Project Team

Dennis Colenutt, NERA Economic Consulting
Essie Linton, NERA Economic Consulting
Professor Predrag Popovski, St Cyril and Methodicus University, Skopje
Professor Rubin Taleski, St Cyril and Methodicus University, Skopje
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1. Introduction

This report is the final deliverable for the World Bank sponsored project that NERA Economic Consulting has been commissioned to carry out on a feed-in tariff methodology for the facilitation of private investments in mini-hydropower plants in Macedonia. The original work scope for the project has been extended during the execution of the project, to include a study to estimate the costs of development of SHPP sites in Macedonia, and the results of that study are included in this report.

This report builds on our earlier Options Report¹, which reviewed international practices with feed-in tariffs and set out options for such a fed-in arrangement. The issues addressed in this Final Report are wide ranging and complex, encompassing not only tariff methodology but also issues of the regulatory and legal framework, allocation of water rights, and tendering. Preparation of this report has benefited substantially from extensive comments submitted by various stakeholders during discussion of our draft Final Report, and from comments and discussion at the workshop presented by the project team in Skopje on 28 November.

In this report, our primary objectives are to:

1. deal with the policy issues that arise in the use of the feed-in tariff for SHPPs;
2. set out the recommended approach for developing a feed-in tariff;
3. provide a draft set of feed-in tariff Rules on Methodology that is suitable for implementation in Macedonia; and
4. present data that indicate the likely level of feed-in tariff that would need to be offered to attract interest.

As with previous report, we have aimed to keep this report as concise as possible, and so have not repeated details of the earlier international review work here. The structure of this report is therefore as follows:

- Section 2 describes the overall framework that we propose for the implementation of a feed-in tariff for small hydro-power plants (SHPPs);
- Section 3 sets out the detailed approach that we propose for the development of the SHPP feed-in tariff;
- Section 4 summarises the results of the work on examining costs of typical SHPP sites and the implications of this for the feed-in tariff;
- Section 5 summarises all the conclusions and recommendations that emerge from the study;
- Appendix A contains a draft of detailed Rules on Methodology for a Feed-in Tariff for SHPPs; and
- Appendix B contains further details of the results of the cost study.

2. The Proposed Framework of Feed-in Tariffs for Small Hydro-Power Plants

2.1. Introduction

Research carried out on the hydro potential in Macedonia suggests that SHPPs represent a significant part of the overall energy potential in the country. Data on the hydrology base of Macedonia indicates a gross hydro potential estimated at 11,500 GWh, with a net value of approximately 9,000 GWh. The technically feasible amount of potential energy is estimated at approximately 6,200 GWh per year. The scale of these estimates indicates that SHPPs are a potentially potent source of energy, and that it is therefore important for a policy to be developed to encourage its exploitation.

As we showed in our Options Report, many countries in the EU and elsewhere now adopt the feed-in tariff approach for small hydro plants and for other forms of renewable generation. Under schemes of this sort, set prices are specified at which any quantity of renewable energy will be purchased by the network operator or distributor.

The prices offered by these other feed-in tariff schemes are generally set for a period of at least several years, often much longer, and where there are extra costs over and above the market price, these are recovered from consumers through a supplement on the retail electricity price. The quantity purchased is generally determined by the available supply at the specified price. Care is needed in setting and resetting the feed-in tariff to ensure that:

- it bears an appropriate relationship to the costs of alternative energy sources, including other renewable energy and imports; and
- excessive funding of any particular renewable energy source is avoided.

This type of scheme is particularly well suited to purchases from small renewable schemes, where individual tendering may be disproportionately burdensome and expensive.

We will consider in Section 3 the detailed issues that arise over establishing the feed-in tariff itself, but in this Section we consider the wider policy and implementation issues that arise. Thus, we discuss below the following issues, and make recommendations on them where appropriate,

- responsibility for overall policy on the feed-in tariff;
- issues of water rights allocation for sites that will receive the feed-in tariff;
- relationship of the feed-in tariff arrangements and tendering for larger sites;
- responsibility for implementation and for the setting of the feed-in tariff; and
- responsibility for the purchase of the energy under the feed-in tariff arrangement.
In a number of places we highlight issues where changes to the existing laws would be desirable or necessary, to help ensure smooth implementation of the feed-in tariff, though it is outside the scope of this project to propose the detailed form of the changes. We conclude the Section with a summary of the proposed policy.

