table 5) (Agnolucci, 2007). Ironically, amidst this flurry of activity, it became apparent near the end of 1999 that key stakeholders were ill-prepared to launch the Danish carbon trading scheme as planned in January 2000. Therefore, a decision was made to postpone the launch until January 2002.

As often happens in markets where expiring subsidies are greater than incoming subsidies, the development rush of 2000 resulted in comparatively subdued performance in 2001, yet still 107 MW of capacity was added. However, in 2001, the Danish government also announced a target under the 2001 European RES-electricity directive to boost the share of renewable energy contribution to gross electricity consumption to 29% by 2010 (European Renewable Energy Council, 2009). This announcement infused renewable energy developers with a degree of confidence that if current polices program fell short of catalyzing the capacity development necessary to meet the 2010 target, there would be further government intervention. When the launch of the Danish carbon trading program was postponed once again to 2003 (in September 2001) (Agnolucci, 2007), the wind power development market once again began to heat up as developers fast tracked more projects in order to take advantage of existing subsidies.

Unfortunately, in November 2001, optimism that the government would eventually sort out its policy quandary was attenuated by the election of a right-wing Social Democrat and Social Liberal Party coalition, led by PM Anders Forgh Rasmussen. The Rasmussen administration

Table 5
Wind power development in Denmark in the 2000s.
Danish Energy Agency (2011).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Wind power onshore capacity, MW	2340	2447	2676	2692	2700	2704	2712	2700	2739	2821	2934
Wind power offshore capacity, MW	50	50	214	423	423	423	423	423	423	661	868
Wind power's share of domestic electricity supply, %	12.1%	12.1%	13.8%	15.8%	18.5%	18.5%	16.9%	19.7%	19.1%	19.3%	21.9%

supported a political platform that decried excessive government wind subsidies (Hvelplund, 2006). In 2002, market fears were confirmed as the Rasmussen government moved to downgrade support for renewable energy development. The annual budget for the Energy Technology Program was reduced by nearly 70% and the “Development Program for Renewable Energy Sources” was eliminated altogether (Rasmussen and Madsen, 2004). Nevertheless, since the prevailing feed-in tariff and turbine replacement subsidy schemes were still in place in early 2002, developers continued to fast track projects (Meyer, 2004b). As Table 5 illustrates, 393 MW of capacity was added (with 164 MW in offshore capacity).

In June 2002, the Rasmussen administration announced that it had shelved plans for introducing the Danish carbon trading program and instead introduced a new reduced subsidy program which provided wind power generators with an added premium of €0.013/kWh (guaranteed for 20 years) on top of the Nordpool spot market price for electricity (Buen, 2006). A separate subsidy added a “scrap premium” of €0.023 for upgrading existing turbines (Agnolucci, 2007). Keeping true to its political promise to minimize the impact of subsidies on fiscal health, the wind power subsidies would be passed on to electricity consumers as an equal Public Service Obligation (PSO) tariff (European Renewable Energy Council, 2009).

The scale of reductions in subsidies virtually stopped wind power development overnight. In 2003, only 16 MW of onshore capacity was added. However, thanks to offshore wind farm installations – catalyzed by the agreement made with the utilities in 1998 to add 750 MW by 2008 – 209 MW of offshore capacity was added. Despite elevated offshore activity, that same year, the Rasmussen administration announced that utilities would not be bound to invest in further wind power development as per the 1998 agreement (Smit et al., 2007). Consequently, by 2004, it was evident that the wind power development market in Denmark was in freefall. That year, only 8 MW of wind power capacity was added.

The collapse of Denmark's wind power market became politicized due to the fact that wind power manufacturing was Denmark's third-largest export industry, providing direct employment to 6600 people, indirect employment to a further 15,000 people and financial returns to an estimated 125,000 Danish wind power investors (Meyer, 2004a). In response, the Rasmussen administration was forced to backtrack on some of its cutbacks. It partially reinstated plans for offshore wind power development by agreeing with utilities that two new offshore wind farms of 200 MW capacity each would be installed by 2007 (Meyer, 2004a). To facilitate this, a tendering system would be developed with the winning bid guaranteed a fixed tariff for the equivalent of up to 50,000 full load hours (approximately 12 years) (Pettersson et al., 2010). The government also partially restored funding for the Energy Technology Program, with a compromise being that the direction of research would focus on sustainable energy systems rather than the development of specific technologies (Rasmussen and Madsen, 2004). These minor concessions would prove to be insufficient for reinvigorating the flagging wind power market. As Table 5 illustrates, between 2005 and 2007, there was actually net zero growth in wind power capacity. However, thanks to other government initiatives to improve energy efficiency, the contribution of wind power to Denmark's electricity grid actually rose to 19.7% in 2007 (from 18.5% in 2004).

