ECA

ECONOMIC
CONSULTING
ASSOCIATES

KPMG

EIHP

Western Balkans Sustainable Energy Direct Financing Facility: Institutional Capacity Building

Sub-assignment No 11: Bosnia and Herzegovina Power Network Analysis for Wind Power Integration and Market Rules Advice

Task 4: Market rules and dispatching of new renewable generation

Final Report
December 2011

for the EBRD

Economic Consulting Associates Limited
41 Lonsdale Road, London NW6 6RA, UK
tel: +44 20 7604 4545, fax: +44 20 7604 4547
http:://www.eca-uk.com

6/1/12

Contents

Figures

Abbreviations

BiH	Bosnia and Herzegovina
EBRD	European Bank for Reconstruction and Development
EU	European Union
FBiH	Federation of Bosnia and Herzegovina
FERC	Federation BiH Regulatory Commission for Electricity
FIT	Feed in Tariff
GW	Giga Watt
ISO	Independent System Operator
MW	Mega Watt
RES	Renewable Energy Sources
RERS	Regulatory Commission for Energy of Republika Srpska
RS	Republika Srpska
SERC	State Electricity Regulatory Commission
Transco	Transmission Company
ZP	Dependant Enterprise

1 Introduction

Our consortium has been tasked by the EBRD to assist regulatory bodies and other institutions in the West Balkan area with their efforts to create a framework that is favourable to investment in renewable technology. For this Task 4 our terms of reference state:

"With the development of competition and new market players potentially responsible for buying electricity from RES, ISO needs to clarify the market rules and also the process in order to be able to incorporate dispatch of new renewable generation supported by feed-in tariffs. This support will include assurance on cash flows from consumer towards renewable electricity producer under the feed-in tariff system and potential for balancing costs to be managed by new balance responsible parties".

This report is therefore divided into the following parts:

- Section 2 provides an overview of how the market rules currently operate.
- Section 3 examines the aspects of the market rules operated by ISO that specifically relate to how renewables will trade in the market and how they will be affected by decisions on the established balancing groups in the BiH.
- Section 4 provides a summary of our recommendations

2 Key principles of the market rules

The Market Rules have been developed by the NOS BiH, the independent system operator (ISO). They are considered transitional in nature because they detail market developments for Phases 1a and 1b but specify that changes will be made when Phase 2 is technically feasible. The rules are due to be modified in the fairly near future.

The market rules set out a variant of the fairly standard bilateral contract market with residual balancing. The most important objectives of the Market Rules are:

- ❑ Develop a competitive market
- ❑ Ensuring that the ISO can fulfil its obligations to ENTSO-E.

Although most of the Market Rules relate to the first objective, they are always constrained by the second.

In this section we look at relevant provisions of the market rules covering:

- ❑ An overview of the key provisions including the design of the market and the treatment of balancing and settlement and cross-border energy flows
- ❑ The main features of balancing groups, which can be considered the building blocks of the market in terms of the balancing incentive on generators and suppliers.

2.1 Provisions of the market rules

2.1.1 Main Design Features of the Market Rules

The key features of the design are:

- ❑ Bilateral contracts between generation and supply.
- ❑ Incentives on market participants to balance their individual positions by matching contracted generation against expected consumer demand.

A balancing mechanism for managing residual imbalances in which the Balancing Responsible Parties buy and/or sell increments of energy based upon instruction from the ISO in order to keep the system in real time physical balance between generation and consumption (net of cross-border exchanges).

- ❑ Cash-out of participant imbalances so that those who are under-contracted[1] pay out money to those who are over-contracted; the volume

[1] Under-contracting means that the participant either did not generate as much as they had contracted to do, or their customers consumed more energy than was contracted to supply them

of over-or under-contracting is known as the participant's imbalance. Imbalance is measured as the difference between the notified contract position (how much energy was bought and sold) and the metered position at generator or consumer meters.

- Cash-out price for imbalances is determined by the actions taken by the ISO in the balancing mechanism.

2.1.2 Main features of the market implementation

The following is a selection of design options used to implement the principles highlighted above. This is not intended as a full description of how the market works but is rather a list of relevant elements of the design that impact on how renewables and suppliers enter bilateral contracts.

- **Balancing Groups**. All suppliers must participate in a balancing group with a designated Balance Responsible Party (BRP). The BRP notifies ISO of balance positions and net bilateral contracts for each hour of the day ahead; after the day, the BRP will notify the metered positions and take financial responsibility for settling all imbalances of the balancing group. Each member of a balancing group has a balancing contract with the BRP that is regulated by SERC as appropriate.

