Promoting Renewable Energy Sources in Portugal: Possible Implications for China

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1 Introduction

The government officials charged with implementing China's renewable energy law have been investigating how to implement both a wind concession/tendering scheme and a standard feed-in tariff policy, while at the same time incorporating incentives for local renewable energy equipment manufacturing. Portugal's renewable energy policy is an interesting case study because that country has also sought to implement these three concepts into a coherent renewable energy policy.

This paper summarizes the Portuguese policy measures promoting renewable energy. It discusses the principal supporting instruments that have been established, with particular emphasis on the feed-in tariff regulation for electricity from renewable sources. A striking element of that regulation is the specific formula that is used to calculate the effective remuneration for renewable energy projects, on a monthly basis, with respect to the individual features of the power generation facility in question. This formula is therefore presented in some detail.

The second part of this paper reviews the large utility tender for wind power that was released by the Portuguese government in 2005. Besides seeking to increase the installed capacity of wind power in the country, this tender aimed to establish a wind turbine manufacturing industry in Portugal. This was done by introducing local content requirements. The present paper lists the requirements potential bidding parties had to meet. It further discusses how bids were evaluated, as well as their interaction with the existing feed-in scheme for renewable electricity. The paper concludes with a brief presentation of the tender outcomes, and an overview of plans for additional tender calls.

Although experience from Portugal is not necessarily applicable to China's unique conditions, three elements of this experience may be of particular interest to our Chinese colleagues:

- The design of Portugal's feed-in tariff policy, and how feed-in tariff levels are established.
- How Portugal has implemented both a tendering/concession program and feed-in tariff policy, and the relationship between these two types of support mechanisms.
- The design of Portugal's tendering system, including incentives and requirements for local wind manufacturing, and bid evaluation methods.

2 Overview of Portugal's Energy Sector

Portugal is strongly dependant upon imported energy. In 2004, 85 percent of the country's total primary energy demand had to be imported. The country does not have significant oil or gas resources; nor does it have a nuclear energy program. Renewables and waste incineration are the only significant domestic resources. Biomass and waste represent 11 percent of the total primary energy, with 4 percent from hydropower. The share of hydropower in electricity generation has constantly decreased from 75 percent in 1973 to only 22 percent in 2004. Thus, the expansion of hydropower has not been able to keep pace with the growth of electricity demand. Moreover, electricity generation from large hydropower plants is subject to extensive fluctuations due to droughts. Over the last ten years, annual hydropower variations of 30 percent to 40 percent from the average generation have been recorded. Consequently, the share of renewable resources in total generation has reflected these variations. For example, due to the fluctuating hydrological resource, the share of renewables in the Portuguese energy portfolio was recorded at 35 percent in 2001, but only 21 percent in 2002.

Portugal's total primary energy consumption (24.3 Mtoe in 2005) has been increasing rapidly in recent years. Its annual growth rate in 2005 was 3.1 percent: one of the highest in the EU-25. This trend is expected to continue for some time. In September 2006, the gradual liberalization of the Portuguese electricity market was completed. Since then, all electricity customers, including households and small and medium-sized businesses, have been able to freely choose their electricity provider.

The country's present-day electricity market is comprised of the publicly regulated system *SEP (Sistema Eléctrico de Serviço Público)* with the provider EDP Distribuição (Energias de Portugal) co-existing alongside the liberalized system *SENV (Sistema Eléctrico Não Vinculado*). Providers within the liberalized system are EDP Corporate (Portugal), Iberdola and Unión Fenosa (Spain), as well as Sodesa (an association of the Portuguese Sonae Capital and the Spanish Endesa Energía).

Liberalizing the power sector has clearly increased the number of competitors. However, with a market share of 49.6 percent, EDP remains the de facto market leader among the electricity providers. Additionally, EDP holds 30 percent of the transmission system operator REN and is involved to a large extent in electricity generation (via CPPE being part of the EDP group).

3 Supporting Renewable Energy in Portugal: Goals and Objectives

There are multiple reasons for the Portuguese government to support Renewable Energy. They are part of an integrative strategy mix that aims at: (1) a more secure energy supply, (2) a diversification of its energy sources, and finally (3) improved environmental quality. Portugal has given high priority to the fulfilment of the international environmental commitments into which they have entered. Portuguese policies therefore reflect the terms of the European Union's environmental policy and the Kyoto Protocol. Further objectives of the country’s renewable energy policies include: an increase in regional development and in national competitiveness, the creation of new jobs, and the modernization of the Portuguese society.

On March 13, 2003 the Council of Ministers *(Conselho de Ministros)* adopted Resolution No. 63/2003 that defines the direction and targets of the Portuguese energy policy. The Resolution names three central goals of the national energy policy:

- security of supply
- sustainable development
- an increased national economic competitiveness.