Given the fact that virtually no wind power development occurred between 2004 and 2007, it is easy to understand criticism that the Rasmussen administration's wind power policy was damaging to the industry (Buen, 2006). However, in retrospect, this developmental lull was perhaps necessary in order to rein in excessive subsidies and re-engineer Denmark's grid for bolder renewable energy initiatives in years to come. By 2004, wind power's share of domestic electricity production had actually risen to 18.5%, compared to 12.1% in 2001 (see Table 5). Not only had this resulted in Denmark's electricity consumers paying substantially higher prices for electricity in comparison to neighboring EU countries, there were amplified concerns of excess wind power production during certain periods that was being off-loaded to the Nord Pool market at a financial loss (Lund and Münster, 2006). Moreover, claims that the new policies were threatening the commercial viability of the wind power manufacturing sector may have been more emotive than logical because 90% of the revenues earned by Danish wind power firms were from export sales (Meyer, 2004b).

There is little evidence to support the contention that the Rasmussen administration was opposed to renewable energy. Indeed, the overall contribution of renewable energy to Denmark's electricity supply continued to increase under the Rasmussen administration. This was partly due to enhanced support for fledgling renewable energy technologies that the government truly felt needed government support. For example, a subsidy was announced for biogas that would provide €0.08/kWh as a feed-in tariff for 10 years and €0.05/kWh for the subsequent 10 years. Other subsidies were announced to support “special plants using energy sources or technologies of major importance to the future exploitation of renewable energy” such as wave power, fuel cells, solar energy and biomass (European Renewable Energy Council, 2009). In fact, evidence suggests that the government was proactively engaged in initiatives designed to avert some of the technical barriers to further wind power development. For example, in 2005, the Danish government, in adhering to terms of an EU agreement to liberalize electricity markets in order to support further renewable energy development, initiated a major restructuring. East and West transmission networks were consolidated under a new state-owned grid operator, Energinet Danmark. Energinet Danmark was also appointed to oversee operation of the nation's gas network, an initiative which provided the technological foundation for attenuating supply fluctuations (Mignard et al., 2007).

Some analysts have pointed out that the Rasmussen administration's wind power subsidies announced in 2002 to replace the terminated green certificate program, amounted to precisely the same amount that would have been provided under later stages of the green certificate program that was proposed by the preceding Social Democrat — Social Liberal coalition that held power between 1993 and 2001 (Agnolucci, 2007). Furthermore, policies that would eventually emerge suggests that the new government was not as opposed to wind power as critics suggested; rather, this period of policy entrenchment represented a period of learning by doing where the government was trying to infuse a degree of financial discipline into a sector that it nevertheless supported.

After five years of stagnant market activity, the government announced a new national energy strategy on 19 January 2007 that signaled the start of a new developmental push. Under the plan, which was agreed to by all the parliamentary parties except the far-left Red–Green Alliance, Denmark would expand renewable energy capacity to satisfy at least 20% of total energy consumption by 2011 and 30% of total energy consumption by 2025 (European Renewable Energy Council, 2009). In the same year, new policies began to emerge to support this plan. The Rasmussen administration announced a new wind turbine substitution scheme to upgrade Denmark's aging turbines. The goal was to replace approximately 900 turbines (450 kW or less) with 150 to 200 turbines in the 2 MW range (Ladenburg, 2008).

In 2008, the government further announced intentions to encourage a 1300 MW increase in wind power capacity by the end of 2012 (Ekman and Jensen, 2010), with 800 MW of this total coming from three new offshore wind parks. To catalyze activity, an additional "balancing cost" subsidy of €0.03/kWh was offered on top of the 2002 subsidy of €0.013/kWh that was tacked on to the spot price (European Renewable Energy Council, 2009). Moreover, a compensation package was announced to financially reward communities for hosting onshore wind farms. On top of all this, the government announced that its CO_2 tax would be increased to a level that would equate with the expected price of carbon in 2008–12 – estimated at approximately €20 per ton – and a new NO_x tax of approximately €670 per metric ton would be introduced from January 1, 2010 (European Renewable Energy Council, 2009).

