

Transactional Efficiency and Public Promotion of renewables in the Electric Industry: The choice between structures of hybrid governance

Dominique FINON,
CIREC, EHESS and CNRS, Paris
and
Yannick PEREZ,
GRJM-ADIS,
University of Paris Sud

Summary

By recourse to the Williamson and Goldberg's transactional analysis, this paper compares the relative efficiency of three institutional devices, recently implemented by some countries to promote renewable energies in electricity generation. These devices are identified as structures of hybrid governance because they are composed of two complementary contracts articulated around an obligation of purchases imposed upon some electricity market players. This contractual duality puts first in relation the public authority mandated by the citizens and the mandated purchasers (generally the electricity suppliers); then it shows the relation between these purchasers and the producers that are candidates for investment in renewable energy sources (RES). For the attributes of the transactions held in the context of these contracts are identified, and an analysis is made of the three governance structures' sensitivity to the risk of hold-up: the guaranteed feed-in tariffs, the bidding system for long-term contracting, and the exchangeable quotas system.

Finally, the performances of these three devices are compared by reference to three criteria: transactional efficiency in relation to protection of investments in renewables in the long term, control of the collective cost and redistributive effects (rents) allowed by these mechanisms, and finally their capacity to stimulate technical progress and to sustain industrial policy in RES equipment manufacture. This paper shows that none of the three devices offers an optimal solution in each of these dimensions, and that according to the relative importance of the criteria, an adapted structure of governance exists.

Since the nineties, governments have developed voluntary renewable energy development policies with the aim of preserving a set of collective goods, climate stability, local environment and energy security. The objectives of the policy became ambitious in the field of electric production, which is the main field of their development besides that of biofuels: if we take the case of the European Union members, the share of “new” renewables in the electricity production must increase from 1% to 8% of the total electricity production in average if the voluntary objectives adopted by the 2001 directive on renewables promotion (European commission, 2001) are reached. The adopted policies are based on subsidisation of investments, or of production by these technologies when they are near to commercial maturity, while the . These devices are necessary because the units of Renewables Energy Sources in Electricity (RES-E) are not competitive with the large electricity generation units for three reasons: (i) their relative commercial immaturity; (ii) the absence of scale effects on transaction and production costs, due to their small size, which limits savings on preparation and realisation costs, and (iii) the random nature of their intermittent production with difficulty in programming of the production from some of these technologies (wind power, mini-hydraulic).

After learning from the experience of voluntary purchases of green electricity by consumers to frame the RES-E investments according to the market, as well as the experience of direct investment subsidies, the European countries and a several states in the United States and in Australia switched to one of the types of institutional mechanisms by organising indirect subsidisation of production. These three devices have a common character: an obligation to purchase RES electricity imposed on clearly specified agents, or a quota to be respected. They are based either on buy-back tariffs guaranteed in the long term, on a system of auctions for the assignment of long-term purchase contracts at the proposed price (pay-as-bid), or on the system of quotas of exchangeable green certificates. These three mechanisms make up different hybrid governance structures that put together a regulatory contract between the public authority and the mandated purchasers on one hand, and contracts that bind the mandated purchasers and the producers who invest in RES-E units on the other hand.

The object of the paper is the analysis of the choice between these devices in the terms of the New Institutional Economics. In the line of Williamson’s developments [1985, 1996] and of the concepts of the Transaction Costs Theory (TCT), we analyze the essential features of the two types of transaction that the structure of governance of the promotion of the RES-E must manage. We make the hypothesis of a stability of the RES-E regulations, and that this stability assures their credibility, hypothesis that we discuss when we adopt the other institutionalist perspective of North (1990) or Levy & Spiller (1994)¹ of embedness of the governance structure in their institutional environment.

The comparison of the incentive devices in the terms of the TCT adds to the assessment of the economic and social efficiency of these policy instruments in terms of public economics. It tends to focus on the collective cost in a perspective of second best optimum and will put in evidence for example the attractiveness of the exchangeable quotas as a way to minimize social cost while pursuing a quantified objective. Taking in consideration the transaction costs in the institutional arrangements is essential since their impact is as important on the choices between types of assets by the potential investors as the anticipated production costs and risks. Here, in relation to the decision of investment in RES-E, each hybrid structure of governance setting up by States exhibits specific qualities in term of guarantees offered to the developers of projects for the limitation of the volume-risk and price-risk. They present also risks for making profitable the projects by the earnings subsidized by the mandated purchasers and indirectly by the consumers of electricity.

The aim of this paper is therefore to explain the principles of selection between devices combining the relation that partly organises relations between investors and mandated purchasers and the institutional

¹ Finon et Perez, 2004b

arrangement between them. The selection is made between institutional solutions that the public authority, the investors and the purchasers choose in order to secure investments in RES-E and frame the transactions to protect investors against risk of opportunism by RES-E electricity buyers or a State wishing to promote development of these renewable energies and likely to change the regulation in the future. In this context, the determining parameters for ordering the devices of promotion of the RES-E cover three points:

- First, performance in terms of installation of new units arising from securing of transactions.
- Second, as production cost are elements as important as the transaction costs for explaining the selection between institutional arrangements, the control of the collective cost, which is affected by the diminishing cost of the new units under the learning factor; it includes the redistributive effects of the devices, as factor of acceptability.
- Finally, stimulation of technological learning and development of an industrial policy in the construction of RES-E units, given that this objective is only valid for the first stage of the life cycle where the technologies are in infancy and could represent an opportunity to create a comparative advantage for the national economy.

We adopt the conventional approach of transaction cost economics for explaining the choice of one of several governance structures for a certain set of transactions. We also adopt a static approach in the sense that we should not interpret the dynamics of these structures and their eventual change under endogenous factors. In the first part, we analyse the attributes of the transactions around the preservation of collective goods (climate stability, energy security) through development of the RES-Es that will condition the choice of the type of RES-E regulation. In the second part we define the features of each of the three hybrid governance structures that the public authority can choose by referring to national experiences. In the third part, we compare the advantages and drawbacks of these three structures and show that depending on the hierarchy of public objectives, there is a preferable governance structure.