2.2. The Policy Framework

2.2.1. Responsibility for Overall Policy on the Feed-in Tariff

The new Energy Law 2006 (in Articles 9 to 17) gives the Government the responsibility to define an energy strategy, and this general energy strategy is to include a strategy on renewable energy. Articles 121 and 133 to 142 of the 2006 Energy Law go on to deal with renewables and energy efficiency, and provide that:

- the Government will create the policy for improvement of energy efficiency and for the exploitation of renewable energy resources;
- this will be established within the Strategy for renewable energy resources exploitation; and
- the Energy Agency (EA) is responsible for a number of procedures in respect of renewable energy, including the granting of guarantees of origin and certifying that producers qualify as “preferential producers”.

Article 141 of the Law specifies that the Regulatory Commission for Energy (the RC) is to support the Government in implementation of this Strategy, but it is clear from what the Law says about preferential producers that at present the EA needs to declare the SHPPs as preferential producers, before the RC can grant special tariffs to them. We consider later in this Section how this can be dealt with.

The other key legal issue relevant to SHPPs is the allocation of water rights, for which the Ministry of Agriculture has responsibility. We discuss this below, but it appears that in the longer term it would be desirable to introduce changes to the legal framework governing water concessions. However, for the present, to avoid any doubt and to facilitate the implementation of the SHPP feed-in tariff in the form proposed here, we recommend that the Government promulgates a policy statement or decree on the matter. This could be issued jointly by the Ministry of Economy and the Ministry of Agriculture. In Section 2.3 below we propose the main points that could be included in this statement.

2.2.2. Allocation of the Water Rights for SHPPs

Before construction of a SHPP (or any other hydro-power plant) can begin, it is necessary for the developer to acquire the relevant water rights. The Ministry of Agriculture is responsible for water rights allocation, and we understand that it has been customary for these to be allocated on the basis of fixed payment terms of:

- a rate of 1% of the annual revenue earned, plus an upfront fee of 5% of the expected annual revenue for plants with a capacity of up to 2MW; and
- a rate of 1% of the annual revenue earned, plus an upfront fee of 10% for larger plants.
Article 132 of the Water Law specifies that hydro-electric power stations shall pay 1% of their production price to the Water Fund. However, Article 157 specifies that the concession fee for the water use that shall be determined pursuant to the criteria stipulated by the Government of Republic of Macedonia upon a proposal of the Minister of Agriculture, Forestry and Water Supply. Article 153 of the Water Law specifies that use of water for generation of hydro-electric power is to be done on the basis of concessions, and Article 155 specifies this shall be by open competition. We understand that at present the tendering that takes place recognises the payment terms mentioned above and is on the basis of the duration of the concession. The bidder offering the shortest duration is awarded the concession.

Though there are exceptions to this\textsuperscript{2}, Article 155 specifies that, generally, the awards should be on the basis that is specified for concessions. The Law on Concessions is a general law governing the granting of concessions on publicly-owned natural resources, such as water, and covers general issues of how tendering is to be carried out, the nature of concession agreements, and administration of the agreement. We also understand that work is currently being carried out to review the legal provisions for granting water concessions, and so this may lead to some revisions being made.

In general, we believe it is correct that water rights be allocated on a transparent and competitive basis, as such an approach would ensure that:

\begin{itemize}
  \item the rights are used as efficiently as possible, by allocating them to the bidder able to make the most efficient use of the water resources; and
  \item revenues to the Government are maximised over the long term.
\end{itemize}

However, for sites with limited capacities it is not sensible or feasible to carry out a full tendering exercise in every case: there may be very limited interest, and the costs of the exercise are disproportionately high for all concerned. Recognising the limitations imposed by the existing laws, and also taking account of the possibilities for some change in the law, we propose that the following revised approach should be adopted:

\begin{itemize}
  \item For the larger hydro sites, the full tendering approach should continue to be used for the allocation of water rights for power plant development;
  \item For hydro sites below a suitable size threshold (see below), the allocation of water rights could be carried out on a relatively simplified basis, to minimise the administrative burden on potential developers. This would also reflect the fact that for smaller sites there will be limited interest, perhaps restricted only to the land owner, a developer who has reached an agreement with the land owner, or local entities. Thus, where the land
\end{itemize}