These new policies reinvigorated wind power development. In 2009, 320 MW of new installed wind power capacity was added (238 MW in offshore capacity) and in 2010, another 320 MW was added (207 MW in offshore developments). After 178 MW was added in 2011 bringing total installed capacity to 3871 MW, wind power was suddenly responsible for 28% of Danish electricity consumption.

Case study analysis: best practice or gradualism?

Despite the successful diffusion of wind power technology in Denmark and the accolades that the nation has received in policy circles for proactive wind power support initiatives, not even Denmark has managed to fully employ the "best practice" principles for wind power policy, as espoused by Garcia. Table 6 summarizes whether evidence of Garcia's best practice principles were found in the Denmark case study; and if so, when the best practice principle was implemented. As the table illustrates, not only were two best practice principles only partially adopted, the other principles that were implemented were initiated at different stages of the program. Moreover, some principles were supported through single policy initiatives, while others were supported through progressively evolving initiatives.

Table 6
Evidence of best practice in Denmark.

	Best practice principle	Evident?	When?
Policies to overcome economic barriers	Elimination of coal subsidies	Yes	Latter stage
	Compensation for the negative externalities of fossil fuels (pollution, etc.)	Yes	Latter stage
	Remuneration for the positive externalities of renewables	Yes	Progressive
	Compensation for higher initial costs (mandated market policies): quantity-based and price-based schemes	Yes	Early stage
	Increased access to capital: fiscal and financial aids	Yes	Early stage
	Ensuring sufficient demand (PPAs)	Yes	Progressive
Institutions to overcome non-economic barriers	General legal security	Yes	Consistent
	Capable bureaucracy: coordination and cutting of red-tape	Yes	Progressive
	Quality of regulations in renewables: specific, legally binding targets and predictable instruments	Partly	Progressive
	Competition and technology-friendly policies in generation: unbundling, absence of oligopolies, openness to FDI	Yes	Progressive
	Competition and technology-friendly policies in manufacturing: openness to external trade and FDI	Partly	Sporadic

The six policies of best practice for overcoming economic barriers were all in evidence at one stage or another in Denmark. The nation has i) eliminated the coal subsidies, ii) introduced a carbon tax as compensation for the negative externalities of fossil fuels, iii) provided green production credits for remunerating the positive externalities of wind power, iv) compensated for higher initial costs by introducing a gradually diminishing feed-in tariff, v) employed investment tax credits to improve access to financing and vi) endeavored to ensure sufficient demand by both establishing capacity and production targets and by working with utilities to expand procurement of wind power.

The five best practice principles for overcoming institutional barriers were also in evidence, although some were less ambitious than others. Denmark has i) provided a degree of legal security by entrenching renewable energy targets in energy acts, ii) nurtured a capable bureaucracy by delegating responsibility for wind power development to municipalities and encouraging them to proactively develop strategies, iii) progressively ramped up targets (though not legally binding and occasionally unpredictably), iv) enhanced competition by unbundling generation services from the grid management function while also supporting a high degree of openness to external electricity trade (in most part to adhere to EU trade policy) and v) established competition and technology-friendly polices (although the policies tended to favor domestic firms).

In summary, the best practice principles espoused by Garcia were evident to one degree or another; however, this does not tell the whole story of wind power policymaking strategy in Denmark. Two best practice principles were not fully operationalized. First, the regulations pertaining to renewable technologies fluctuated as the market evolved. Incentives were reinforced, reduced, redirected or removed altogether as new challenges arose. Second, there is clear evidence that the Danish government created a market bias in favor of Danish manufacturers through domestic-content laws and the cultivation of industry-government-academia links. Moreover, many of Garcia's other best practice principles were also reinforced, reduced, redirected or removed as the program progressed. In short, they were not applied in the consistent manner that is typically attributed to the concept of best practice. Therefore, it merits considering whether or not there is evidence of the alternative strategy – gradualist policy – better characterizing Denmark's policy approach.