- **Gate closure**. Although initial nominated contract positions and generator scheduled positions are notified earlier, the final position that is submitted to ENTSO-E is at 14:30 on the day ahead. At gate closure the following commitments will be available to ISO or will have been determined by ISO:

  - Contract schedule of each BRP
  - Generation and demand schedules for each hour
  - Bids and offers into the balancing mechanism
  - Constraints and cross-border exchange commitments
  - Ancillary service contract utilisation.
  - Expected transmission losses.

- **Contract trading**. Suppliers and generators in a balancing group can trade energy contracts both with each other and with suppliers and generators registered in other balancing groups. Trading parties can also export and import energy across interconnectors.

- **Balancing mechanism prices**. Prices for bids and offers into the balancing mechanism are the regulated prices for provision of secondary and tertiary regulation under ancillary service contracts. The prices are regulated by SERC based on the costs of the generation units selected to provide ancillary services.

- **Imbalance price**. The ISO will set two imbalance prices announced at the start of each day and to apply for the full day as follows:
  - The price of the marginal unit nominated to provide additional energy as an ancillary service when there is a shortfall of energy in the system will be used to set the imbalance top-up price that will apply in all hours where the system is overall short of energy;
  - The price of the marginal unit nominated through an ancillary service contract to absorb surplus energy when the system has too much energy will set the price to apply in all hours when the system is long.

  This means that the imbalance price will be high when the system is short and low when the system is long.

- **Imbalance costs**. The net contract position of each balancing group will be compared with its net metered position (at generation and offtake meters) to determine whether the BRP was long or short in any hour. A BRP that is long in any hour will be paid at the imbalance price for that hour for each MWh by which it was long; a BRP that is short will pay at the same imbalance price for every MWh by which it was short.

- **Imbalance settlement**. In the current market there are only 3 BRPs allowed, which are the three existing power utilities. BRP(s) that are short make bilateral payments to BRP(s) that are long; the ISO calculates the amounts to be paid but does not manage any of the payments.

2.1.3 ISO obligations to ENTSO-E

The ISO's key requirements are:

- **Before the day**
  - **Present a balanced schedule with regard to neighbouring systems**. This means that all cross-border exchanges with other control areas are planned and feasible.
  - **Maintain secondary reserve**. This is a requirement that a defined proportion of the output of its largest generation unit can be available to replace that unit for 15 minutes in the event that the unit fails.
  - **Ensure tertiary reserve available**. ISO must maintain rights to capacity that can be called on once secondary reserve has been used to ensure that it can return to maintaining its secondary reserve obligations.

- **On the day**
  - **Contribute to maintaining the frequency across the ENTSO-E synchronised system**. At least some of the generating units in BiH must have the flexibility to respond to changes in frequency by increasing or decreasing their output.
  - **Minimise inadvertent exchange**. This is essentially a requirement to maintain flexibility in generation and demand and to call on that flexibility to ensure that the BiH system remains in balance as demand (or generation) fluctuates.
- **After the day**
  - **Settlement of inadvertent exchanges**. If the ISO's control area ends up out of balance in any hour, it must participate in an exchange program to swap energy with other control areas.

The Market Rules set out how these requirements are addressed.

2.2 Balancing groups

2.2.1 Imbalance settlement

In the current rules, only the three power utilities can be balancing groups (EP HZ HB – Mostar, and EP BiH – Sarajevo in FBiH and ERS – Trebinje in RS). This will not change until such time as a system of central financial clearing is put in place.

Currently, there is a central calculation of imbalances by the ISO. The current financial settlement involves:

- If one balancing group is short then it must make direct payments for imbalances and for use of ancillary services to the other two balancing groups in the proportions stipulated by the ISO;
- If two balancing groups are short then they must make bilateral financial restitution to the third.

Clearly, while there are only 3 balancing groups these arrangements for financial settlement are feasible but if the number of balancing groups is increased then the whole system would become infeasible. Reasons for this include:

- Problems due to discrepancies in multiple bilateral contracts, especially if some form of retrospective reconciliation is required because one or more meters were misread.
- Credit arrangements: each balancing group will need a contractual arrangement with each other balancing group whether they deem the other group trustworthy or not. This also leads to:
  - Issues of seniority of creditors if there are bad debts.

2.2.2 Balancing group membership

Eligible customers can either source energy directly from 'the market' or can be supplied by an independent supplier. Under current arrangements, they will be in the default balancing group of the local utility. However, they can elect to be a member of one of the other balancing groups.