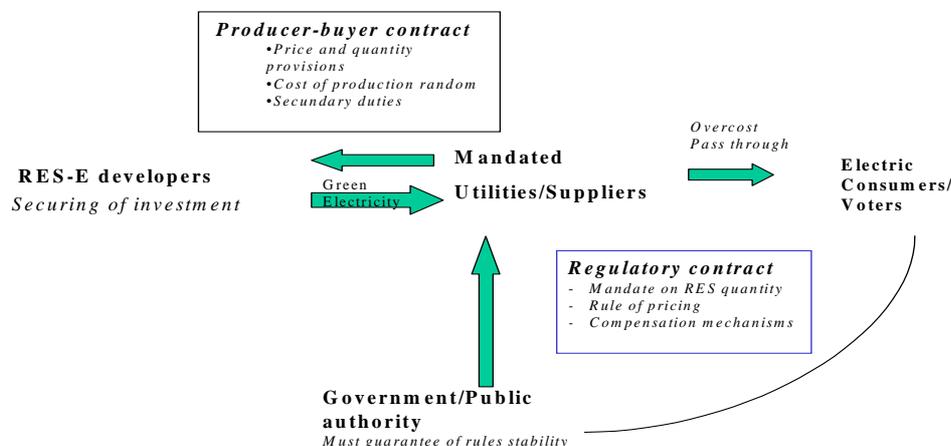
1. The attributes of transactions associated with development of RES production

The TCT takes account of the attributes of the transactions to explain and determine the institutional arrangement to adopt. The seminal authors note the different types of assets specific to the transaction (especially specificity of site and competence and temporal specificity), but also the uncertainty, complexity and measurability of the performance levels within the transaction. It is known that the main determining factor of the institutional arrangements in an uncertain environment and with external aspects present is the constitution of specific assets [Williamson 1996, Masten & Saussier 2002]. The empirical studies also show that frequency, complexity and external factors surrounding some transactions condition the choice of institutional arrangement. In generalising the transaction costs analysis to the government's choices of governance structures for leading tutelary policies, Williamson (1999) analyses the characters of political transactions to explain the choice between public bureaucracy and market, while passing by regulation and contract by delegation.

Here, to identify the transactions organised around the RES-E promotion, we distinguish four groups of agents involved in several types of transaction between them around the promotion of the RES-E:

- The public authority that takes on the government's commitment to provide or preserve a set of collective goods through development of RES-E production.
- The electricity consumer citizens who call on the government to act for the preservation of these collective goods through RES-E development.
- The agents who will carry an obligation either to purchase green electricity or to respect a quota of physical RES-E, contractual RES-E and green certificates.
- Applicants for investment in RES-E.

Figure 1: General hybrid governance infrastructure for promotion of RES-E



The transactions associated with RES-E production between these agents are set at two levels.

- At the level of definition of public policies, political transactions concern the protection of a set of collective goods through RES-E promotion under the supervision of the government elected by the citizens. These transactions lead to the setting up of the device that organises stable indirect subsidisation of RES-E production. It is at this political transaction level that the public authority prefers regulation to market, given the limitations of green tariff programs or direct purchases of green electricity through green marketing to boost investment in RES-E for providing this set of collective goods. Regulation is also preferable to public bureaucracy because of the institutional environment (in particular, the cultural reluctance of public power companies to develop decentralised generation before the market reforms in the nineties; and incompatibility with the market ruling of the sector after the reforms). It is also at this level that, once the choice of regulation is made between the various modes of governance, the public authority must choose between the three institutional devices that each correspond to a specific regulatory contract between public authority and mandated purchasers.
- At the second level, the transactions concern relations between producers who invest in RES-E units and the mandated purchasers of their green electricity. The investors refer to the regulation set to define the contractual arrangements with the mandated purchasers in order to secure their investment and to attract lenders for establishing a project-financing contract. In the case of the quotas system, the transactions are more complex at this level because the system divides the green electricity into two types of goods: electricity that cannot be differentiated, and green certificates, which are property rights on environmental goods that are exchanged between green producers and purchasers subjected to quotas expressed in terms of green certificates that should be owned at the end of the year.

For these two intricate transactions, the specific nature of the assets and other transactional attributes such as uncertainty and external factors also exert a degree of influence.

1.1. Specificity of RES-E assets to political transaction

The asset in RES-E production is strongly specific to the political transaction associated with promotion of green electricity production. From this transaction, the regulatory set that organises the incentives to invest in RES-E units is deduced. These units are based on techniques that, as underlined already, are penalised by their commercial immaturity, the additional costs inherent in the absence of scale economies, and the intermittence of their production. In the line of first best environmental policies, the objective of installed capacities in RES-E is in principle supposed to equalise the excess cost of the marginal units (i.e. marginal cost of pollution reduction) and the value of the marginal benefit (i.e. the damage avoided if one only considers preservation of environmental goods). In this way, the environmental quasi-rent is created by the new RES-E units whose additional kWh cost is lower than the social value of the avoided damage. We could add the social value of the increase in energy security.

The RES-E regulation must allow steady compensation for the additional cost of kWh production by the new RES-E units over a sufficiently long period to assure recovery of investment. Their realisation depends heavily on the credibility of the public authority's long-term commitment regardless of which three regulation devices are selected. The government's opportunism, especially in cases of electoral change, and discretionary and unforeseeable amendments of the rules of the device, create a risk of expropriation of former or current investments, and this risk can be a strong deterrent against investing in RES-E. The absence of long-term predictability of the policies, or possible limitations of the safeguards offered by the Constitution, the law or decrees can make candidates reluctant to invest [Finon, Perez, 2004b]. It is however important to distinguish the stake of stability of the indirect subsidy rules to the former RES-E units constructed under a given set of regulation rules on one hand, and the interest in indefinitely upholding this institutional device when the technological costs decrease under the learning effect, or when political changes could alter the weighting of social preferences around environmental goods, on the other hand. It is indeed on the first stake that the credibility of a regulation to encourage investment is involved, because changes to regulations could be organised in a way that preserves the rules of the former regulation for former RES-E units.

1.2. RES-E asset specificity to transactions between producers-investors and purchasers

At the second transactional level, between RES-E producers and mandated RES-E electricity purchasers, asset specificity depends on the institutional rules for mandated electricity purchases arising from the RES-E regulation and the legal rules for network access that condition the geographic specificity of assets.

1.2.1. The geographic specificity of RES-E assets

The regulation of the electric industries conditions the geographic specificity of the RES-E units and determines the rules for safeguarding the investments in RES-E. Thus, in the previous regulated public service monopoly set that does not allow purchasers to access the network and choose their suppliers and therefore differentiate the product according to the character of its production process, there exists a geographic specificity of RES-E asset. Indeed, RES-E producers are forced to sell to the electric utility that is in monopoly in the area where their units are located. They are therefore greatly exposed to the risk of hold-up, which leads the public authority to impose a purchase obligation and payment of an administered price to the local monopolies in return for the passing of the additional cost of the subsidised green kWh (that is, the difference between this price and the wholesale electricity market price) to their retail tariffs.

The market deregulation rules change the deal. The provision of third party access that fundamentally modifies the property rights over physical network capacities erases the supply monopoly and suppresses the geographic specificity of RES-E assets. RES-E producers can now reach voluntary purchasers. Therefore, a regulatory or legislative decision is necessary so that the RES-E unit's production is removed by the local or regional distributor-supplier and paid according to an administered tariff over a guaranteed period.