Throughout the history of the Danish wind power program, there is clear evidence of gradualist policy being applied in relation to overall development strategy, the creation of market demand, supply incentives, management of public perception, management of grid access and development linkages. In terms of overall development strategy, the government began its wind power program with the intent of encouraging big industry to take the reins in technology development. However, when it became apparent that smaller firms were leading the vanguard in technological development, policy was adjusted to support the process (Kamp, 2004). In terms of creating market demand, the government progressively elevated its installation targets, sending the message to suppliers that there would be a progressively evolving market in wind power. The government progressively announced targets of 1500 MW by 2005 (in 1990), 5500 MW by 2030 (in 1996), 20% contribution from wind power to electricity by 2003 (in 1999), 29% contribution from wind power to electricity by 2010 (in 2001) and at least 20% of total energy consumption by 2011 and 30% of total energy consumption by 2025 (in 2007). In terms of supply incentives, there were numerous stages in the process (notably in 1984, 1986, 1992, 1994, 1999, 2002 and 2008) where the government adjusted its incentives to regulate the pace of supply. Not only were terms altered, different tools were also utilized. For example, in the early days, the government focused on encouraging supply expansion through investment tax credits (i.e. 1979), whereas in ensuing years the policy tool of choice was a feed-in tariff. In terms of managing public perception, the government has adjusted tax incentives to encourage individual and co-op ownership; and in the face of rising community opposition has refocused efforts on offshore wind power development. Finally, in regard to development linkages, the government has done a very effective job of encouraging the development of a domestic wind turbine manufacturing sector through policies such as providing export loan support, nurturing technical and R&D support (provided through Risø Laboratories), and establishing a government owned Wind Turbine Guarantee Company (Kamp, 2004).

So given that there is ample evidence of both best practice and gradualist policy being applied in Denmark, what does this reveal in relation to our research objective of ascertaining the extent to which either of these two perspectives accurately describes actual applied policy experience? It tells us that neither the thesis nor the anti-thesis of our dialectic sufficiently describes Denmark's strategy approach to wind power policy development. Both best practice and gradualist strategies were evident and the dichotomy that is purported to exist was not as clear in the Danish experience. This suggests a potential synthesis to these two positions — gradualist best practice (see Fig. 3).

The notion of policy based on gradualist best practice rectifies the main drawbacks of applying a pure gradualist strategy. The main drawback of the gradualist strategy is that without a foundation for guiding policy development, policies become ad hoc. The trouble with ad hoc policies is that they are usually based on the whims or perspectives of powerful stakeholders and prone to agenda capture by special interest groups. This potentially engenders a “muddling through” approach to policymaking that does not result in cohesive strategy (Lindblom, 1959). In sum, a gradualist approach to policy development can be very useful in most policy arenas today where the complexity of the variables that influence policy effectiveness is sufficient to confound the achievement of predicted outcomes (Valentine, 2013); however, a degree of control is needed to ensure that policy exploits what Beinhocker (1999) calls “emergent landscapes” (emerging opportunities).

The notion of policy based on gradualist best practice also rectifies the main drawbacks of applying best practice principles in isolation. Best practice principles can provide the needed direction to ensure the effectiveness of a given policy initiative. However, “best practice” is not a concept that can be universally quantified or measured using dichotomous analysis (such as “yes” or “no”). A nation can adopt all of Garcia's best practices and still engender slow renewable energy development due to failure to establish best practice principles at levels that are substantive enough to catalyze development. Best practice needs to be adjusted to respond to market dynamics, suggesting that gradualism