Pursuant to the EU Directive 2001/77/EC on electricity production from Renewable Energy Sources, Portugal aims to generate a minimum share of 39 percent of its gross domestic electricity consumption from renewable sources by 2010. The total capacity of renewable energy is supposed to increase by 5000 MW by 2010, doubling the Portuguese capacity in 2001. The national energy strategy also specifies individual targets for each renewable technology. As a result of increasing oil prices in 2004/2005 and the success of the Socialist Party in the parliamentary elections in February 2005, the national energy strategy was expanded once more in October 2005. Resolution Nr. 169/2005 was enacted, defining additional targets for the expansion of renewable power generation until 2013. However, this resolution only outlines additional targets for wind power generation. Table 1 presents Portugal's renewable electricity capacity in 2001, and renewable energy targets for the years 2010 and 2013. As shown, sizable increases in renewable energy capacity are planned, especially for wind power.

Table 1: Indicative targets for renewable electricity capacity according to Council of Ministers Resolution No. 63/2003 and No. 169/2005.

Technology	*Installed capacity in 2001 (in MW)*	*Installed capacity in 2010 (MW) (Res. 63/2003)*	*Installed capacity in 2013 (MW) (Res. 169/2005)*
Wind	101	3750	5100
Small Hydro	215	400	400
Biomass (without CHP)	10	150	150
Biogas	1	50	50
Municipal wastes	66	130	130
Wave	0	50	50
Photovoltaics	1	150	150
Large Hydro	4209	5000	5000
Total	**4603**	**9680**	**11030**

Source: IEA (2004a)

4 Supporting Instruments

The Portuguese government promotes Renewable Energy principally via guaranteed feed-in tariffs for renewable electricity, direct subsidy payments (PRIME-Programme) and tax incentives. Beginning in 2005, a tendering/concession process has also been established. Subsidy payments and tax incentives have been largely, though not entirely, used for smaller-scale renewable energy applications, and are discussed first. Feed-in tariffs and tendering schemes, used principally for larger-scale renewable applications, are then covered in detail.

4.1 Investment subsidies

The *Programa de Incentivos à Modernização da Economia (PRIME)* constitutes a key program of the Portuguese government for modernizing the country's economy, including the promotion of Renewable Energy. The MAPE-Programme (Support Measure for the Maximization of Energy Potential and Streamlining Consumption) is particularly aimed at the energy sector. It grants financial aid as well as low interest loans to public and private investors. Projects eligible for funding have to be related to renewable electricity generation, energy efficiency, cogeneration, renewable fuels for transport fleets, or the switching of fuel to natural gas. The level of subsidy varies according to the renewable technology involved and the economic feasibility of the project. Renewable electricity generation projects, for instance, can benefit from a non-refundable incentive of up to 40 percent of eligible expenses.

Furthermore, possibilities to support related projects under other PRIME-subprograms exist, provided that the fundable projects aim for the creation of a so-called industrial cluster for the generation, use or technology development of renewable energies. A respective promotion within the scope of the programmes SIME, SIPIE, SIME R&RD or DEMTEC is possible. [1]

The entire PRIME-Programme, however, has been temporarily withdrawn. No applications can be accepted at the present time. This is due to the interaction of national and European support schemes. The structure of national schemes is largely dependent on the corresponding European framework, and the promise of financial support within the European Structural Fund. For each funding period the Member States have to elaborate, in accordance with the European Commission, so-called Operational Programmes. Within these, individual measures, like the PRIME-Programme, are defined.

In March 2007, the Portuguese government submitted the relevant Operational Programme for the next funding period 2007-2013. The Commission must review it within four months. Only when the Commission has approved the Portuguese Operational Programme for the upcoming funding period will new applications for funding within these programmes be accepted.

4.2 Tax incentives

For certain goods and services related to renewable energies Portugal has introduced tax reductions. These include:

1) A reduction of the value-added tax from 21 percent to 12 percent, applicable on all equipment necessary for the production and use of renewable energy resources.
2) An increased annual tax-depreciation rate for investments in equipment related to renewable energy.
3) A reduction of individual taxable income - up to 30 percent (maximum amount of €745) of the investment in renewable energy equipment can be discounted from taxable income in the corresponding year of installation. The tax relief is valid for equipment with respect to the use of renewable resources as well as micro-turbines running on natural gas up to a capacity of 100 kW, including all components essential for their operation.
4) A reduction of fuel taxes for renewable fuels used in transportation.

4.3 Feed-in tariffs

Guaranteed feed-in tariffs for electricity produced from cogeneration, renewable resources (except for large-scale hydropower installations) and endogenous resources (e.g., industrial, agricultural or municipal wastes) have been in place in Portugal since 1988. The Decree-Law 189/88 established the legal basis for the feed-in of electricity from independent power producers. The grid operator is thus obliged to purchase any offered renewable electricity from independent producers.

Initially, feed-in tariffs were applied uniformly to all sources of renewable energy based on the avoided costs to the public grid (investments in new fossil reference plants, including their operation, maintenance and fuel) and the environmental benefits achieved (avoided CO_2 emissions). Since 1988, however, the regulation has been reviewed and modified several times. With these reviews, the tariffs have been raised repeatedly; the current calculation methods for the tariffs are described below.