1.2.2. The temporal specificity

A second type of asset specificity concerns some RES-E technologies (wind power, mini-hydraulic) that are bound by the intermittence of their production; this means the weakly programmable character, based on meteorological risk, which cannot be managed by storage because of the nature of electricity. The meteorological risk, superimposed on the normal operational risk, compels the RES-E producers engaged in real-time contractual sales to search for compensatory electricity to balance their contractual load as per the provisions of the arrangement. Intermittence of production generates a problem of instantaneous adjustment of physical supply to the quantities that must be contractually provided to the purchasers.

Under the regulated monopoly regime, this problem was settled by the monopoly purchase obligation, which imposed the responsibility of real time balancing due to intermittence. On the deregulated electricity markets, where RES-E production is treated as normal production on the organised wholesale markets, the market players must advise the system operator several hours in advance of the quantities that they will produce or buy. The costs of technical adjustment by the system operator, associated with all physical imbalances in contracts between producers and buyers, are not grouped together anymore and mutualised, as in the old monopoly situation. The market logic leads to real-time individualisation of responsibility of actors involved in bilateral or multilateral transactions, despite the need for general system stability. They therefore bear responsibility for the instantaneous balance between injection of their production into the electricity grid and off-takes by their purchasers. One level of the organised markets, the intra-day market of balancing, is dedicated to gathering offers of instantaneous increase or reduction of producers' injections (or conversely of purchasers' off-take) in order to allow the system operator to assure balance of the system in quasi-real time. However, the price of balancing does not reflect the marginal cost of adjustment, because the market rules give it the function of deterring producers and purchasers from being in physical unbalance in real time. Moreover, mutualisation of balancing costs due to intermittence of RES-E production becomes impossible if some market rules are not dedicated to RES-E production transactions.

If the priority of RES-E promotion does not balance the electric markets' efficiency objective, the organisation of these markets can be defined in terms of ignorance of the specific features of the ENR units' weakly programmable production, as was evident in the UK in 2001 when the new market rules (NETA) were implemented (Mitchell & Connors, 2004). It depends on two particular rules: the period between gate closure and realisation of the transactions, and the balancing prices that the system operator calculates for balancing the shifts between producer's offer and realisation. In the first place, the gate closure period can be chosen mostly as a precaution (3½ hours in Great Britain in 2001). This creates a recurrent risk of shift between the announced RES-E unit production and the production achieved. In the second place, the general electric market efficiency objective that leads the electricity regulator to limit load unbalances leads the regulator to define price incentives for the producers to self-balance the load in real time between their production and their contractual sales, This explains the difference between the balancing prices and the actual average costs of the adjustments for which RES-E producers are jointly responsible.

Because of the difficulties in forecasting their production three hours in advance, RES-E producers are therefore doubly penalised beyond the reality of the overall balancing costs that they cause. In this case, therefore, the system operator captures the quasi-profit from the RES-E production because of the rule of market closure. Indeed, this market rule can so depress the value of this production that one is deterred from investing in RES-E (Mitchell & Connors, 2004; Menanteau & Finon, 2004).

Temporal specificity which is associate with strong real time externalities therefore generates transactional complexity and creates uncertainty. It obliges one of the other contractual parties to commit to assuming the production risk *ex ante* in order to suppress the risk of hold-up associated with the weakly programmable character of the RES-E production.

Before concluding on the determination of institutional arrangements by transaction attributes, let us note the importance of externalities via the intermittence of supply, and uncertainties. These ones are common or specific to the two transactional levels. They are of various types, at the first level the regulatory risk (changes of rules), at the second level the technological risk on the investment cost and the performances of the plants. These risks can be more easily assumed in a device granting the environmental quasi-rent to the developers of RES-E units.

The hybrid governance structure to be introduced should therefore take account of the original forms of the specific asset features, the uncertainty over how they will affect the transactions, and the management of externalities. They direct the choice of the most efficient institutional arrangement. The definition of transaction attributes now allows analysis of the various governance structures and determination of the most efficient one for offering the guarantees necessary to the investors while limiting the risk of excessive appropriation of quasi-profit by any of the parties. Three elements will influence the efficiency of each device and the level of transaction costs:

- The content of the contractual relations between public authority and mandated purchaser, which can go so far as to determine the relation in quantity and price between producer-investors and purchasers.
- Securing of the investments allowed by each of these arrangements, when at the second level the RES producers and mandated purchasers have the opportunity of choosing between various types of arrangements (this is the case with the quotas system).
- Within these institutional arrangements, the possibility of sharing the balancing costs for the weakly programmable productions in deregulated electric industries.

2. The features of the governance structures of promotion of the RES-E.

We consider now the features of the governance structures and more especially, the content of the contractual relations between the actors, the methods of safeguarding investments and finally the ways of the mutualisation balancing costs of intermittent RES-E productions. We successively consider the three devices (feed-in tariffs, bidding and exchangeable quotas), with their two relations: the relation between the public authority and the mandated purchaser, and the relation between the producers/investors and the mandated purchasers. The first that we called the “regulatory contract” specifies a set of contractual parameters of the relation between RES-E producers and purchasers. They are supposed to give guarantees to the two parties in order to help the realization of RES-E investment by the first ones and to organize *de jure* or *de facto* the pass-through of the purchase obligation cost in the tariffs or prices paid by all the electricity consumers.

The regulatory contract resembles the “administered contract” as understood by Goldberg [1976]. In the public service industries, it binds the authority of regulation and the enterprise in natural monopoly while organising and standardising all contracts between the industry and the electricity consumers. This administered contract imposes on the industry a supply obligation and redistributive principle in pricing rules, while the same pricing rules guarantee cost recovery and just and reasonable conditions of return on assets, thus easing investment in production and networks. Here the “regulatory contract” on the mandatory purchase is supposed to create favourable conditions that allow realisation of investments in RES-E.

The relation between the public authority and the mandated purchaser specifies a set of contractual parameters of the relation between RES-E producers and purchasers. They are supposed to give guarantees to the two parties in order to help the realisation of RES-E investment by the first ones and to organise *de jure* or *de facto* the passthrough of the purchase obligation cost in the tariffs or prices paid by all the electricity consumers. They shape the way of organising

2.1. The hybrid structure of governance of the feed-in tariffs

We consider successively the regulatory contract and the contract producers-mandated buyers.

2.1.1. The regulatory contracts

In the feed-in tariffs system, the regulatory contract compels the regional distributors or suppliers to buy the RES-E units' electricity at an administered price much higher than the wholesale price. The guaranteed prices are defined for a given technology and guaranteed for a period of 10-15 years, for every unit installed according to the level of this price signal. This principle allows discrimination between RES-E technologies, the tariff levels being adapted to each one according to their respective degree of maturity.