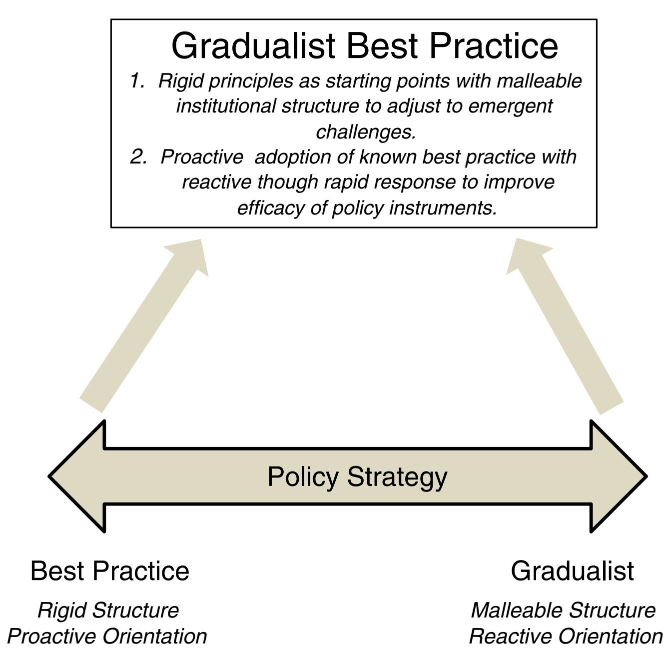

Fig. 3. Gradualist best practice.

is not an impediment to wind power development effectiveness as Garcia suggests (García, 2011) but rather a necessary component of the process.

During different phases of technological evolution, different policies are needed because the application of best practice principles is influenced by temporal and contextual factors (IRENA, 2012); therefore, policy malleability is critical. Technological innovation often needs to be seeded at the beginning of a program, not at the end. Supply-side or demand-side incentives need to be increased or decreased based on market response. Challenges wax and wane and during each phase, so does the importance of applying each individual best practice principle. Furthermore, stakeholder behavior will evolve over the course of the transition. This all points to the realization that excellence in policy making for technological transition cannot be simply distilled down to a list of quantitatively measured best practices that can be universally applied. Best practice is a dynamic concept that embodies change.

Public policy is not a natural science, it is a social science which is conducted within the boundaries of a complex adaptive system (Hughes, 1983). Therefore, although best practices may be useful principles to consider when designing technological transition strategy (such as a transition to wind power), policy also needs to be malleable and responsive to change. Market conditions and stakeholder needs must be constantly monitored and policy must be appropriately adjusted in order to sustain transitional momentum (Valentine, 2013). This suggests that a gradualist approach to public policy – such as the types of riposte strategies exhibited by Denmark in regard to wind power development – is the most effective way of ensuring that best practice principles can be tailored for maximum impact given the disparate contextual influences within any given nation. Far from being the antithesis to the application of best practice, gradualism if practiced in a manner that responds suitably to environmental conditions and stakeholder needs is the enabler of best practice.

Avenues for future research

Given that the analysis in this paper affirms a place for best practice, one of the first questions that needs to be answered is, what exactly constitutes best practice in wind power policy?

In this paper, Garcia's list of best practice principles was used for guiding part of the analysis; however, in the final analysis, it became evident that in some areas, Garcia's best practice principles may be overly prescriptive. For example, she advocates the importance of legally binding renewable energy targets, when there is no evidence that such a firm commitment is actually needed. Indeed, in some cases, legally binding targets might actually restrain development. Policy tools which target fixed renewable energy capacity development – such as a renewable portfolio standard or a request for proposal system – can artificially limit development. Similarly, Garcia advocates the elimination of coal subsidies and remuneration for the positive externalities of renewables. However, both are certainly not always necessary. The key economic principle for encouraging the pace of renewable energy development to increase is to ensure that renewable technologies are competitive with fossil fuel technologies. This may indeed require incentives for renewable technologies or elimination of coal subsidies, but not necessarily both. This caveat also applies to Garcia's principle of increasing access to capital. A competitive, well-constructed feed-in tariff will cause this to occur indirectly — ensuring access as a policy prescription is not essential.

Recently, the International Renewable Energy Agency (IRENA) released a less prescriptive list of 7 best practice principles based on comprehensive case studies of 12 nations (Table 7). There is a high degree of overlap with Garcia's principles but the IRENA framework emphasizes end-outcomes rather than specific policies. For example, instead of advocating incentives for renewable technology providers or disincentives for fossil fuel energy providers, the IRENA framework simply recommends an “effective pricing structure”, leaving policymakers to decide

Table 7
IRENA's framework conditions for assessing policy and regulatory performance.
Source: IRENA (2012).