They cannot change balancing group within year. This means that the essential supply contract will be an annual contract. It is possible for a supply business or a self-supplier to be a member of one balancing group but to buy in energy under bilateral contract from another balancing group.

Balancing group membership is via a standard Balance Responsibility Contract approved by SERC.

3 Effect of balancing groups on renewables

This section reviews the impact of the Market Rules on the market risk faced by RES generators. In common with other markets, the rules have not been written with renewable generation in mind. The Market Rules include arrangements for thermal and hydro power plants (including pumped storage) but do not mention RES generation. In addition, neither the RES Operator in FBiH nor the Incentive System Operator in RS is mentioned in the Market Rules. The focus of the analysis in this report is therefore on how the rules could be changed to minimise their impact on small generators that cannot easily control their dispatch.

The key issue from a short-term policy perspective is whether the distribution companies should act as the purchaser of feed-in supported RES or whether Renewable Energy Operators should be set up immediately. This issue is discussed below and we conclude that specialist independent Operators for renewable energy[2] should be set up from the start with the responsibility to:

- ❑ Buy all feed-in tariff supported RES; and
- ❑ Manage balancing group activities on behalf of RES generators.

Therefore, in this section we review:

- ❑ The key issues facing renewable generation;
- ❑ Options for improvement in the market rules; and
- ❑ The impact of balancing upon RES generation.

3.1 Issues for renewables

3.1.1 Balancing groups

Renewable generators (and, in particular, wind generation) will inevitably cause imbalance on the system and this imbalance must be managed by one or more of the three balancing groups.

Balancing Group Membership

Currently, independent generators and suppliers must be members of one of the three balancing groups operated by the utilities. Although the membership agreement offered by the utilities must meet regulatory approval, independent parties have several key concerns:

- ❑ **Information**. The need to nominate a contractual position to the balancing group ahead of time means that the utility has crucial

[2] Under the proposed new Law, the Renewable Energy Operators will only administer renewable energy which is eligible for payments under the FIT scheme.

information about the likely balance position of their competitors. Admittedly, with 3 balancing groups in operation, this information does not give a full picture of the market balance, but there is sufficient information to inform on the competitors access to flexibility – especially as information must be passed on a daily basis.

- **Imbalance allocation**. The balancing group is meant to share out the imbalance costs equitably between members but it is not clear how this can be policed efficiently when one of the parties has all the required information.

- **Portfolio benefit**. A balancing group is a means of pooling and netting off the imbalances of individual generators and customers. The main supplier (the distribution company) will have an inbuilt advantage due to the relative size of its portfolio of customers and generation. There is potentially an added advantage if the portfolio benefits of other balancing group members accrue to the incumbent distribution company.

A market participant can register with any of the three balancing groups. This means that, for example, a wind farm in the territory controlled by EP HZ HB - Mostar could register with EP BiH - Sarajevo or ERS – Trebinje. As its metering data will still be recorded by EP HZHB – Mostar, this is not a difficult issue for settlement of feed-in tariff payments.

The restrictive membership of balancing groups is more an issue for competition because it puts suppliers (and RES generators) at a competitive disadvantage because they must provide nomination information and forecasts to the BRP which is able to react to the implications in terms of expected system balance and thereby potentially profit from influencing the cash-out price. For example: a distribution company knows that a competing supplier in the balancing group is likely to be under-contracted in a particular hour, and that this is likely to make the whole market short. In this case, the temptation is to slightly increase its own forecast of demand so that its portfolio ends up slightly long. If the system remains short then the BRP will profit in the cash out of its surpluses at a high price.

RES generators are less exposed to this sort of manipulation even if registered with the utility BRP because they will be contracted for their full output with the utility (under the FiT arrangements), and the utility will balance its total supply (including RES contributions) against its total load.

3.1.2 The Renewable Energy Operators

In FBiH the Decree on the usage of renewable energy sources and cogeneration will establish an Operator for RES and Cogeneration. This Operator will be in charge of calculating, collecting and paying a fee for an incentive for electricity generation from plants that use RES and Cogeneration in accordance with the strategic goals of the Federation that relate to the share of electricity generated from renewable energy sources and cogeneration in the total consumption of electricity.

In RS, the Decree on the regulation of production and consumption of energy from renewable sources and cogeneration states that the administrative, financial and other operational affairs related to the system of incentivizing the production of energy from renewable energy sources and cogeneration plants will be conducted by an independent body established by the RS Government and tasked to serve as an operator of incentive system called the Incentive System Operator.