\textsuperscript{2} Specifically, Article 155 says that in this case the concession for water usage may be awarded by a direct agreement between domestic and foreign legal entities that deposit funds for construction of hydro-energy facilities and on the basis of an agreement with the Government of Republic of Macedonia. The contract of the direct agreement from paragraph 2 of this article may be concluded with domestic and foreign legal entities if:
- they have closed financial plan for construction of the facility and
- they have obtained a financial guarantee equal to the value for realization of the facility.
owner or other local interest expresses interest in the water rights for a site, there should be a process for advertising the site to establish any other interested parties. If there are no other interests registered then the concession could be granted on standard terms; if other interests are registered, then there could be a simplified tendering arrangement, with the bidding for water rights limited to a single parameter, which could be either an additional up-front payment or the length of the concession.

The Government is also responsible for granting authorisations for the construction of new generating plants. However, we understand from paragraph 7 of Article 52 of the 2006 Energy Law that when the proposed plant also involves the granting of a concession for use of natural resources this authorisation is not necessary. Thus, it would appear that the Government’s role would be limited to the granting of the water rights.

2.2.3. Relationship between the Feed-in Tariff and Tendering

As noted above, it is clear that Government may still wish to tender the water concession for the larger hydro sites, and it makes sense to do so. At the same time, a simplified process needs to operate for the smaller sites, to minimise the transaction costs for developers of SHPPs. On this basis, we propose a flexible tiered approach, based on estimated plant size, as follows:

1. Estimated capacity up to 1MW: In any such case there would be:
   - A simplified water rights tendering approach, limited to advertising for other expressions of interest when an initial approach is received from a developer. If no other interest is expressed, the concession would be granted at standard terms; if there is other interest there would be a simplified tender on a single parameter (ideally the percentage concession fee rather than duration), and award would be subject to a condition that development is completed within a specified time limit.
   - Any such site would automatically qualify for the feed-in tariff.

2. Estimated Capacity Between 1MW and 10MW: In these cases there would be the potential to qualify for the feed-in tariff, but only if a site were not on the Government’s tender list, that is a listing of sites that the Government has identified and published as of special potential and that will therefore be tendered. Sites could be added to the Government list, subject to a notice period to protect the interests of any developer currently investigating the site. Therefore, in the case of any 1MW to 10MW site the situation would be EITHER:
   - It is not on the reserved list for tendering, in which case it qualifies for the feed-in tariff and the simplified process for allocating water rights; OR
   - It is on the tender list, in which case it will be the subject of the full Government tendering procedure and would not be eligible for the feed-in tariff.

To ensure a consistent policy approach, we also recommend that where tendering does take place it should be on the basis of:
the parameter that is tendered should be the energy price rather than an up-front payment, as this will allow direct comparisons with the feed-in tariff and provide direct benefits to consumers; and

- the upper limit for acceptable bids should be the relevant feed-in tariff that has been fixed for a plant of that size.

To summarise, the relationship between the feed-in tariff and the allocation of water rights by plant size is shown in Table 2.1

Table 2.1

<table>
<thead>
<tr>
<th>Estimated Site Capacity</th>
<th>Up to 1 MW</th>
<th>1 MW to 10 MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eligible for Feed-in Tariff?</td>
<td>Yes</td>
<td>Yes, if not listed</td>
</tr>
<tr>
<td>Procedure for allocation of Water Rights?</td>
<td>Simplified</td>
<td>Simplified if not listed</td>
</tr>
</tbody>
</table>

### 2.2.4. Responsibility for Setting the Tariff and Its Implementation

We noted above that, based on our review of the 2006 Energy Law, it seemed clear that the Government’s responsibility would be to promulgate policy with regard to the development of renewable generation, including SHPPs.

The 2006 Energy Law also indicates that it is the RC’s responsibility to implement the feed-in tariff, as follows:

1. Article 19 defines the RC’s responsibilities to include price regulation, and specifically for it to prepare regulations on price formation - the criteria to be adopted in preparing these regulations are set out in Article 20.

2. More importantly, Article 141 specifies that the RC shall establish tariffs for electricity sold by “preferential producers” of electricity; in Article 8 the term “preferential producer” of electricity is defined clearly to include hydro generators.