Condition	Explanation
Some expression of political commitment from government	National targets, such as the 2020 Renewable Energy Targets adopted by the European Union, are clearly defined and implemented in the legislation. These targets give clarity and confidence to the industry and investors for making long-term investments.
Effective rule of law and transparency; and effective administration and permitting process	The overall energy legislation is perceived as well-defined, well understood by the public authorities, and fairly implemented. This element influences investor confidence, and keep determines country risk premiums for financiers.
Financing mechanisms: a clear and effective pricing structure	Wind energy projects are characterized by large upfront costs and lower operation costs. Project developers need to assess the financial viability of their projects over the whole project lifetime (e.g. 20 years), and their financiers require clarity on the level of stability of the remuneration scheme. This information is used to assess the projects bankability. The stability of the pricing mechanism also influences the cost of capital.
Grid access: Provisions for priority access to the grid; connection availability and ease of grid access for wind farms	Early experiences in several markets have shown that early guidance for the integration of renewable energy within the electricity system is a critical element for the development of projects. There are several aspects to this issue: the capacity of the grid operator to handle grid connection requests and allocate a grid connection point; the authorized agent to effectively connect to the grid; and during the project operation, the capacity to inject the power generation into the system.
A government and/or industry-led strategy for public and community by-in/ acceptance and awareness	Over the last three decades of wind power development, there have been ample documented cases of delays to wind projects due to a combination of lack of community support, lack of public consultation, and little (sic) awareness levels about the technology.
An industrial development and employment strategy	The development of the wind sector is also seen as an element for promoting local industrial development and competitiveness.
A functioning finance sector	The easiness (sic) of access and the cost of capital are important elements of project economics. Governments can mobilize funding instruments to support the wind sector. Those financial instruments may partly or fully cover some of the investment risks, thus increasing the attractiveness of projects to investors, who may not be familiar with the technology.

what this may entail. Similarly, the IRENA framework advocates "political commitment" rather than the far more prescriptive "binding targets" espoused by Garcia.

The IRENA framework also addresses some important policy considerations that Garcia's list overlooks. It stresses the importance of government efforts to improve community awareness of the benefits of renewable energy. It also advocates government policies to enhance grid access, which is another significant omission from Garcia's list. Moreover, the IRENA framework highlights the importance of strategically managing links between renewable energy development and industrial development. In short, the IRENA framework is perhaps a more comprehensive "best practice" model, despite its broader perspective.

Whether the IRENA framework or Garcia's framework is applied to Denmark's wind power program, the conclusions presented in the previous are the same. As was the case with Garcia's principles, all the best practice principles of the IRENA framework were evident in Denmark's wind power diffusion efforts. Moreover, as the review of Denmark's wind power history in the second section of this paper attests, the IRENA "best practice" principles were adopted, adjusted or discontinued in response to evolving needs, like the elements covered under Garcia's principles were.

On the other hand, the IRENA framework is constructed at such a high level of abstraction that it is difficult to actually implement it in practice. Take for example the principle of establishing "a government and/or industry-led strategy for public and community by-in/ acceptance and awareness". This is clearly important, but it does not provide much insight into what specific initiatives should be targeting. As Valentine observed in constructing his STEP framework (Table 1), social opposition could be amplified by cultural, economic, environmental or aesthetic concerns that will vary in each society (Valentine, 2010). Establishing best practice principles for enacting a strategy for countering disparate forms of community opposition is a sizable challenge (Firestone and Kempton, 2007). In short, the IRENA framework is a start, but more research will be required to allow it to be of optimal use in guiding policymaking.

In any case, regardless of the best practice framework that emerges in support of enhancing wind power diffusion, the analysis in this paper should make one thing abundantly clear, best practice for complex adaptive markets is a necessary concept for plotting an initial course, but gradualist policy based on effective market monitoring is the mechanism that ensures that best practice continues to be best practice. Just how and when gradualist practice is to be applied in support of enhanced best practice represents a green field arena of research that this paper has hopefully played a role in encouraging.

Acknowledgment

The author wishes to thank Dr. Gautam Dutt for valuable feedback in the revision of this paper and an anonymous reviewer for encouraging deeper reflection. The author also acknowledges the Alliance for Global Sustainability at the University of Tokyo for financial support in presenting the research upon which this paper is based. Opinions and errors remain solely with the author.