[1] Incentive Scheme for Business Modernisation (SIME), Incentive Scheme for Small Business Initiatives (SIPIE), Incentive Scheme for Business Modernisation - Research and Technological (SIME R&TD) and Incentive Scheme for the Implementation of Pilot Projects Related to Technologically Innovative Products, Processes and Systems (DEMTEC)

4.3.1 Electricity produced from cogeneration

Initially, electricity produced from combined heat and power (CHP) plants and electricity produced from renewable resources were promoted under the same feed-in regulation. However, in 1995 a separate regulation for co-generated electricity was introduced (Decree-Law 186/95, revised by Decree-Law 538/99 of December, 13 1999). The tariffs are applied for a period of ten years. During this period, the electricity producer is free to choose between supplying the entire electricity production to the grid or supplying only the surplus electricity (beyond that which is used on-site). The tariffs are indexed to the price of oil, i.e., as the price of oil increases, so do the tariffs for co-generated electricity. Additionally, a premium exists that may be paid to micro cogeneration facilities (up to 125 kW). The premium is technology specific in order to foster emerging technologies.

4.3.2 Electricity produced from renewable resources

As already mentioned, electricity produced from renewable resources has been treated under a separate feed-in regulation since 1995. However, only since 2001 (Decree-Law 339-C/2001) has the feed-in tariff for renewable sources been differentiated based on the technology and renewable resource. The corresponding tariffs are not listed explicitly in the wording of the law. Instead, they have to be calculated on a monthly basis for each generation plant. The elements of the formula represent, to some degree at least, the relevant factors that influence the costs avoided by the electricity generation from renewable resources. However, technology specific factors are also employed to ensure that a range of renewable sources – with varying costs – will benefit form the feed-in tariffs.

The most recent modification of the Portuguese feed-in law took place in February 2005, when Decree-Law 33-A/2005 was approved. For most technologies (solar and biomass, for instance) tariffs were increased; for wind power, however, they were cut.

The formula for determining the effective tariff for electricity generated from renewable resources, according to Decree-Law 33-A/2005, is:

$$T_{m,i} = CL_m * \left[FC + VC + EC * Z_i\right] * \left[\frac{CPI_{m-1}}{CPI_{ref}}\right] * \left[\frac{1}{1-GL}\right]$$

With:

m	Considered month of operation
i	Considered plant technology
$T_{m,i}$	Tariff applicable during month m to the electricity produced by the respective installation of technology i, using renewable resources for power generation
CL_m	Coefficient considering the temporal profile of feed-in. The respective time intervals and coefficients are defined in the regulation.

FC	Specific fixed costs of a new reference installation using fossil fuels that can be avoided by the respective renewable installation. A fixed value per generated kWh is applied over the entire runtime of the installation.
VC	Specific variable costs of a new reference installation using fossil fuels that can be avoided by the respective renewable installation. A fixed value per generated kWh is applied over the entire runtime of the installation.
EC	Specific environmental costs (referring to CO_2 emissions) of a new reference installation using fossil fuels that can be avoided by the respective renewable installation. A fixed value per generated kWh is applied over the entire runtime of the installation.
Z	Technology specific coefficient taking into account the individual properties of the renewable resource and the technology applied. It is multiplied by the respective environmental costs avoided EC_{Em}.
CPI_{m-1}	Consumer price index relating to the month (m-1). The index is calculated for the Portuguese mainland and does not consider leasing costs.
CPI_{ref}	Consumer price index relating to the month before initial feed-in by the respective installation. The index is calculated for the Portuguese mainland and does not consider leasing costs.
GL	Losses in the transmission and distribution grid that are avoided by the respective renewable installation. The regulation only differentiates between installations above or below 5 MW, respectively.

The above formula ensures that the feed-in tariff for renewable energy is related to the cost of avoided conventional generation that the renewable energy project offsets, considering both direct costs as well as environmental costs. Tariffs increase with inflation, over time, and vary based on temporal generation profiles and based on avoided transmission and distribution losses. In the new regulation (2005), inflation is no longer considered from the date that the license of a particular facility is awarded, but rather from the date the facility actually starts operation; this measure is expected to minimize delays in the starting-up-process.

Each operator of a renewable energy generator will select the temporal profile of the feed-in tariff to match the actual profile of the renewable generator, thereby adjusting the resulting tariff by the factor CL_m. However, operators of hydropower plants are not allowed to chose a certain profile to limit their ability to benefit from this extra income.

The coefficient "Z" varies according to the specific properties of the renewable resource and technology applied (Table 2). Varying levels for the coefficient are intended to account for the fact that the various renewable energy technologies have different cost profiles, and therefore also have different needs for feed-in tariff levels. The specific values for Z are listed in more detail in Annex I of this paper.

Table 2: Values of coefficient Z according to the renewable resource applied.

Wind	Water	PV	Biomass/ Biogas	Municipal wastes	Others
4.6	≤ 4.5	35-52	7.5-8.2	3.8	1

Source: Decree-Law 33-A/2005

The differential costs between the feed-in tariff and the actual market price for electricity are covered by an apportionment of costs to end consumers through their electricity bills. Because the feed-in tariff is calculated on an individual basis for every installation and every month of operation, only averaged values can be provided to give an estimate of the actual tariff level (Table 3).