For the purposes of clarity in this report we have adopted the expression "Renewable Energy Operators" to mean the Operator for RES and Cogeneration in FBiH and the Incentive System Operator in RS.

There is the option to use the Renewable Energy Operators for the purposes of balancing renewable energy in BiH. In RS there is only one balancing group - ERS – Trebinje and thus the Incentive System Operator must belong to this group. However, in FBiH there are two balancing groups and thus the Operator for RES and Cogeneration will need to choose which balancing group it wishes to join. Alternatively, consideration could be given to the possibility of the RES Operator joining both balancing groups in FBiH with the output of each RES project being assigned to one of the balancing groups.

Within both jurisdictions RES generators will sell their output to the relevant Renewable Energy Operator at a price determined by the applicable FiT. The Renewable Energy Operator will then sell this output to the respective supply businesses in each jurisdiction with the output allocated pro rata to the total energy consumption of each supply business.

The Renewable Energy Operators will need to make daily schedules available to their balancing groups ahead of gate closure in order to allow the balancing groups to include the forecast renewable energy output in the daily schedule that they submit to the ISO. Any difference between the forecast of renewable energy output in the schedule and the actual output will result in imbalance which will be resolved in the operational time frame through instructions given by the ISO. Settlement of the imbalance costs will be done by the three balancing groups.

For wind generation in particular, accurate forecasting of its output is problematic particularly more than four hours into the future. The imbalance costs that result for the difference between forecast generation and actual metered output will need to be passed onto the customers in a fair and transparent manner. It is important that this process is a simple and straightforward as possible.

3.1.3 The Renewable Energy Operators and System Balancing

Under current market rules, this Renewable Energy Operators could not be BRPs in their own right. However, they could have an arrangement that would work along the following lines:

- The Renewable Energy Operators could be registered as a member of one of the BRP balancing group (perhaps as a Supplier).
- Each RES generator is registered with one of the Renewable Energy Operators '

- The Renewable Energy Operator aggregates the forecasts of all generation provided by the RES plants registered to it. In order to minimise imbalance costs, the Operator should be incentivised to ensure that this aggregate forecast is as accurate as possible.

- The Renewable Energy Operator allocates the forecast RES generation as contracts for sale to each Supplier. This allocation would be in proportion to the Supplier's total RES obligation (or in proportion to RES obligation in each technology).

- The Renewable Energy Operators would be assigned their share of imbalance cost based on its forecast error in each balancing group and would share out the error and associated costs amongst RES generators on a defined basis.

3.1.4 Imbalance exposure

Forecast risk

It has been decided that within F BiH that RES generators with capacities of more than 150kW will face imbalance costs[3]. This creates a strong incentive for the generator to forecast its output accurately. This policy is almost certainly aimed at wind generation where the ability to accurately forecast output is the weakest particularly for periods greater than four hours into the future.

In RS the Decree states that the funds for incentivizing the production of electricity from renewable energy sources and cogeneration plants will cover the part of costs of imbalance. These funds are to be secured through the use of extra charges on top of the tariff for electricity delivered to the end-buyers in RS.

There is a systemic risk that wind generation will, nevertheless tend to under-forecast[4]. The reasoning behind this is as follows:

- With a day ahead gate closure, there is the possibility of a large generator failing or having to reduce its output sometime during the 24 hour period, leading to a small system being short[5].

- In certain weather conditions wind output could form a significant part of the on-the-day generation mix in a relatively small country.

    - Wind forecast error at the day ahead stage could be as in Figure 1.

[3] Article 12 of the Decree states that the RES Operator makes payments of fees for electricity imbalances and will participate in the issuance of rules on the balancing of the electricity system in cooperation with authorized institutions, including rules for the calculation of fees for electricity imbalances, which are under jurisdiction of Independent System Operator.