In the former monopoly regime, the additional cost of a RES-E purchase is compensated when it passes through the tariffs; this ensures the indirect subsidisation by all electricity consumers. In the market regime, in which the suppliers who bear the obligation are in competition, the additional cost compensation is an important provision of the regulatory contract; repayment is made through a special fund financed by a tax on every kWh transported and thus passed mechanically to all consumers.

2.1.2. The contractual arrangement producers-mandated buyers

The second contractual arrangements that govern transactions between developers and purchasers offers clarity and simplicity to developers. It was Langniss [2001] who underlined that these transactions rest completely on the regulatory contract that is the basis for the public authority's commitment when set at the first level. The first allows reduction of all transaction costs for setting up and following up the producer-buyer contract. There is no producer-purchaser co-ordination via prices and quantities, to the extent that frequently there is no explicit contract [Langniss, 2001], as the German and Spanish experiences show. In terms of governance structure, the mandated agent acts as an agent of the public authority assigned to remove green electricity produced in its area while repaying itself by passing the cost to the tariffs or by subsidies financed by a general tax on transported kWh.

So the producer-buyer contract is thus defined by advance in price. With regard to volumes, the purchase obligation means the mandated companies do not know *a priori* the quantities that they should take in future. In real time, they must assume adjustments of delivery in relation to the random nature of the production (wind, mini-hydraulic) by the RES-E units concerning them. The producer-buyer relation is therefore codified by the regulatory contract, so that the purchases need not be formalised in a formal contract, except for technical conditions and method of settlement.

In this governance structure, the risk of opportunism by the public authority exists, consisting mainly of discretionary decisions to review tariffs for existing facilities or those in construction. There could also be a risk of opportunism in complete revision of the regulatory contract, but this change will not affect the former investors if it maintains the former arrangement for them in terms of guarantees over off-take and prices relating to RES units. This change only affects investments by RES-E unit constructors when the units are dimensioned in relation to optimistic market development predictions directly linked to the level of incentives created by the feed-in tariff system.

Finally in this governance structure, the risk of hold-up lies only in the regulatory contract. The risk is placed either on the level of the purchase tariffs, which can be changed on a discretionary basis, or on the device itself, which can be replaced by another device. In cases of radical change, the stability of the second contract, that is, feed-in tariffs and off-take, is called into question for the RES-E assets. There is therefore a need to guarantee upholding of the previous rules for these units when institutional change occurs.

2.2. The hybrid structure of governance in the bidding system

2.2.1. The regulatory contract

The regulatory contract with a mandate is quite similar to the precedent in the bidding system. The auctions are organized to gain the possibility to establish a long term contract with a

mandated buyer. So it links the public authority and mandated buyers and defines the terms of the second contract between the latter and the RES-E producers: obligation on the local networks (distributors or bundled suppliers) to buy RES-E electricity produced in their area, rule of definition of contractual price in pay-as-bid for a specified long period (10-15 years), implicit obligation to carry out the balancing necessitated by random production, and compensation for additional costs through a special fund plus a tax on each kWh transported. We note also the mode of selection according to technology bands (wind power units by power level, mini-hydraulic, sewage gas, landfill gas etc). In comparison to the previous RES-E regulation, the price in the producer-buyer contract is not defined in advance by the regulatory contract, but it defines the rule for defining the contractual price². Finally this regulatory generally includes a cost-cap rule, according to technology, for the selection of bid contracts; this imposes a requirement on developers not to overcharge on prices in their tenders issued to suppliers.

For the mandated purchaser, the purchase obligation is compensated either by passing the cost through the tariffs when the industry is in monopoly regime, or by repayment of additional costs through a special fund plus a tax on each kWh transported in the competitive regime.

The regulatory contract should give clear information to the players directly involved in the opportunity for investment, that is, the investor applicants in various directions, for limiting the cost of organising the innovation process and encourage the successful applicants to realise their projects. First, the hybrid governance structure should include clear and reliable information on the successive date of auctioning, the rule of price definition and the composition of technological bands. With reference to the British experience of the Non Fossil Fuel Obligation from 1991 to 2000 (Mitchell, 2000), it is observed that the successive invitations to tender have taken place at times decided on by the public authority without the possibility of long anticipation, although they came within a policy based on a long-term capacity objective at a specified horizon (initially 2000 and then 2005). The same applied to the evolution of technological bands, and the developers' strategies were heavily restricted.

Secondly, the institutional device is incomplete if it does not include incentives for developers selected to realise their proposed equipment. They could in fact play on the year of realisation by postponing it, thus allowing them to bet on technical progress in years to come as they could have underestimated their price in order to be selected. However, they tend to abandon their project when they meet the first difficulty. The incentive could be a penalty to encourage successful applicants to bid at a reasonable price to give concrete expression to their installation project. It does not exist in the UK bidding system and a large number of selected projects have not been realised (Mitchell & Connors, 2004).

2.2.2. The long term contract producers-mandated purchasers

In this system, the costs of tendering are high for the developers. These *ex ante* transaction costs concern the cost of preparing and following up the projects and, after their eventual selection, the administrative costs of licensing and setting up the contract. These costs may be high, given the small size of the RES-E projects and the absence of scale economies. They are included in the price proposed in the investor's bid, but will only be recoverable if the tender is successful and thereafter if the selected candidate succeeds in installing its equipment to control the investment cost.

Conversely, ex-post costs are reduced by the regulatory contract that specifies the contractual period (15 years generally), as well as the rule of defining the kWh price for the entire contractual period; this requires neither surveillance nor re-negotiation, nor flexibility of contractual provisions. The RES-E producers' responsibility required by the intermittence is limited, and the responsibility of the balancing adjustments is passed on the mandated buyer.

2.3. The hybrid structure of governance in the exchangeable quotas system

² Other pricing rules could be envisaged, such as marginal prices, but the choice of pay-as-bid allows limitation of profits and is considered to be socially more efficient.

2.3.1. The regulatory contract

In the system of exchangeable quotas, commonly known as Renewable Portfolio Standards, the regulated contract is weakly coercive and leaves considerable scope of choice to mandated purchasers and producers. The RES-E purchasers' mandate is defined *ex ante* in quantity but not in price. It does not concern RES-E electricity produced by a specific unit, as is the case with the two other devices. The obligation concerns an increasing total of wholesale electricity purchases to be covered by RES-E production, contracts or green certificates. One type of agent, generally electricity suppliers, is required to have a specific proportion of green certificates in relation to their yearly sales. An incentive to respect the quota is given, with the threat of a penalty.