Table 3: Approximate feed-in tariffs for electricity produced from renewable resources according to Decree-Law 33-A/2005 in euro cents.

Technology	Wind	Small Hydro	Biogas	Biomass (Forest)	PV		
					<5 kW	5 kW-5 MW	>5 MW
Tariff (€Cent/kWh)	7.35	7.90	10.40	11.00	54.20	38.10	37.30

Source: INETI, APREN in: Neue Energie. June 2005

A further modification to the preceding regulation (2001) concerns the so-called modulation applicable to wind power tariffs. The term modulation refers to a stepwise reduction of the tariffs with the effective yield of an installation, i.e., a differentiation of the tariffs according to the annual full load hours. The modulation mechanism was designed as an incentive for wind park construction on less windy sites. However, it was abolished in the 2005 Decree-Law in order to minimize possible inefficiencies in wind park operation. This result highlights the difficulty of establishing wind power feed-in tariffs by wind resource class that do not create incentives for inefficient wind project operation; though certainly possible, some care needs to be placed in the design of such tariffs.

A completely new element was introduced in the 2005 regulation: limitation of the feed-in tariff remuneration period to a maximum of 15 years. This is supposed to encourage project developers to quickly achieve commercial operations of their plants. The limitation applies to every installation that generates electricity from renewable resources. Existing installations can also receive the guaranteed tariff only for a maximum period of 15 years, measured from February 16, 2005, the date Decree-Law 33-A/2005 entered into force. Operators of installations licensed under previous regulations can request a remuneration of their electricity according to the new tariffs.

In addition to the temporal limitation to 15 years, another mechanism has been implemented into the regulation to limit remuneration in specific cases. This mechanism is coupled with the output of an installation. As an installation exceeds a defined upper limit of annual electricity output, the electricity produced in excess of that limit is no longer remunerated under the given tariffs (instead, “market prices” are paid for such output). For example, a limit of 2100 full load hours per year (corresponding to a capacity factor of 0.24) has been established for photovoltaic installations, and 3300 full load hours per year (corresponding to a capacity factor of 0.38) for wind power installations.

Once the feed-in tariff remuneration is no longer effective (e.g., after 15 years), the tariffs are adjusted to the market price plus revenues from the trading of Green Certificates. If a trading system for Green Certificates is not yet in place when the feed-in tariff remuneration expires, the feed-in tariff remuneration period will be extended for five more years.[2] In effect, this overtly encourages and signals a likely transition between a feed-in tariff policy and a to-be-designed quota or RPS model, at the same time allowing certain framework conditions. In no other country, of which we are aware, has this transition been signalled through feed-in tariff design.

The present Portuguese feed-in law also describes a specific procedure that aims at minimizing local opposition towards new wind projects. In consideration of the crucial role of wind power within Portugal's energy strategy and the immense increases in installed capacity required to meet Portugal’s wind energy targets, this measure is justifiable. Under this procedure, municipalities in which a wind farm is located will automatically benefit from the remuneration the operator of the wind project receives. Altogether, the municipality receives a share of 2.5 percent of the monthly remuneration paid to the wind project operator. As expected, municipalities have responded with support for wind power projects in their territory. Local resistance against new installations has consequently remained negligible. A comparable procedure for other renewable technologies does not exist under the Portuguese regulation, and most other countries with feed-in tariffs have not experimented with this approach to minimizing local opposition to new renewable energy projects.

Finally, apart from feeding all electricity produced into the public grid, each operator of an installation using renewable resources for power generation can opt for the so-called Consumer-Producer Scheme. According to this scheme, at least 50 percent of the generated electricity is to be consumed directly by the producer. Only the surplus electricity is fed into the grid. As compared to an operator selling the entirety of the electricity production to the grid, an operator under the Producer-Consumer Scheme receives a lower remuneration. In addition, the initial remuneration is available only for a period of 10 years, rather than 15 years. However, after the first ten years of remuneration, a slightly reduced, but fixed tariff is applied for the whole remaining run-time of the installation. The simplified licensing procedure for new installations is an additional advantage. Usually, licensing is subject to the approval of national authorities, more precisely the Directorate General for Geology and Energy (DGGE). In the case of an installation under the Producer-Consumer Scheme, however, the respective regional authority is in charge. This allows a more flexible short-tem planning of relevant projects.

4.4 Renewable energy tenders

Despite the policies described above, two major issues constrain a fast and well-directed development of renewable energies in Portugal. These are:

- An insufficiently developed grid system
- Lengthy, bureaucratic licensing procedures for new installations, in particular the performance of environmental impact assessments.

In addition, there was a desire to encourage greater local manufacturing of renewable energy equipment. In consideration of its ambitious targets for renewable energy and these constraints, the Portuguese government therefore introduced an additional support tool: a tender scheme for grid connection concessions. The Directorate General for Geology and Energy was appointed as the authority responsible for issuing invitations to tender.