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3 The definition is:

“Preferential producer of electricity” shall mean a producer that generates electricity with high level of utilization of the primary fuel or that utilizes renewable energy resources or waste, in an economically acceptable manner and pursuant to the requirements pertaining to the environmental protection.
However, we noted in sub-section 2.2.1 above that before the RC can offer a special feed-in tariff to SHPPs as “preferential producers” it will be necessary for the EA to declare that these plants satisfy its criterion for preferential producers. In order to ensure that a feed-in tariff for SHPPs can be put in place without undue delay, we recommend that either:

- the EA delegates these powers of certification for SHPPs to the RC to eliminate any delays; or
- the Law is modified to allow the RC to grant feed-in tariffs to SHPPs (and perhaps to other smaller renewable producers), without these producers having to seek certification from the EA.

This approach of transferring these responsibilities to the RC would be consistent with the RC’s wide-ranging responsibilities for setting tariffs in the power sector. Article 19 defines the RC’s responsibilities as including price regulation, and the preparation by the RC of regulations on price formation; the criteria to be adopted in preparing these regulations are set out in Article 20.

Assuming the RC can be empowered in this way, this approach would mean that the RC’s responsibilities would be to:

- Set, review, and reset the SHPP feed-in tariff, taking full account of other tariffs in the sector, and of their impact on the licensed companies and consumers;
- Receive and review approaches from developers of proposed qualifying SHPP facilities, and approve or reject them as being eligible for the feed-in tariff – the RC is also responsible for licensing electricity generators (see below), including SHPPs, and consideration of a plant’s eligibility for the feed-in tariff could be done at the same time as consideration for a licence;
- Deal with licensing of the facilities, including monitoring whether they have obtained the other necessary approvals and water rights; and
- Ensure that the purchasing obligations are followed as envisaged in the policy (see sub-section 2.2.4).

In setting the tariff it will be important to make clear the position in relation to carbon credits. No formal framework exists at the present time within Macedonia that would allow small hydro producers to benefit from the value of carbon credits. However, it would be desirable for the published tariff framework to state the position, and for the tariff to reflect that position. It would therefore be desirable for the Government to clarify its position on this issue prior to the finalisation of the feed-in tariff regime.

### 2.2.5. Responsibility for the Purchase of Energy Under the Feed-in Tariff

We noted in our Options Report that a common arrangement in other countries is for the relevant distribution company to be responsible for the purchase of the energy supplied under SHPP feed-in tariffs. This arrangement is appropriate, as the hydro facilities are often connected directly to their system, and they can recover the extra costs from their customers.
However, going forward, purchase of this energy by the distributor may not be the best solution, for two main reasons:

- First, the additional costs that may result need to be spread across all consumers, including those connected to the transmission system, and it is difficult for the distributor to do this.
- Second, as retail competition develops some consumers will cease to buy directly from the distribution company, so the distribution company may find it less easy to recover the costs in an efficient and equitable way\(^4\).

It is therefore important to consider what arrangements are most suitable for efficient recovery of the costs of SHPPs in the case of Macedonia, and the starting point is to review the new Energy Law. Article 141 of the 2006 Law says that the Market Operator is obligated to purchase the whole electricity generated from the preferential producers of electricity (see definition above), and that to recover the cost for this kind of purchase the Market Operator will invoice the participant in the market for electricity in accordance with the tariffs that have been set for the purchases\(^5\).

Though there are no electricity market arrangements yet implemented in Macedonia, there is now a transmission system operator, METSO, which will also have the responsibility for market operation in due course. In view of this, and the issues associated with recovery of costs through the distribution company, we propose that the SHPP feed-in tariff arrangement in Macedonia be established with METSO as the body responsible for purchasing the SHPP power. In its regulation of METSO, the RC would need to allow METSO to recover the additional costs of this arrangement through its transmission system or other charges. The RC would also consult with METSO, in its capacity as the MO, in setting and resetting the feed-in tariff. This approach, we believe, is not only consistent with the objective of cost recovery, but also consistent with the provisions of the new Electricity Law that specify that the MO is responsible for the purchase of SHPP energy.

### 2.2.6. Simplification of Procedures for SHPPs

Though the introduction of a feed-in tariff of the type discussed here would make an important contribution to the encouragement of SHPPs in Macedonia, it may not be sufficient alone to ensure that significant quantities of SHPPs are developed going forward. The small size of these plants means that they cannot bear the cost of a large administrative burden, and

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\(^4\) It should be noted, however, that renewable energy such as hydro power may still be able to compete in the retail market, if appropriate conditions can be established. Thus, for example, if purchase and/or sale prices reflect the fact that SHPPs avoid many of the costs of transmission, or if emissions costs are taken into account, or if obligations are imposed on retailers. As significant retail competition is not likely to exist in Macedonia for some years, these alternatives are not discussed here.