An important principle is clarity of the property rights assigned by the regulatory device to RES-E producers RES-E to allow exchange with buyers subjected to quotas. The public authority must ensure the predictability of the device in order to guarantee the durability of these rights. For that purpose, the regulation must be established for a long period, 15-20 years, in order to secure investors; the quota must increase for a long time beyond the first ten years in order to create a demand for certificates that maintains their market price, the quota increase must be defined up to this horizon and not revised downwards, and finally, the composition of the basket of eligible technology shall only be reviewed for exceptional and legitimate reasons. All additions or modifications to the regulatory RES-E portfolio shall alter the rights of ownership and have the effect of decreasing certificate prices.

With regard to financial compensation for purchasers subjected to quotas, the design is quite different from the preceding devices. There is no rule of compensation in electric industries under the market regime; the players carry the additional cost of their RES-E purchases over to their retail electricity sales. The logic of this design is twofold: competitive equity between market players who have to support identical obligations, and pressure of competition to encourage them to limit their expenses to respect the quotas, given that they are supposed to be price takers on the respective markets of electricity and green certificates.

Two other institutional rules enforce the regulatory contract.

- First, a penalty system is established to encourage purchasers subjected to quotas to respect them, but also to discourage them from excessive spending. Payment of the penalty is full discharge, so that the marginal costs in respect of the quota do not exceed the penalty total. However, to avoid significant losses in relation to quotas through payment of the penalty, the public authority could create an additional incentive by redistributing income from collected penalties between agents who respected their quotas on the basis of their certificates, as it does in the UK in the Renewable Obligation adopted in 2001. This provision can be very efficient because it allows those competitors who respect the quota to be subsidised by those who do not.
- Secondly, framing the market prices of the certificates with a price ceiling and price floor is intended to limit the volatility of this market and therefore to facilitate recourse to this market for the RES-E purchasers. With these two elements, the actors benefit from an interval of reference prices to invest or to commit themselves in long-term deals in green electricity.

Moreover in some countries as the US states with RPS programs, but not in the European countries, the obligation is completed by a tax credit system on the investment, which is a form of subsidization of the investment. This tax credit is effective for an equipment during ten years after its commissioning. If it is suppressed by a new government, it must be suppressed for the new units to be ordered in order to avoid partial hold-up on the assets developed under this incentive.

It will be noted that unlike the two other devices, the regulatory governance structure presents three specific features.

- In transactions associated with green electricity, the device dissociates electricity and environmental goods, the sale of the goods being in the form of green certificates. It is

however also true that the agents can choose to integrate the two transactions while passing contract for one type of goods with one price covering electricity and certificate value.

- Finally, it does not dissociate the technologies, and this encourages developers to recommend the more mature techniques.
- It does not oblige the mandated purchasers to establish only one type of contractual arrangement with the RES-E producers, but allows them to choose between certificates market, contract and vertical integration. Neither does it specify the contractual elements, in period, price or quantity; the investor must negotiate one or more contracts, the purchasers offering different contractual periods that depend on the price that they agree to pay.

2.3.2. The relation between RES-E producer and mandated purchaser

In contrast to the two previous devices, which impose a price and quantity contract, the contractual solutions are left to the free choice of the mandated buyers and evidently to the free choice of the producers. As the quota system does not offer formal protection to investors, it introduces a strong bilateral dependence. On one hand, the investors take the investment risk, in contrast to suppliers subjected to quotas, whose objective is to fulfil their obligation while minimising their costs and risks. For their part, the mandated buyers are exposed to the risk of investor blackmail in RES-E, and resorting exclusively to the green certificate spot market does not offer them transactional security.

a. The difficulties of framing RES-E transactions through the certificates market

Like all environmental policy instruments based on ownership rights allocation and market mechanisms, the inherent risk to the exchangeable quota systems depends on the size of the certificates market and therefore on the number of actors (purchasers and sellers) concerned by this policy, with all the inherent risks of price volatility. Exchanges of green certificates can be facilitated by creating an organised market, but the exchanges will remain on narrow national markets while waiting for possible and hypothetical regional markets, and the result will be price volatility. Besides, the future price of the certificate is affected by a number of uncertainties: uncertainty arising from the discretionary possibilities of modification in the RES-E portfolio of eligible technologies (adding a technique will lower the prices because it increases the quantity of available certificates), and uncertainty over market players' behaviour. Market rules can reduce market liquidity, such as the possibility of certificates banking (up to 25% of the certificates generated in a year). Conversely, adding a price floor and price ceiling to limit the volatility of the certificate market or the flexibility allowed by certificate borrowing could encourage partial recourse to this market.

A priori, however, this configuration of investment incentives drives both mandated purchasers and producers to protect themselves mutually from the risk of hold-up through long-term contracts or vertical integration, which *de facto* reduces the liquidity and depth of the market while maintaining the volatility. Also, the vocation of the certificates market should intrinsically remain limited to a search for flexibility by the operators bearing the quotas, or to the needs of those too small to enter into long-term arrangements with RES-E producers.

On the investors' side, recourse to the certificates market to frame the transactions on the production of a new unit is highly risky. They must try to protect investment against the risk of volatility and to avoid purchasers' opportunism (active or passive). For investors who have to sell green electricity as a joint product (normal electricity sale on one hand and green certificates on the other), the price risk on the green certificates is joined to the risk on the wholesale electricity market. RES-E investors therefore have a double interest in negotiating contracts with buyers subjected to quotas. These contracts define a guaranteed price for the green kWh that includes the two aspects of this product, the electricity and the certificate. This price will be defined by reference to the complete costs of new RES-E units and not to the market prices of certificates.

Of the buyers' side, respect for quotas without the rule of compensation for the additional cost of green electricity (the purchase cost of the certificates, in fact) is a powerful incentive to avoid opportunism in relation to respect of quotas. As they are in competition to sell electricity, the

electricity suppliers subjected to the quotas are encouraged to respect them as inexpensively as possible while limiting the short and long-term risks. Therefore they meet the investors' interest while also trying to frame their green electricity purchases through long-term contracts or by installing themselves the ENR units that they need to respect their increasing quota, as current experience shows. Therefore, in Texas the Renewable Portfolio Standard system in place since 1999 shows a massive recourse to the long-term contract (Langniss & Wiser, 2003).