References

Agnolucci P. Wind electricity in Denmark: a survey of policies, their effectiveness and factors motivating their introduction. Renew Sust Energ Rev 2007;11:951–63.
Beinhocker E. Robust adaptive strategies. Sloan Manage Rev 1999;4:95–106.
Blaikie N. Designing Social Research. UK: Polity Press; 2000.
Blanco MI, Rodrigues G. Direct employment in the wind energy sector: an EU study. Energy Policy 2009;37:2847–57.
Breton SP, Moe G. Status, plans and technologies for offshore wind turbines in Europe and North America. Renew Energy 2009;34:646–54.
Buen J. Danish and Norwegian wind industry: the relationship between policy instruments, innovation and diffusion. Energy Policy 2006;34:3887–97.
Carlman I. Wind power in Denmark! Wind power in Sweden? J Wind Eng Ind Aerodyn 1988;27:337–45.
Christensen P, Lund H. Conflicting views of sustainability: the case of wind power and nature conservation in Denmark. Eur Environ 1998;8:1–6.
Cook TD, Campbell DT. Quasi-experimentation: design & analysis issues for field settings. Boston, USA: Houghton Mifflin Company; 1979.
Danielsen O. Large-scale wind power in Denmark. Land Use Policy 1995;12:60–2.
Danish Energy Agency. Annual Energy Statstics 2010. Copenhagen, Denmark: Danish Energy Agency; 2011.
Danish Energy Agency. Accelerating Green Energy Towards 2020. Copenhagen, Denmark: Danish Energy Agency; 2012.
Dyer WG, Wilkins A. Better stories, not better constructs to generate better theory: a rejoinder to Eisenhardt. Acad Manag Rev 1991;16:613–9.
Eisenhardt KM. Building theories from case study research. Acad Manag Rev 1989;14: 532–50.