In July 2005, the Portuguese government issued an invitation to bid for grid connection concessions to the public grid totalling 1500 MW. The invitation was limited to the wind power sector, and constitutes the largest tender of its kind in Europe to date.

The tender, which was open to international and domestic competitors, is split into two phases:

- Phase A of 800 MW
- Phase B of 400 MW

Winners in phase A are excluded from bidding in phase B. This way it is ensured that at least two different entities will construct and operate the plants. If the tender requirements are fulfilled in an extraordinary way by a specific bidding party, the bid evaluation committee can award an extra 200 MW in phase A and an extra 100 MW in phase B. Furthermore, an additional 20 percent of capacity can be assigned for the exceptional merit of a specific bid. Under the terms of the tender, the first turbines must be installed by 2008 and the entire capacity installed by 2013. Bidders are given flexibility on the location and size of the wind projects used to fulfil these capacity requirements.

[2] In other (not yet specified) cases, an extra extension of up to ten years for hydropower and biomass installations may be provided.

4.4.1 Objectives

In addition to achieving environmental targets, the tender principally aims to establish relevant renewable industries in Portugal by encouraging local manufacturing of wind turbines and components, and by creating local manufacturing clusters. Clusters, or learning networks, are characterized as horizontal networks of firms in which producers deepen their own capabilities by specializing, while engaging in close, but not exclusive relations with other specialists. Network systems are also said to “flourish in regional agglomerations where repeated interaction builds shared identities and mutual trust while at the same time intensifying competitive rivalries” (Saxenian, 1994). Certainly the wind industry - an industry that within each national context has a small number of players that often work in close geographical proximity on a highly specialized technology - is likely to exhibit many of the characteristics of the regional learning networks that have been observed in other industries and locales. An example of a successful learning network in the wind industry is Denmark. A combination of first-mover advantage, and the close proximity of many Danish firms experimenting with early turbine technology, both in Denmark and in California, allowed for valuable learning networks to develop (Lewis, 2005).

At the time of writing, wind turbine towers are the primary renewable energy component that is produced locally; the wind power tender, however, should change this in the years ahead. The establishment of local manufacturing clusters for wind power equipment is supposed to not only bring jobs and local economic development, but also to reduce the installation costs for new wind generators. Also, by encouraging manufacturing clusters, rather than just requiring local content, these tenders encourage the development of a wind turbine export market. New export possibilities may further increase the employment opportunities associated with these clusters. This demonstrates an anticipatory industry planning approach; in the long run, Portugal's wind industry must be able to rely on the export of turbines given limited domestic demand for wind over a long time frame. Once a wind power manufacturing cluster is established it may benefit from comparative advantages like low local labour costs, proximity to other important European markets as well as good accessibility to more distant markets via sea-transport.

The tendering procedure adds increased reliability in planning for all involved parties, as well as positive impacts on the regional development of the country. For the tender winners, it establishes a longer-term demand for up to 1500 MW of wind power projects. For local and federal government authorise, it establishes an early signal for grid expansion and wind power approval needs.

4.4.2 Evaluation of bids

A project that fulfils the minimum requirements concerning technical feasibility and grid integrity is forwarded to the second evaluation round. There, the actual evaluation of the bids takes place.

Individual bids are evaluated using a specific credit points system. This system establishes requirements that are to be fulfilled by individual bidding parties. Bidding parties are encouraged to band together in large consortia spanning the entire production and operation process of a wind turbine project. The most points are granted to bids that would generate the maximum number of local jobs and that would boost local economies. Extra points are given for business strategies that set up enough manufacturing capacity inside Portugal to allow an export of more than half of the produced goods.

More specifically, proposals are assessed by means of the following criteria:

1) Increased economic efficiency, in terms of reduced prices for generated electricity from the standard feed-in tariff, described earlier. A discount of 5 percent compared to the usual feed-in tariff for wind power is awarded the maximum number of evaluation credits.
2) Contribution to the development of industrial clusters producing and operating wind turbines.
   The relevant sub-criteria are:
   - Direct investments in less developed regions of the country. Investments in the production, assembly and monitoring of mechanical and electronic turbine components are rated higher than corresponding investments in other components.
   - The indirect investments in less developed regions.
   - The creation of direct and indirect employment in less developed regions for a minimum period of five years. A differentiation is made according to the specialization of the job.
   - Direct and indirect gross turnover of industrial clusters.
   - Sustainability of the proposed project. This includes the financial, legal and temporal reliability of the project, as well as the projected export volume of industrial clusters. An export of 60 percent of the total production is awarded the maximum number of points.
3) Technical management of the project. The knowledge, experience and technical capabilities of the bidding party concerning the operation and control of a wind park are assessed. Additionally, the projected power output, the flexibility of the turbines concerning varying grid conditions, and finally, the electricity storage capacities are evaluated.

4) The commitment of the project to promoting innovation in the wind energy sector, e.g., through funding of research and development programmes.

Table 4 summarizes the weighting of these various criteria. In phase B of the tender the same evaluation criteria are applied. Their weighting, however, varies slightly from phase A, e.g. increased emphasis is put on creating industrial clusters.