In the same way the first lessons of the British experiment started in 2002 show that the five main suppliers who bear 90% of the quotas develop themselves the new RES-E units to follow the increase of their quotas (Mitchell & Connors, 2004). It is also observed that the small-sized suppliers subjected to the obligation prefer flexibility and search to limit the period of their contractual arrangements, because they bet that the prices of the green certificate will decrease in the future when the quota ceases to increase and that the demand for certificates will cease to grow. In this context, which results from the buyers' passive opportunism, investments can be made difficult, and this would create tensions on the certificates market. It brings pressure to bear on the public authority for to rectify the "regulated contract" by maintaining the growth of the quota (1% per year) beyond this horizon in order to make predictions for certificate price increases [Mitchell & Connors, 2004].

b. The choice of vertical or quasi-vertical integration

When the RES-E producers-investors have found a contractual counterpart, the definition of the contractual structure must aim for price stability at a level that allows the RES-E additional cost to be compensated, under conditions of share of technological risk (and intermittence cost for weakly programmable RES productions). With reference to the RPS experience of Texas, it is noted that ultimately the contract institutes a relation of guaranteed between each RES-E producer and a distributor, but it is a negotiated relation as opposed to the producer-purchaser relation in the feed-in tariff device. (By comparison, in the recent Renewables Obligation in the UK, this risk is borne by the producer). Another provision places the technological risk on the producer-investor, making him bear all excess investment expenses, and penalising him for construction delays and operational failures other than meteorological risks (Langniss & Wiser, 2003). It is therefore possible to add contractual incentives to good operational performance of RES units, even if the buyer bears the meteorological risk.

However, the long-term contract is not the only solution, if one also considers the conditions of financing the investment. Long-term contracts are associated with a classic project-financing contract guaranteed on future cash flow and backed to a securing purchase contract. It is generally more expensive, because it presents transaction costs and risks higher than those of a loan guaranteed on the borrower's assets. The large suppliers would be able to obtain these loan conditions if they develop these RES-E projects themselves. For this reason, since 2002 in the Renewable Obligation in the UK, the RES-E projects are developed by the big suppliers themselves or by their specialised subsidiaries in an organisational context of vertical integration.

In some countries such as the USA, with RPS programs, but not in European countries, the obligation is complemented by a tax credit system on the investment, which is a form of subsidisation of investment. This tax credit is effective for equipment for ten years after its commissioning. If a new government abolishes it, the abolition must be for the new units ordered in order to avoid partial hold-up on the assets developed under this incentive.

c. Management of meteorological risk: an incentive to choose vertical arrangement

Where the RES-E is hindered by meteorological risk, the absence of purchase obligation in the RES-E device reinforces the producers' incentive to conclude a contract. Against a background of competitive electricity markets, the responsibility of the balancing cost will depend upon the institutional arrangement chosen by the producer-investor to sell its RES electricity, or by the buyer subjected to quotas:

- If that buyer decides to respect its quota only by buying the certificates, he *de facto* passes the responsibility for balancing costs and risks to the “green” producer. The uncertainty inherent in the intermittence is therefore borne wholly by the RES-E producer, as is the case in the British device.
- If the mandated buyer chooses vertical integration to respect its increasing RES-E quota (generally by the creation of a subsidiary dedicated to this activity), it shall bear the balancing costs arising from intermittence of production.
- If the arrangements chosen by the mandated buyer are long-term contracts with RES-E producers, risk sharing between the two actors can be negotiated. Purchasers who buy the physical electricity and the green certificates at the same time assume the costs imposed by market rules on intermittent production. The green producer is thus as much protected against the meteorological risk as he would be in the two other devices (guaranteed tariffs or bidding system).

To sum up the characterisation of the three hybrid governance structures by focusing on the risk of hold-up, in the cases of feed-in tariffs and bidding, this risk does not affect the relation between RES-E producers and mandated purchasers because the contract is nearly defined comprehensively by the regulatory contract issued from the political transaction; and in these two cases, without presenting the same contractual thickness. Conversely, we show that, in the system of the quotas where the regulated contract is alleviated and the choice given to different institutional arrangements (between market and hierarchy), relations between RES-E producers and purchasers constitute the essence of the hybrid governance structure. However, we will see that this possibility of choice is marked by a strong bilateral dependence that leads to vertical integration or quasi-integration via long-term contracts. These organisational forms do not completely eliminate the solutions of recourse either to the green certificate spot market or to payment of the penalty for the part of the quota not respected. These last two elements allow adjustments by the agents subjected to the quotas to respect them, or for RES-E producers to find additional outlets for their production. For the former, payment of the penalty for non-respect of the quota also acts as a limit to their marginal cost for respecting quotas and avoiding opportunism.

Now, to underline the major differences between them, we point the following elements. In the case of the feed-in tariffs system and the bidding system, there is no risk of hold-up at the level of the producer-mandated purchaser relation, which is already codified by the regulatory contract. In the quotas system, the regulatory contract is open, and the two types of agent are thus obliged to search for an arrangement that protects them from the risk of hold-up. This price of this flexibility is the presence of a strong bilateral dependence. Management of this dependence pushes towards vertical integration or quasi-vertical integration via long-term contracts. However, this vertical integration is not complete, as recourse to the certificates market or to payment of the penalty offers flexibility.

3. The performances of the three hybrid governance structures

The choice of regulation has been made by governments to frame transactions associated with the supply of a set of collective goods, on the basis of new production in RES-E. The hierarchy of the underlying objectives (climate stability, air quality, energy security, promotion of a national RES-E equipment industry), and their balance with control of the collective cost, are never formulated clearly because they cannot be in another way by political arbitration. There is an intrinsic difficulty in assessing and rationalising them in terms of monetary advantages. Selection of the RES-E regulatory device by the public authority depends nevertheless on its implicit hierarchy of objectives and criteria underlying the governmental choices. Given its political nature, it is a moving hierarchy that can bring about changes in the regulatory contract and introduce uncertainty.

The aim of the public authority is to encourage the development of the RES-E units by private agents by mandating buyers and organising indirect subsidies on RES-E productions by placing a purchase obligation or quota on one type of agent. However, depending on the country and its government, the public authority attaches more or less importance either to the performance of RES-E capacity installations, to control of the collective cost of the policy, or to stimulation of the learning process and the development of a national industry. Control of the collective cost will result in a search for incentives to productive efficiency through the choice of a device including elements of competition (bidding, selection of contracts by buyers in the quotas system) or through rule of rent restrictions (for example the cost cap in the former British bidding system, decreasing tariffs in the case of feed-in tariffs).

Between the three types of hybrid governance structures, the performances and the shortcomings of each are clearly identifiable according to the hierarchy of the objectives and criteria between transactional efficiency, control of collective cost and individual rents, and joint promotion of the national industry and clean technology innovation.

3.1. Transactional efficiency and investment protection

These two complementary characters will determine the installation performance levels of RES-E units. The hybrid governance structures must not have any excessive transaction costs for preparation of projects and progress of contracts. They must limit the ordinary investment risks (technological risk, volume risk and price risk), but also protect against risks of hold-up in the regulatory contract and in the producer-buyer contracts.