Eisenhardt KM. Better stories and better constructs: the case for rigor and comparative logic. Acad Manag Rev 1991;16:620–7.
Ekman CK, Jensen SH. Prospects for large scale electricity storage in Denmark. Energy Convers Manag 2010;51:1140–7.
European Renewable Energy Council. Renewable Energy Policy Review: Denmark. RES 2020: Monitoring And Evaluation of the RES Directives Implementation in EU27 and Policy Recommendations to 2020. Brussels, Belgium: European Renewable Energy Council; 2009.
EWEA. Support Schemes for Renewable Energy: A Comparative Analysis of Payment Mechanisms in the EU. The European Wind Energy Association; 2005.
Firestone J, Kempton W. Public opinion about large offshore wind power: underlying factors. Energy Policy 2007;35:1584–98. [2007, 35].
Fischlein M, Larson J, Hall DM, Chaudhry R, Rai Peterson T, Stephens JC, et al. Policy stakeholders and deployment of wind power in the sub-national context: a comparison of four U.S. states. Energy Policy 2010;38:4429–39.
Frandsen S, Andensen PD. Wind farm progress in Denmark. Renew Energy 1996;9:848–52.
García C. Grid-connected renewable energy in China: policies and institutions under gradualism, developmentalism, and socialism. Energy Policy 2011;39:8046–50.
Gipe P. Wind energy comes of age: California and Denmark. Energy Policy 1991;19:756–67.
Gipe P. Wind Power: Renewable Energy for Home, Farm, and Business. White River Junction, Vermont, USA: Chelsea Green Publishing Company; 2004.
Hughes TP. Networks of Power: Electrification in Western Society 1880–1930. Baltimore, USA: Johns Hopkins University Press; 1983.
Hvelplund F. Renewable energy and the need for local energy markets. Energy 2006;31:2293–302.
IRENA. 30 Years of Policies for Wind Energy: Lessons From 12 Wind Energy Markets. Abu Dhabi, UAE: International Renewable Energy Agency (IRENA); 2012.
Kamp LM. Wind turbine development 1973–2000: a critique of the differences in policies between the Netherlands and Denmark. Wind Eng 2004;28:341–54.
Komor P. Renewable Energy Policy. USA: iUniverse; 2004.
Kristinsson K, Rao R. Interactive learning or technology transfer as a way to catch-up? Analysing the wind energy industry in Denmark and India. Ind Innov 2008;15:297–320.
Ladenburg J. Attitudes towards on-land and offshore wind power development in Denmark; choice of development strategy. Renew Energy 2008;33:111–8.
Lemming J. New and important initiatives promoting the wind energy development in Denmark. Renew Energy 1994;5:551–5.
Lindblom CE. The science of “Muddling Through”. Public Adm Rev 1959;19:79–88.
Liu Y, Kokko A. Wind power in China: policy and development challenges. Energy Policy 2010;38:5520–9.
Lund H, Münster E. Integrated energy systems and local energy markets. Energy Policy 2006;34:1152–60.
Lüthi S, Prässler T. Analyzing policy support instruments and regulatory risk factors for wind energy deployment—a developers' perspective. Energy Policy 2011;39:4876–92.
Madsen BT. Windfarming in Denmark. J Wind Eng Ind Aerodyn 1988;27:347–58.
Mallon K. Renewable Energy Policy and Politics: A Handbook for Decision Making. UK: Earthscan; 2006.
Mendonca M, Jacobs D, Sovacool B. Powering the Green Economy: The Feed-in Tariff Handbook. Oxford, UK: Earthscan; 2009.
Meyer NI. Development of Danish wind power market. Energy and Environ 2004a;15:657–73.
Meyer NI. Renewable energy policy in Denmark. Energy Sustain Dev 2004b;8:25–35.
Meyer NI, Koefoed AL. Danish energy reform: policy implications for renewables. Energy Policy 2003;31:597–607.
Mignard D, Harrison GP, Pritchard CL. Contribution of wind power and CHP to exports from Western Denmark during 2000–2004. Renew Energy 2007;32:2516–28.
Mitchell C. Comparison of the means and cost of subsidizing wind energy. Proc Inst Mech Eng Part A J Power Energy 1995;209:185–8.
Montes GM, Prados Martín E, Ordóñez García J. The current situation of wind energy in Spain. Renew Sust Energ Rev 2007;11:467–81.
Moran M, Rein M, Goodin RE. The Oxford handbook of public policy. In: Goodin RE, editor. The Oxford Handbooks of Political Science. USA: Oxford University Press; 2006.
Morthorst PE. Capacity development and profitability of wind turbines. Energy Policy 1999;27:779–87.
Morthorst PE. The development of a green certificate market. Energy Policy 2000;28:1085–94.
Pembina Institute. How Feed-in Tariffs Maximize the Benefits of Renewable Energy. Canada: The Pembina Institute; 2008.
Pettersson M, Ek K, Söderholm K, Söderholm P. Wind power planning and permitting: Comparative perspectives from the Nordic countries. Renew Sust Energ Rev 2010;14:3116–23.
Rasmussen F, Madsen PH. Current direction of Danish wind energy research — the researchers point of view. J. Solar Energy Eng. 2004;126:1105–9.
Rivier Abbad J. Electricity market participation of wind farms: the success story of the Spanish pragmatism. Energy Policy 2010;38:3174–9.
Saidur R, Islam MR, Rahim NA, Solangi KH. A review on global wind energy policy. Renew Sust Energ Rev 2010;14:1744–62.
Schumacher EF. Small is Beautiful: Economics as it People Mattered. New York, USA: Harper Collins Publishers; 2010/1973.
Smit T, Junginger M, Smits R. Technological learning in offshore wind energy: different roles of the government. Energy Policy 2007;35:6431–44.
Szarka J. Wind power, policy learning and paradigm change. Energy Policy 2006;34:3041–8.
Toke D, Breukers S, Wolsink M. Wind power deployment outcomes: how can we account for the differences? Renew Sust Energ Rev 2008;12:1129–47.
Valentine SV. A STEP toward understanding wind power development policy barriers in advanced economies. Renew Sust Energ Rev 2010;14:2796–807.
Valentine SV. Wind power policy in complex adaptive markets. Renew Sust Energ Rev 2013;19:1–10.
Wiser R, Bolinger M, Barbose G. Using the federal production tax credit to build a durable market for wind power in the United States. Electr J 2007;20:77–88.
Wizelius T. Developing Wind Power Projects: Theory and Practice. UK: Earthscan; 2007.
Wüstenhagen R. Sustainability and competitiveness in the renewable energy sector: the case of Vestas wind systems. Greener Management International; 2003105–15.
Wüstenhagen R, Bilharz M. Green energy market development in Germany: effective public policy and emerging customer demand. Energy Policy 2006;34:1681–96.
Xia C, Song Z. Wind energy in China: current scenario and future perspectives. Renew Sust Energ Rev 2009;13:1966–74.
Zitzer SE. Renewable Energy Policy and Wind Energy Development in Germany. Leibzig, Germany: Leibniz Information Centre for Economics; 2009.