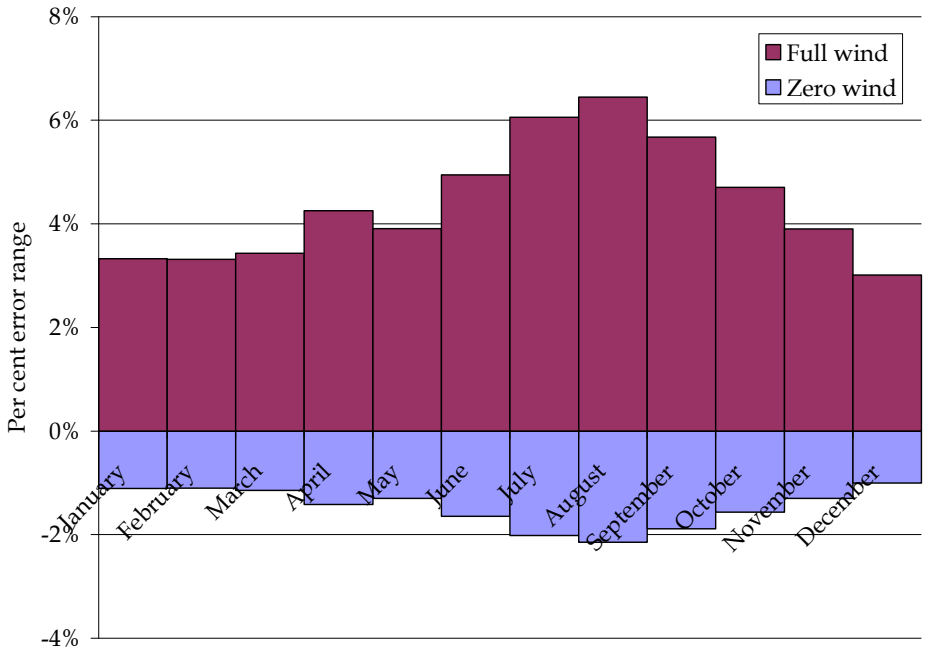
[4] Or indeed forecast a zero output.

[5] This is purely because, in small systems, a single conventional generating unit is likely to be a larger percentage of total available generation even though, in large systems such as Germany, France or UK, individual generating units tend to be much larger.

- When wind is above forecast, the whole market is likely to be over-delivered – low imbalance price paid to wind farm.
- When wind is below forecast, the whole market is likely to be short – high imbalance price paid by wind farms.
- The expected cost associated with over-forecasting is higher than the expected lost revenue due to spill prices.

Wind farms selling to the incumbent distribution BRP give that balancing party an opportunity to deliberately offset its own contract position thus undermining the wind farm's own prediction of its risk profile[6].

Figure 1 Potential forecast errors on 100 MW wind – 2010 hourly average dispatch[7]



Source: ENTSO-E, 2010 monthly dispatch for BiH

Note that the data that has been used in Figure 1 are only illustrative and await full analysis for BiH.

[6] E.g. a wind farm makes an under-forecast of its expected output in order to minimise its risk of being short in the market; knowing this, the BRP could adjust its own forecast to slightly under-contract for its requirements thereby making a the profit.

[7] Figure based on average hourly dispatch in each month of 2010 assuming 100 MW of wind is added with average output of 25%.

Impact of Gate closure

The gate closure adopted in the Market Rules is specified in Section 6.5 of the ISO Grid Code. This is adequate for most forecasts with the exception of wind output. The purpose of a gate closure is to transfer the responsibility for re-dispatch instructions that are given to generators from the commercial market to the ISO.

This has implications for large generators as well as small generators. A large generator that unexpectedly loses output cannot trade its way back into balance; for a generator that fails any time after 14:30, it is exposed to imbalance for up to 33.5 hours. A portfolio of generators is less exposed to this commercial cost because there is a reasonable probability that a company with a generator that has tripped will earn revenue from other generating units selling reserve services to the system operator as secondary or tertiary reserve; single site generators and individual renewable generators are not protected in the same way.

Usually, however, the most exposed RES generators are wind farms because they cannot control dispatch and accurately forecasting their output is problematic and so can face a large forecast error.

The best remedy for reducing imbalance exposure is to move gate closure closer to real time. Rolling gate closures between one and four hours before real time are now common in Europe; generators and suppliers have the ability to re-nominate and re-contract throughout the day. Such an arrangement would involve more work for ISO.

Consideration could be given to a more modest balanced re-nomination arrangement in which generators are permitted to contract with each other in order to hedge their positions and transfer some generation requirements away from ancillary service provision towards replacing a failed generator. This approach would reduce the commercial consequences of imbalance exposure while not necessarily making a change to the physical operation of the system. The same generator(s) that ISO would have otherwise instructed to increase their output would probably be used anyway but the commercial consequences to the parties involved would be different. The consequences of this would be:

- Ensuring balancing actions taken by ISO were due to forecast error rather than generator failure.
- The tripped generator would have a less extreme incentive to recover from failure quickly. The generator incentive to recover quickly would however remain.

If this failure insurance scheme was applied for generator failure, there seems a valid case for a similar scheme to be offered to wind farms. It might operate by giving the wind farm the opportunity to reforecast its output within day and to be able to call off an adjustment in generation from ancillary service at some form of average price rather than facing the full imbalance price.