Concerning the first problem, the system of bids is the more penalising in that it cannot allow recovery of preparation costs in the event of project failure. Concerning the second problem, every RES-E promotion regime is subject to the requirement of long-term predictability of governance structure. The three devices offer guarantees of differing nature for investors. In the feed-in tariffs, even though there is a political commitment to tariff stability for 15 years for projects realised in the event of device change, the real guarantees lie in the institutional environment and in the legal features of this tariff, notably the dissuasive character of appeal to administrative or civil courts [Levy & Spiller 1994, Finon & Perez 2004b]. In the bidding and quota systems, the guarantees lie in the existence of private contracts between producers and mandated buyers (or recourse to vertical integration), these private contracts being guaranteed otherwise by the civil courts. In the quotas system, however, the private contracts can be weakened by changes of rules (composition of the eligible technology portfolio), which will change the level of constraints, or even by disappearance of the device, which would abolish the ownership rights to the environmental goods. It is therefore in this setting that the investor is most exposed to the discretionary risk, because the least change of composition of the renewables portfolio weakens the potential for repayment and profitability of new assets.

The comparison of performances of the feed-in tariffs and bidding system before the adoption of the quotas systems in some European countries shows the efficiency of the former, as far as this

performance alone is concerned. The experience of exchangeable quotas systems is too short to draw any lessons from it yet.

Table 2: Comparison of wind power installations under feed-in tariffs or bidding system in Europe on 1990-2000 (in MW)

<i>Incentives</i>	Countries	Capacity end 2000	Addition in 2000
Bidding	United Kingdom	409	53
	Ireland	118	45
	France	79	56
	TOTAL	606	154
Feed-in tariffs	Germany	6,113	1,668
	Denmark	2,402	872
	Spain	2,297	555
	TOTAL	10,812	3,095

Source: Wind Power Monthly, *The Wind Indicator* (<http://www.wpm.co.nz>), May 2001.

In each hybrid governance structure, the credibility of the regulatory contract for the investor arises from its stability, but also from its flexibility under the effects of tension that the RES-E diffusion can create between public objectives. This tension can be initiated by the growth of the collective cost in cases of success in terms of installations and in the system of the feed-in tariffs, the increasing profits arising to developers under the learning effect, and the cost decrease of new units (as observed in the controversy over the German RES-E tariffs between 1998 and 2000 analysed by Laufer (2004)). Conversely, the device can be politically contested if the rules of the regulatory contract which are destined to limit the developers' rent are too restrictive and curb the development of RES-E facilities by deterring potential candidates from investing, as is the case with the bidding system if the public authority imposes a severe cost cap (as is the case with the French Eole 2005 program, replaced in 2001 by a feed-in tariff system, or the former British NFFO analysed in Mitchell, 1999).

In order to preserve its political acceptability in the long run, the feed-in tariff system can include codification of adaptability of the tariffs in the regulatory contract. It programs two rules: reduction of the tariff after the depreciation period for a new unit, and successive reductions of the tariff for each RES-E technology for the next units. For the two other devices, it is stressed that their adaptability does not have the same positive effects. In the bidding system they add transaction costs for bids and limit the learning effects. In the quotas system they create a risk of loss of asset value. The problem lies in the fact that the adaptations are discretionary in these two systems; the codification of evolutionary rules seems much less feasible than in the feed-in tariffs system.

3.2. Control of collective cost and rents

In the three devices, there is always a way by which the market operates and the competition exists. The more the public authority wishes to control the collective costs, the more the selected device will implement competition inside the governance structure.

In the feed-in tariff system, the competition is virtual: the producer-investor looks to maximise its surplus by lowering its costs with reference to the feed-in tariff as if it referred to a competitive market price and would be the price-taker. However, if it is this governance structure that shows the lowest transaction cost, this device is also the least auspicious for controlling the collective cost for two reasons: the absence of limits on installation capacities in this protective framework, and the limiting of the buyers' incentives to limit the costs. The developers can certainly bring the equipment constructors into competition, but if they do not succeed in tightening their costs and margins as far as possible, they will not be excluded, as they would be on a competitive market.

In the two other devices, the public authority controls the quantities to be developed and the competition for gaining contracts with mandated buyers also has a function of incentives on cost reduction. In the bidding system the public authority fixes the final RES capacity target at 10 years (or

more) but the capacity objectives of the successive rounds according to technology are defined when the invitation to tender is issued. It can therefore adjust it according to the collective cost limit that must not be surpassed. It could also decide to slow down the process for the same goal. Otherwise the developers are in competition to have a long term contract on each technological band within the price limit of the cost cap. In the quotas system, the public authority fixes the trajectory of increasing quotas on a long-term horizon and there is a double competition, one for the producers-investors and one for the purchasers subjected to the quotas, which look for the best purchase opportunities in terms of costs and risk. Moreover, they can refer to the penalty that is a means of collective cost control by offering a way of evasion to them if the marginal cost to respect quotas are too high.

With regard to operating cost control, the first two governance structures are the same: the threat of non-payment if it does not produce, as there is no double price structure. In the quotas system, where the contractual arrangement has a double price structure with fixed and variable terms, the incentives to good operating performance are given by the structure of the contracts (possibility of penalty, etc).

3.3. Promotion of national skills and technological progress

The feed-in tariff system is the device that best favours stimulation of technical progress, by stimulating the innovation process and the learning of the nascent national constructors. As the producer-investors' profit is large, it could be shared with the manufacturers. Being in a position to benefit from the profit increase that will arise from the incremental innovation to be introduced by the latter, the producers-investors can share profits with them and allow investment in R&D and incorporation of new knowledge. Feed-in tariffs allow the environmental quasi-profit to be shared with the equipment manufacturers through the establishment of partnership relations between developers and national constructors. This happened in Germany, Denmark and Spain, which possess the three best wind-power equipment industries in the world. It will be noted that the public authority can establish the tariffs at a high level at the first stage of the RES-E life cycle in order to encourage such partnerships. However, the balance is delicate to maintain because at a certain time, with help from the incorporation of innovations and the increasing return on adoption, the additional quasi-profit that the producers can clear on their new units will become an undue burden on the profits from the innovation rather than a support to the innovation. This is the time to decrease the tariffs or move to another device.

The two other devices do not greatly favour technical progress or the development of national industries because they do not greatly profit the developers, because of the pressure of competition to be selected by the public authority (or by the mandated purchasers) for award of the contract [Finon & Menanteau, 2003]. It is therefore no coincidence if one notices an absence of RES-E equipment industries or national manufacturers, especially in wind equipment, in Great Britain and the United States. It is also a fact that after the first stage of a RES-E life cycle, this objective loses its interest when the technological maturity stage approaches. Investors in one country can henceforth prefer to benefit from the performance of the best available technology by buying the facilities from the most efficient foreign enterprises.