Table 4: Weighting of the individual evaluation criteria in phase A (800 MW) of the tender.

Evaluation criterion	Weighting	Sub-criterion	Weighting
1. Increased economic efficiency	20 %	Reduced tariffs for generated electricity	20 %
2. Development of industrial clusters	45 %	2.1. Direct investments by the project	11 %
		2.2. Indirect investments by the project	8 %
		2.3. Direct employment created	11 %
		2.4. Indirect employment created	8 %
		2.5. Gross turnover of the industrial clusters	7 %
		2.6. Sustainability of the project (project reliability, project stability, export volume)	multiplicative factor to the sub-criteria 2.2
3. Technical management of the project	25 %	3.1. Technical management of the wind parks	10 %
		3.2. Technical management of the turbine production	2.5 %
		3.3. Storage capacities for generated electricity	7.5 %
		3.4. Additional measures for voltage control	2.5 %
		3.5. Cooperation regarding frequency regulation	2.5 %
4. Innovation promotion	10 %	Innovation promotion	10 %

Source: DGGE

An examination of the weighting factors of the individual tender criteria reveals that major emphasis has been placed on so-called local content and industrial cluster development requirements. These include all requirements concerning the creation of an industrial cluster for wind energy (listed under point 2, table 4) and account for a total of 45 percent of the evaluation scoring made in phase A (and, not shown here, for 47 percent of the scoring in phase B of the tender). The purpose of these high percentages is evident: to boost the wind industry in Portugal by promoting local manufacture over imports. This creates new employment opportunities and stops money from flowing out of the country. Other nations besides Portugal, e.g. Spain and Canada, have been utilizing comparable local content requirements for tendering wind power concessions, though in Portugal such local content requirements are combined with specific encouragement to establish industrial clusters to create export markets. These requirements, however, might constitute a barrier to trade. It therefore remains uncertain whether the use of these factors in the decision-making/scoring process conforms to international trade law. For more information on the possible international trade implication of such criteria, see Lewis (2006).

Though local content and industrial cluster development are key aspects of the scoring, they are not solely responsible for bid selection. Other factors account for the remaining 55 percent in the final assessment of the bids (cf. Table 3). Additionally, the tender, despite its emphasis on local production centers, does not require products containing locally-owned intellectual property. That means the intellectual property does not necessarily need to be rooted locally. Such a requirement would constitute a far more serious disadvantage for foreign-owned firms, and hence be a major barrier to trade. The aforementioned points might explain the reason that the local content requirements in the Portuguese tender calls have not yet been challenged by foreign bidding parties.

Of the remaining 55 percent of the scoring criteria, 25 percent represent an assessment of the feasibility and technical management of the project. Interesting 12.5 percent of the scoring relates to the voltage and frequency control capabilities of the wind projects, as well as the storage capabilities, and another 10 percent relates to innovation promotion (R&D investments, and the such). Finally, 20 percent relates to the price that is offered for the delivered electricity, with greater scoring for those bids willing to sell electricity at below the prevailing feed-in tariff rate. However, since the maximum score in this category is awarded when bid prices are 5 % lower than the fixed feed-in tariff, bidders will presumably not bid below this feed-in tariff minus 5 %. Thus, the full benefit of a full fledged tender - i.e. getting wind power for the lowest possible price - is lost. This and the low importance of price in bid scoring indicate that low costs were not the primary focus of policy makers. The approach of bidding large blocks of wind power, up to 1500 MW, appears to have successfully led bidders to offer pricing concessions up to 5 percent relative to the standard feed-in tariffs, however, suggesting that wind tenders and feed-in tariffs can be effectively combined.

4.4.3 Tender results

The major part (phase A) of the auctioned concessions were allocated to the consortium Eólicas de Portugal, led by Portugal's biggest energy supplier Energias de Portugal (EDP). Other consortium members are Enercon, the firms Termoélectrica Portuguesa and Finerge (both subsidiary companies of the Spanish Endesa), and the Portuguese wind park developer Grupo Generg. In total, 1200 MW were awarded in this first phase of the tender: the announced 800 MW plus 200 MW and an extra 20 percent of capacity due to the exceptional merit of the bid.

The consortium is projected to spend a total of €1.7 billion by 2011; that constitutes one of the most significant foreign investments in renewables in Portugal's history. The investment will support the development of 48 new 20-25 MW wind parks in Northern and Central Portugal that will supply some 2.3 million households with electricity. Roughly one quarter of the total annual electricity produced from wind in the entirety of Portugal will be supplied by these wind parks, equivalent to 4 percent of Portugal's national power production. Besides the installation of the wind projects, the consortium will construct seven wind turbine manufacturing facilities. The project additionally envisages the development of an industrial facility in Viana do Castelo with a planned total surface area of 135,000m2. The facility will consist of the production facilities required to guarantee the integral production of a new ENERCON wind turbine model, the E-82, for the consortium, with a production capacity of 180 wind turbines/year and 600 towers/year. The factory will comprise of a concrete tower factory, a rotor blade manufacture, a generator production and the turbine assembly (Windblatt 2007). Siemens is expanding its Portuguese transformator production to meet the additional demand. Saartex, the carbon fibre manufacturer, is also planning to set up a factory in the vicinity of Viana do Castelo. More than 60 percent of their total production is planned to be exported after 2011. Meanwhile, Energias de Portugal as the biggest shareholder of the consortium has acquired large US wind power developer and operator Horizon. The project pipeline of Horizon, totalling 9000 MW in sixteen countries (National Wind Watch 2007) may create good import prospects for the Portuguese industrial facility. Altogether, the project is projected to create 1800 new jobs in the Portuguese wind industry.