3.2 Balancing group impact on renewable generator contracting

Renewable generation in BiH to date has mainly been developed as hydro power in larger projects owned and operated by the incumbent utilities. This may limit the future development of renewables due to limits in financial capability to fund new projects, particularly smaller ones. This is the background to the development of feed-in tariffs to support continued growth of renewables in a market that needs to allow competition in generation and supply in compliance with the Energy Community Treaty and the aquis communautaire of the EU.

Future development of renewables will increasingly be based on independently financed projects supported by feed-in tariffs. Therefore, in discussing renewables in this report we focussed upon new feed-in supported projects, which will mainly be small hydro but could, critically, include larger wind projects. The market environment and the market rules governing the sale of electricity from these future renewables will impact on the viability of these investments and this is explored.

This section reviews:

- ❑ The sale and purchase of energy from RES projects and balancing group membership
- ❑ Balancing cost attribution.

3.2.1 Sale and purchase of energy from RES projects

The laws and regulations for sale of energy from RES projects have yet to be fully developed. A crucial issue to be decided is who will purchase RES energy in BiH. The main options are:

- ❑ Bilateral contract with the incumbent utility.
- ❑ New independent Renewable Energy Operators in both FBiH and RS.

The current interim solution is that the utilities are contracting on behalf of the Renewable Energy Operators for the output from all renewable generation. Once the new Law has been passed, the Operators will only purchase the output from privileged generators (i.e. those eligible for a FiT) with other renewable generators then selling directly into the market.

Sales to the incumbent distribution companies

This approach is superficially attractive as it could be administratively simple. It will, however, be a problem moving forward and could have particular problems for cost allocation between the customers of the three utilities. In F BiH, if RES is developed disproportionately in one utility area then one set of consumers will

potentially face paying a disproportionate cost of RES support[8]. Ways of equalising this support cost between consumers served by the different utilities can be devised but this would immediately increases the level of administration, and almost certainly increases the workload of FERC and RERS in supervising this[9].

From the perspective of a renewable generator, the issues are slightly different:

- **Payment guarantees**. Is the purchaser able to fund payments associated with the feed-in tariff? This is not a problem at present; it is mentioned purely for completeness. However, selling to a distribution company will not have the same government guarantee for feed-in tariff payments as selling directly to a government entity. The feed-in contract is a long-term agreement that may lead to future credit risks if the distribution company's supply business volumes reduce due to competition.

- **Balancing costs**. Will the major party in the balancing group (i.e. the utility) allocate imbalance costs on a fair basis? At issue here is a sharing of portfolio benefit, which is when surpluses and shortfalls of different customers and generators within a balancing group offset each other. Although there is an obligation for a regulated balancing contract to be used, there is no real information on how this can be regulated effectively. This is explained further in section 3.2.2 below.

- **Information imbalance**. The renewable generator is being asked to be dependent on a single company for connection and metering. It is not in the utility's interest to ensure that in any dispute (e.g. on meter reading), that the renewable generator is given the benefit of the doubt. Additionally, the generator is asked to submit output nominations to the utility, putting the utility in an advantaged position when determining issues like system balance. In sum, the utility is not commercially neutral with regard to the generators it buys from and renewable generators perceive this as a risk.

- **Collection of funds from third party suppliers**. Particularly once independent suppliers enter the market, the distribution company is going to require contributions from these suppliers for their share of the obligation to buy energy from renewable generators at feed-in tariff rates. If these suppliers do not pay their contribution (including events associated with bankruptcy), it is not clear exactly how the generator would be reimbursed despite all customers being obliged to pay the FIT premium on their bills.

[8] The balancing cost allocation issue does not apply to RS because it has a single BRP for the whole of RS.

[9] All consumers in FBiH currently pay a FIT premium on their bills.

Sales to the Renewable Energy Operators

Renewable generators have a clear preference for selling their energy to an independent Renewable Energy Operator. The reasons for this are essentially the mirror of the problems associated with selling energy to the local distribution company. This option is not, however, without its own problems:

- **Administration**. A Renewable Energy Operator is an untried institution in BiH. Initial problems on metering and data flows for the first generators could prove expensive. There could also be delays in setting up the two Operators and determining their governance arrangements (and setting up their governing board).