\(^5\) This Article also specifies that the Regulatory Commission may require the electricity transmission system operator, when dispatching generation facilities, to give priority to generation facilities producing electricity from renewable resources and from high-efficiency co-generative installations. This may not be directly relevant, since most or all SHPPs are expected to be connected to the distribution system.
may not have sophisticated management. They are therefore likely to be discouraged if the procedures for gaining all necessary approvals for the plant are too complex. A number of complementary measures are therefore likely to be desirable, to ensure favourable conditions for potential developers. As recommended below in sub-section 3.3, ideally a “one-stop-shop” arrangement should be introduced, under which a single entity (perhaps the RC) would take responsibility for the administration of all approvals necessary for a SHPP to be established.

2.3. Summary of Proposed Policy on Feed-in Tariffs

As noted above, it is clear from the 2006 Energy Law that the RC has the power to set SHPP tariffs, and to regulate the other entities in the power sector, though we noted that some change to the role of the EA in certifying SHPPs as preferential producers would be required, in the interests of streamlining the process. This could be done through delegation of powers by the EA, or preferably by some modification to the Law. Another key issue that arises is that the power to issue water concessions, and hold associated tenders for construction and operation of hydro facilities, rests with the Government. It appears to us that, to make the policy framework for hydro feed-in tariffs clear, it may be desirable to make some amendments to the law, though it is not clear over what timescale that could be done. For the moment, it appears possible to work within the existing law as we have proposed above, and it would be desirable that the Government should issue a formal decision or decree, announcing the new policy framework for feed-in tariffs.

Based on our analysis of the legal and regulatory framework, we believe that such a policy statement or decree would need to specify the following elements of the policy:

1. in future, for all hydro sites with an estimated capacity of less than 10MW, their development as SHPPs would be on the basis of a feed-in tariff arrangement to be established and monitored by the RC, as follows:
   - any site with estimated capacity below 1MW would automatically be eligible to acquire the water rights under simplified arrangements, and for the feed-in tariff;
   - any site of between 1MW and 10MW may be eligible, providing it is not named by the Government on a published list of sites that will be tendered. Sites can be added or removed from this list, with a suitable notice period;

2. the RC would be delegated with the powers currently held by the EA to declare any categories of plants or plant as preferential plant that can be offered the special feed-in tariff rate;

3. the allocation of the water rights at sites eligible for the feed-in tariff would continue to be the responsibility of the Government, through the Ministry of Agriculture, and it is expected that these would be allocated in a simplified and transparent basis where there is no tendering. Developers will need to obtain the rights from the Ministry before becoming eligible to receive the feed-in tariff;
4. to become eligible actually to receive the feed-in tariff, a developer would need to make an application to the RC;

5. when a particular hydro plant is confirmed by the RC as qualifying under the feed-in tariff arrangements, all its output will be sold to the Market Operator, METSO, at the specified tariff, and METSO would be allowed by the RC to recover the extra costs it incurs;

6. the Government will continue to be responsible for the tendering or other arrangements that will apply in specific cases, including all sites with a capacity of more than 10MW and some sites with a capacity of between 1MW and 10MW;

7. steps would be taken to introduce “one-stop-shop” arrangements for the whole process of establishing a SHPP, including obtaining the water rights, obtaining other necessary permissions, licensing, and confirmation of eligibility for the feed-in tariff.
3. Detailed Approach for Hydro Feed-in Tariffs

As noted in the previous Section, a feed-in tariff is a regulated tariff at which the market operator is required to purchase electricity from qualifying SHPP generators meeting the specified criteria. This is a relatively simple concept, but a number of issues arise in the design and implementation of such a tariff. In this Section we therefore make proposals for a methodology for setting the tariff, and for the process that the RC would follow for considering and granting approvals of eligibility for the tariff.

We set out these proposals under the following three main headings:

1. The scope of the tariff, in terms of the size category of plants to which it applies, its duration, its application to new and existing plants.
2. The determination of the structure and level of the feed-in tariff, so as to provide appropriate incentives to the developers; and
3. The procedures to be followed, to ensure straightforward processes that will incentivise the necessary investment.