All threshold values, as long as they have been explicitly named in the tender documents, were met by the winning consortium. This holds true for the export quota of 60 percent concerning locally manufactured wind turbines and the discount of 5 percent applicable to the electricity generated by the new turbines, compared to the usual feed-in tariffs for wind power. This characteristic of the presented bid is not surprising even though, especially in the second case, exceeding the maximum requirement (i.e., a reduction beyond the required 5 percent) would presumably prove to be less profitable from a strategic point of view, as a reduction of 5 percent is already awarded with the maximum number of evaluation points.

The decision on the winner of the second tender phase (phase B of 400 MW) is expected in the first half of 2007. Eólicas de Portugal, having won phase A, is automatically excluded from the tender in phase B. However, all of the other applicants from phase A have submitted bids. The applicant most likely to win phase B is the Ventiveste consortium, a joint venture comprising the Portuguese firms Galp Energia, Martifer and Enersis, as well as the German Repower.

Subsequent to the decision in phase B, the Portuguese government has scheduled a third tender phase with a series of small lots, 10 to 20 MW, of wind power concessions. In total, 200 MW shall be tendered in that third phase.

4.4.4 Other active and planned tenders

In addition to wind power, biomass and solar energy are expected to play a crucial role in the Portuguese strategy promoting renewable energy. However, in comparison with renewable resources such as wind and water, biomass and solar currently constitute a very small share in the country's use of renewable energy. In 2006, biomass (without CHP) contributed only a fraction of the total renewable electricity produced, 0.4 percent. Biogas supplied only 0.2 percent. The amount of energy produced by photovoltaic systems was so small that it did not appear in the official statistics published by the Directorate General for Geology and Energy (DGGE). Increased weight is planned to be ascribed to the promotion of biomass and solar energy during the upcoming years in order to support these less developed technologies.

4.4.4.1 Biomass

Agriculture and forestry are essential elements of the Portuguese economy. Nevertheless, biomass has only been utilized to a very marginal extent in national electricity generation. In 2006, the share of electricity produced from biomass (without CHP) only accounted for 0.1 percent of Portugal's primary energy consumption. Electricity produced from the incineration of municipal wastes and biogas only contributed with 0.9 percent and 0.1 percent, respectively. By 2010, however, the Portuguese government wants to extend these shares to 0.7 percent (biomass not incorporating CHP), 1.6 percent (municipal wastes) and 0.3 percent (biogas).

At the present time, only two biomass-fired power plants feed electricity into the public grid in Portugal. However, the construction of new power plants is scheduled. On February 22, 2006 the Portuguese government launched a call for tenders aiming for the construction of 15 new thermoelectric power stations running on forest biomass. The total installed capacity of the projects shall amount to 100 MW, divided into individual projects of 2 to 15 MW. The total investment of the project is estimated at €225 million. The 15 concessions are location bound, i.e. the tender documents explicitly name the region in which the future plants shall be located. Most installations are to be distributed over the Northern and Central part of the country, especially in the regions Castelo Branco and Vila Real. Altogether, approximately 500 to 800 new jobs shall be created.

Comparable to the 2005 wind energy tender, a credits scoring system is used to evaluate presented bids. Applicants must fulfil minimum requirements (combustible with a minimum of 60 percent forestry biomass and a maximum of 5 percent fossil fuels, as well as a maximum distance of 20 km between power plant and grid connection point). Provided that these requirements are met, the following additional criteria are applied for evaluation (see also Table 5):

1) The composition of the fuels with which the specific plant is fired. Admissible fuels are forestry biomass, other renewable combustibles such as wastes from agriculture and the wood-working industry, as well as biofuels. The higher the content of forestry biomass, the more credits are awarded during the evaluation. A maximum content of 5 percent of fossil fuels are allowed, however, the presence of fossil fuels negatively influences the scoring of the project.
2) Sustainability and stability of the project. The contractual relationships between the plant operator and the fuel suppliers are assessed, as is the contractual reliability of the plant operator.
3) Technical management and energy efficiency of plant operation. This includes an assessment of the plant's efficiency factor and the utilization of waste heat.
4) The commitment to the promotion of innovation and biomass technology image (cooperation with research institutes, public information campaigns, etc.).

Table 5: Weighting of the individual evaluation criteria.