- **Payment guarantees**. Although it is the intention that the implementation of the FIT will be done in such a way as to always ensure adequate revenues for RES, the Renewable Energy Operators may not have sufficient funds to guarantee prompt payment. The money must be collected from suppliers and a supplier failure may lead to bad debts and funding shortfalls. However, ultimate funding shortfalls can be more easily passed back to customers through higher levies on the remaining suppliers – after all, if a supplier goes bankrupt, its consumers will be transferred to other suppliers (especially once a supplier of last resort arrangement is put in place as will be required by the EU) so the new supplier(s) should have the additional funds to pay for the bad debts which have accrued to the Renewable Energy Operator from a bankrupt supplier. Nevertheless, a government guarantee on the cash flow of the Renewable Energy Operator would increase the confidence of the RES generators.

- **Balancing cost attribution**. The Renewable Energy Operators have no incentive to misallocate costs between generators but it is far from obvious how any portfolio benefit should be shared out between the various generators involved. This issue is discussed in more detail below.

- **Imbalances with other balancing groups.** Section 3.1 above discusses the problems of the current market rules with regard to balancing groups. In summary, neither of the Renewable Energy Operators can form a balancing group in its own right under the current market rules. The RES Operators will need to make agreements for the share out of their imbalances with the three utilities in BiH.

3.2.2 Balancing cost attribution

The role of a balancing group is to net off the imbalances of individual meters or groups of meters. This works as follows:

1. The RES generator makes a forecast of generation in each hour of the day ahead by the time of gate closure.

2. Conventional generation is similarly forecast.

3. For each customer a notional forecast is made by the supplier.

4. Suppliers make bilateral contracts to cover their demand forecasts; generators schedule output to meet the contracts (noting that the generators and suppliers can also contract with parties in other balancing groups). These contracts are notified to the market operator.

5. Renewable generators make a notional contract based on forecast output with a supplier (or with a Renewable Energy Operator) for a specified volume of energy.

6. Customer forecasts are summed together into a whole supplier forecast; generator forecasts are kept together.

7. Supplier and generator forecasts are added together to get a net forecast (it is net because generation obviously has the opposite impact of customer consumption).

8. All contracts are settled bilaterally outside the balancing market based on the notified contract volume. An exception could be made for renewable generation contracts which are supported by feed-in tariffs. These could be settled based upon the daily delivered volume of energy from the generator rather than the contracted volume of energy; (i.e. a 'notional' contract).

9. After the hour, meter readings are taken at each meter and the readings are summed together to achieve a net meter reading.

10. The BRP makes an estimate of transmission losses[10].

11. Imbalance of the balancing group is the difference between net metered volumes and notified net contractual volume. For a RES generator, although they will be paid based on metered volume, they will still be liable to potential imbalance charges based on the difference between metered and contracted volume.

12. The BRP is charged (if it is short) or is paid (if it is long) for its net imbalances at the single imbalance cash-out price. Imbalances are net of actual metered losses.

13. The BRP allocates imbalance costs between suppliers and generators in accordance with its balancing agreement. This will involve financial transfers collecting money from suppliers who are short (at the imbalance price) and paying money to suppliers who are long, at the same price. Note that larger generators will rarely be out of balance because they are dispatchable and can keep closely to their output nominations unless there is a plant failure or forced derating.

[10] Noting that losses are assigned to customers and not to generators

14. Suppliers will usually calculate an average imbalance cost and apply it through tariffs to customers. For RES generation, imbalance costs will be calculated and may be applied as a charge to individual generators.

The central difficulty for renewable generators contracting directly with a supplier arises from the fact that the supplier will have claimed all the portfolio benefit from offsetting customers' long positions against the short positions of other customers. Renewable generators, in contrast will be cashed out at their individual imbalances with no opportunity to gain portfolio benefit even from other generators.

The situation could be made worse to the extent that renewable generators are asked to contribute to the transmission and/or distribution losses that the balancing group will have been required to fund.

The ability to retain portfolio benefit within a Renewable Energy Operator's independent balancing group would be a significant benefit for renewable generators in comparison with participation in the existing balancing groups.

3.3 Provision of Ancillary Services by RES generation

There is currently no provision in the Market Rules to accommodate RES generation providing ancillary services. While the ability of RES generation to provide such services may be limited, none the less it would be appropriate to include a mechanism within the Rules whereby such provision would be possible in the future.

3.4 Central financial settlement of imbalances

If there is either a requirement or a desire to have more than three BRPs in BiH then it will be necessary to move to an arrangement involving central financial settlement of imbalances. Such a move would, for example, enable the Renewable Energy Operators to become BRPs.