Table 3: Comparison of performances of the three-hybrid governance

	Feed-in tariffs		Bidding		Exchangeable Quotas	
	<i>Ex ante</i>	<i>Ex post</i>	<i>Ex ante</i>	<i>Ex post</i>	<i>Ex ante</i>	<i>Ex post</i>
Transactional efficiency & Investment protection	++	-	-	++	+	+/-
Cost control	+/0	+	++	0	++	++
Technical progress & Industrial policy	++		- (Best available per technology band)		-- (The most mature technique)	

Given the differences in the set of qualities of the three considered instruments, there is no optimal solution for every situation. None of the three devices proposes an optimal solution in each of these

dimensions. It is only according to the relative importance of the criteria that there is an adapted structure of governance.

We could observe several examples in different countries and at different periods (cf. Table 4), that shows the relevance of this explanation.

- The countries that are or have been governed by a coalition including green parties (France in 2001, Germany in 1996 and in 2001) choose a feed-in tariffs system and maintain it, because they favour the installation of green equipment and tend to discard the collective cost of such an objective. So it is in countries with a political culture which gives priority to the environment protection : the Denmark and the Netherlands have a form of feed-in tariffs and in 2004 they have given up to adopt the quotas system that they have contemplated because of the transactional complexity and uncertainty of the system. Despite a clear-cut liberalisation reform Spain has also chosen and maintained the system of feed-in tariff in a view of performance in capacity installation.
- In Germany, Denmark and Spain where price-instruments, the creation of an industry of RES-E units and the acceleration of technological progress by allowing an important technological rent to the developers and manufacturers for investing in RD have been a criterion, which has reinforced the criteria of installations in the feed-in tariffs system
- The countries most committed to the market reform of electricity industries in the name of efficiency (UK, Italy, Australia, and some American states) tend to choose the exchangeable quotas.
- The countries focused on the control of costs for reasons of strong market culture (Britain in 1991) or technocratic bias (France in 1995) can also choose the bidding device with a measure of efficiency in mind, but tend to give up if the performance of installation is limited.
- Finally, some countries decide to substitute one instrument for another if one of the secondary criteria in the hierarchy becomes the primary, either if the collective costs and the rents reach the ceiling of social acceptability (case of the feed-in tariffs in many States in the USA) or if there is no sufficient performance in the installation of RES-E units (case of relinquishment of the bidding system in the UK and France). However, in the logic of the remediability used by Williamson to explain the change in governances structures in the terms of the Simon's "satisfying" principle (Williamson, 1996), the improvement of the device is a way to improve some of the performances without changing the RES-E regulation, as it has be done in Germany with flexible feed-in tariffs which limit the rent of the future developers in order to hacve a better control of the collective cost (Laufer, 2004).

Table 4. National Choices between institutional devices for the promotion of RES-E

Feed-in tariffs (or assimilated)	Bidding	Exchangeable quotas
Germany (since 1995) France (since 2001) Spain (since 1995) Portugal (since 2001) Ireland (since 2004)	UK (1991-2001) France (1996-2000) Ireland (1995-2003)	USA (seventeen states with RPS* since 1999) UK (since 2002) Italy (since 2002) Belgium (since 2003)
Denmark (with de-fiscalisation) Netherlands (with de-fiscalisation)		Provinces in Australia Austria (mini-hydro) Candidates: Sweden, Denmark,

		Netherlands
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*A number of Renewable Portfolio Standards do not include the possibility of exchange of certificates.

4. Conclusion

The analysis of the choice of public policy instruments led in the terms of transaction costs economics introduces an aspect ignored by the traditional approaches of Public Economics. By centring on the risk of expropriation of investors and the guarantees that it must obtain via the contract or credibility of regulation, this type of approach clearly insists on the investment of developers and shows up some advantages and shortcomings of the competing regulatory devices that the Public Economics approach does not see when it concludes to the clear superiority of exchangeable quotas.

The particular features of the asset specificity to the political and green electricity transactions, the uncertainties and the externalities, leads to the identification of three objectives of choice between the three concurrent governance structures: making investments secure (with a corollary of dynamic efficiency by the learning and the technical progress), the possibility of mutualisation of balancing costs associated with intermittent RES-E, and incentives to economic efficiency.

The features of the three concurrent structures of hybrid governance (feed-in tariffs, bidding system and exchangeable quota system) that the public authority can choose are determined mainly by the content of the regulatory contract between the public authority and the mandated purchasers in the two first devices. The third one, the quota system shows great originality in that the bilateral dependence between producer-investors and mandated purchasers has to be managed autonomously by the two parties, which choose themselves between market, contracts, vertical integration or a mix of those ones. And on this point the TCT approach shows that bilateral dependence requires recourse to vertical integration or to quasi-vertical integration. Use of the certificates markets must be mainly a means of adjustment to respect the quota; this is not considered as such by the Public Economics approach to the quotas system, which is focused on the conditions of the second best optimum and the imperfect competition on the certificate market ((Morthorst et al., 200X)

The comparison of the advantages and the shortcomings of the three structures according to three criteria (the transactional efficiency, the control of the collective costs and rents, and the innovation and industrial policy) show that according to a given hierarchy of criteria, one structure of governance is more suited to it than the other two.

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Table 1. Comparison of the features of three hybrid governance structures

	Regulatory Contract	“Producers – Mandated Purchasers” Contract
Feed-in tariffs according to technologies	<ul style="list-style-type: none"> - Obligation of purchase on distributor-suppliers - Administered prices (guarantee on 15 years) - Balancing cost for random production borne by the mandated buyer - Compensation of buyer’s additional cost 	<ul style="list-style-type: none"> - When it exists, only secondary duties³
Bidding according to technology bands	<ul style="list-style-type: none"> - Obligation of purchase on distributor-suppliers - Balancing cost for random production borne by the mandated buyer - Bid for long term contracts (15 years) - Compensation of additional cost 	<ul style="list-style-type: none"> - Competition for candidate selection - Selection based mainly on price criteria - Definition of contractual price by <i>pay-as-bid</i> rule - <i>Secondary duties</i>
Exchangeable quotas with no technology bands	<ul style="list-style-type: none"> - Definition of property rights (type of RES technology) - Increasing quotas on suppliers (on 15-20 years) - Penalties - No regulatory rule for carrying cost of intermittence - No compensation of additional buyback costs - <i>Additional subsidy by credit tax (ex. US RPS programs)</i> 	<ul style="list-style-type: none"> - Choice between three types of arrangements: <ul style="list-style-type: none"> - Certificates and kWh markets - Long term contract - Vertical integration - <i>Secondary duties</i>