Evaluation criterion	Weighting	Sub-criterion	Weighting
1. Composition of combustible	30 %	Composition of combustible	30 %
2. Sustainability and stability of the project	45 %	2.1. Stability of contractual relations between plant operator and fuel suppliers	25 %
		2.2. Contractual reliability of the plant operator	20 %
3. Technical management and energy efficiency of plant operation	20 %	3.1. Efficiency factor of the plant	10 %
		3.2. Utilization of produced waste heat	10 %
4. Innovation and image promotion	5 %	Innovation promotion	2,5 %t
		Image promotion	2,5 %

Source: DGGE

The bidding deadline for this tender was September 12, 2006. Most bids were for the larger concessions/projects of over 10 MW. The smaller concessions have been in lower demand. For example, one of the 15 future power plants did not receive any applicants.

4.4.4.2 Photovoltaics

In spite of the very favourable climatic conditions, very little photovoltaic power generation has been developed in Portugal. However, in recent years, isolated off-grid photovoltaic systems have experienced a striking annual growth of almost 30 percent. In 2005, the capacity of installed photovoltaic systems in Portugal reached a total of 3.3 MW_p. Only one fifth of this total, equivalent to a capacity of 0.6 MW_p, was connected to the public grid.

Targets for photovoltaic electricity have been defined as an installed capacity of 150 MW by 2010. 128 MW of the 150 MW total have already been approved based on tenders. The demand for the remaining 22 MW is very high. The approval process for these remaining projects, however, had to be postponed as the Portuguese Directorate General for Geology and Energy (DGGE) currently lack the capacity to process further applications. The DGGE is expected to elaborate a new call for tender on the remaining 22 MW photovoltaic concessions when licensing for the biomass and wind tenders, which are occupying DGGE capacity at present, are completed in 2007. The decision must still be made on whether the 22 MW shall constitute one major project or several smaller projects.

5 Possible Implications for China

China is unique, but the case of Portugal provides at least three potentially important implications for Chinese policymakers.

- ***Tenders/concessions may co-exist with a standard feed-in tariff.*** One remarkable feature of the Portuguese case is the co-existence of a feed-in tariff scheme for renewable electricity alongside a governmental tender scheme for large renewable power generation concessions. In particular, the approach of bidding large blocks of wind power, up to 1500 MW, has successfully led bidders to offer pricing that is lower than the standard feed-in tariffs, suggesting that wind tenders and standard feed-in tariffs can be effectively combined. That said, a 5 percent discount in prices offers the maximum number of credit points during the evaluation of the bids, impeding any attempt of reducing the price beyond this limit. By limiting price competition, however, the Portuguese case has allowed for greater competition in the establishment of local wind turbine manufacturing clusters. Though price reduction is desired, more emphasis has been placed on local industry development. This approach to limiting price competition to encourage greater investments in local manufacturing may have some merit, especially in a situation in which a standard feed-in tariff also exists to limit the industry's desire for price competition. Further discussion of what level of price limitation is optimal is deserved.

- ***Tenders may encourage the creation of local industry clusters and exports, not just local manufacturing.*** As with the Quebec, Canada case study that we provided earlier, the Portuguese case illustrates a somewhat more refined/complicated approach to encouraging local wind turbine manufacturing than that used in China in recent years. Of particular note is the importance placed on the development of industry clusters and developing product for export (as well as innovation, and R&D), rather than simply encouraging local manufacturing for in-country projects. Though it is too early to report definitive results in terms of manufacturing investments in Portugal, results from the first tender suggest that success in this regard is imminent. Other elements of tender/concession scoring and evaluation may also be of interest to our Chinese colleagues.

- ***Feed-in tariff pricing based on avoided costs, temporal generation profiles, environmental benefits, and technology-specific factors is possible.*** The Portuguese case provides an example of a relatively sophisticated approach to establishing feed-in tariffs, taking a number of relevant considerations into account. These factors include: (1) the cost of conventional power avoided by the use of renewable energy; (2) the cost of avoided transmission and distribution losses; (3) inflation adjustments; and (4) the environmental benefits of renewable energy. In addition, to reflect the varying maturity and cost of different renewable energy technologies, project sizes, and other factors, tariffs are established in a targeted manner to account for these conditions. Additional innovative features include an explicit reference to a transition to a quota/RPS model over time, and remuneration to local communities in which wind facilities are sited.

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7 Annex I

Specific values of coefficient Z for the monthly calculation of the feed-in tariffs for electricity from renewable resources:

wind power generators	4.6
hydro power generators	
- with an installed capacity up to 10 MW	4.5
- with an installed capacity between 10 MW and 30 MW: 4.5 less 0.075 per installed MW exceeding 10 MW	
- with an installed capacity of more than 30 MW: the value of Z is defined by the DGGE	
- with pumping facilities	0
PV installations with an installed capacity up to 150 MW	
- with an installed capacity over 5 kW	35
- with an installed capacity under 5 kW	52
installations using biomass and an installed capacity up to 150 MW	
- fired with forestry biomass	8.2
- fired with animal biomass	7.5
biogas installations fired with landfill gas and an installed capacity up to 50 MW	7.5
incineration facilities fired with municipal wastes	3.8
installations not explicitly named in the wording of the regulation	1

For projects, being of national importance due to their innovative character, the above listed values of Z may vary.