Central settlement would involve the ISO establishing a national settlement system which had both the capability and the authority to settle all imbalances incurred by market participants with BiH including the associated payments.

3.5 Forecasting Wind Generation

There are a number of entities which will have an interest in forecasting the output of wind farms from the perspective of system balancing including:

- ❑ The ISO;
- ❑ The three balancing groups;
- ❑ The two Renewable Energy Operators; and
- ❑ The wind farm operators.

The ISO will be interested in a national forecast and the expected error bands on this forecast. The three balancing groups will be interested in the national forecast but will have a particular interest in the forecast within their respective geographical areas. The two Renewable Energy Operators will have an interest in a forecast for FBiH and RS respectively, and the national forecast while the RES Operator in FBiH will also have an interest in the forecast for the balancing group which it has decided to join.

Wind forecasting and the associated forecasting techniques have been discussed in our Task 1 report. In the light of the above interested parties, it is important that the wind forecasting is done on a sufficiently disaggregated basis to satisfy the needs of the parties involved.

3.6 Inadvertent exchange

The ISO operates the system in agreement with ENTSO-E as part of a large synchronous system. Inadvertent exchanges are a feature of energy transfers between control areas and are measured. ENTSO-E operates a compensation programme (detailed in the Market Rules) whereby inadvertent energy exchanges in one hour are reversed during one or more trading hours approximately one week later. This involves the repayment of the energy involved rather than any financial transaction.

Inadvertent exchanges are caused by balancing groups going out of balance either intentionally or accidentally, with most inadvertent exchanges caused by a generator failure in one control area resulting in unscheduled imports from other control areas.

Due to likely inaccurate forecasting of wind generation output (both within BiH and in the wider region) there is a strong possibility in the future of increased inadvertent exchanges occurring fairly regularly. ENTSO-E will inform ISO of how much energy ISO will need to procure or dispose of in each hour as a consequence of inadvertent cross-border exchanges in the preceding week. Based upon this information from ENTSO-E the ISO will notify the BRPs of their share (positive or negative) in the ongoing compensation programme. The ongoing problems associated with maintaining inadvertent energy to acceptable levels has been discussed in our Task 1 Report.

Each BRP will need to allocate the adjustment volumes amongst suppliers and other balancing group members requiring them to provide energy or reduce nominations to match the compensation programme allocated to them. A difficulty arises for a BRP because the compensation programme does not correspond exactly to inadvertent exchanges in the same hour of the preceding week. Across Europe, this is usually a service retained by the BRP (for a fee) on behalf of the balancing group. In BiH, it is likely that each BRP will want to allocate the compensation programme to the offending party – especially if that offending party is the Renewable Energy Operator or an independent generator.

The existence of a Renewable Energy Operator will actually make it easier for RES generators who should thereby become insulated from the effects of the inadvertent

exchange programme. This is because the Renewable Energy Operators would have contracts in place with suppliers in balancing groups for the forecasted RES output and the compensation volumes would be part of the contract nomination – suppliers would, however, still be obliged to pay for RES according to the fee established by the Renewable Energy Operators.

Without a Renewable Energy Operator, the BRP could potentially impose an effective energy charge on RES generators for past imbalance – this process would be difficult to regulate because the compensation period would not exactly correspond with the period when the inadvertent exchange occurred in the previous week and therefore accurately determining the balancing costs involved is fraught with difficulty.

4 Recommendations on market rules to accommodate renewables

The following recommendations apply to renewables but some recommendations also have wider application for the competitive market.

- **Balancing groups**. Renewable Energy Operators should be in place in both FBiH and RS from the start. These Operators should have a contract with each of the suppliers in BiH for compulsory nomination of their day ahead forecasts of RES output. These would be registered as bilateral contracts in the day ahead schedule in order to ensure that RES output is not classified as spill

- Appropriate memberships of the BRP for each of the Renewable Energy Operators needs to be established in each balancing group. This would include appropriate terms needed in the balancing group agreement to ensure imbalances are allocated correctly.

- Modifications will be required to the Market Rules and the Grid Code. The options for such modifications include:

  - Rolling gate closures much closer to real time (as is the case in other European markets); or

  - A right to re-nominate for wind farm output (to account for its variability) with later contracts adjusting ancillary services in order to ensure that the Renewable Energy Operators can maintain a more precise balance even if the rest of the market must otherwise remain with a gate closure at 14:30 on the day ahead.

  - Facilitate provision of ancillary services by RES generation.

- Implementation of central financial settlement of imbalances which would be required if more than three balancing parties are to be introduced.