We set out these proposals in general terms in sub-sections 3.1 to 3.3 below, and then in Appendix A we provide a draft set of Rules on Methodology for the RC covering the operation of the feed-in tariff.

3.1. Scope of the Tariff

In our Options Report we discussed issues concerned with:

- size limits of plants;
- the duration of the tariff, in terms of how long it applies to an individual plant once that plant is approved;
- periodic revision of the tariff that is offered to new plants;
- whether the tariff would apply to only new plants, or to new and refurbished plants, or to all plant types; and
- other plant characteristics.

On the basis of our discussion of those issues, below we set out our proposals in each of these areas, together with other related issues.

3.1.1. Plant Size Limits

As noted in the previous Section, we propose that the feed-in tariff for SHPPs in Macedonia should apply to plants with capacities of up to 10 MW. This limit appears suitable for the circumstances of Macedonia, provides flexibility as described in the previous Section, and is consistent with practices elsewhere.

A lower limit might be thought desirable, in that it would reflect the current tendering round, where sites of significantly less than 5 MW potential are being tendered. However, the
framework proposed in Section 2 means that opportunities for development are maximised by offering the feed-in tariff scheme to larger plants, though still allowing larger sites to be tendered in appropriate circumstances.

3.1.2. Duration of the Tariff for Each Plant

Our Options report discussed the issues of tariff duration at some length. There is always a trade off in these circumstances between the duration of the tariff and the level of the tariff that needs to be offered to cover the risks of the developer. The shorter is the duration of the tariff, the higher the tariff that will need to be offered to provide certainty to developers, and vice versa. This relationship is illustrated for a range of durations in Table 3.1, using typical cost data.

Table 3.1
The Trade Off Between Duration and level of Tariff

<table>
<thead>
<tr>
<th>Duration of Tariff (Years)</th>
<th>Output Price (MKD/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0</td>
<td>4.5</td>
</tr>
<tr>
<td>15.0</td>
<td>3.8</td>
</tr>
<tr>
<td>20.0</td>
<td>3.5</td>
</tr>
<tr>
<td>25.0</td>
<td>3.4</td>
</tr>
<tr>
<td>30.0</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Source: NERA calculations based on costs of a hypothetical plant

On the basis of what we consider to be an appropriate compromise between a reasonable tariff level and avoiding an excessive duration, we propose that the feed-in tariff, once granted, should apply to individual plants for a period of 20 years. During this period, the tariff actually paid may, of course, vary in accordance with any pre-specified adjustments, for example adjustments for inflation.

This 20-year period will provide simplicity and certainty of revenues for developers and investors. The risks faced by investors in these SHPPs are therefore much reduced. This risk reduction for investors has two important implications:

1. The purchaser (and hence the consumers) may have to pay more over a period of time than would have been the case without the feed-in tariff, if market prices fall. Set against that is the advantage that the reduced investor risk is likely to result in lower cost of capital, which reduces costs overall.

2. Conversely, the generator may find that, if market prices rise over time, the feed-in tariff he receives will be below market prices. This may bring suggestions that the generator should be released from the feed-in tariff arrangement, to take advantage of the higher market prices. This release should not, in our view, be permitted, as the possibility that market prices may rise should be seen as part of the risk reduction package accepted by the generator when applying for the feed-in tariff.
At the end of the 20 year feed-in tariff period, the plant owner would be free to choose how to utilise the plant and its output in the future. Options are likely to include:

- cessation of use of the plant;
- continued operation of the existing plant and sale of its output through whatever market arrangements exist at that time; and
- utilisation of any feed-in tariff opportunities that exist at that time, perhaps in conjunction with a major refurbishment of the facilities.

Another issue with duration is its relationship with the term of loan financing obtained by the developer. Though the 20 year period may exceed the duration of some loan financing, it has the benefit of ensuring that plant costs can be depreciated over sufficiently long periods to minimise the tariff level.

A period longer than 20 years would clearly be possible, and longer periods would be consistent with the maximum duration of water concessions. However, longer periods would introduce increased risks for both developers and consumers, and are therefore not desirable in our view.

We therefore recommend that the duration of the feed-in tariff should be set at 20 years, which strikes an acceptable balance between certainty and flexibility, and is consistent with our findings from other countries.

### 3.1.3. Periodic Revision of the Tariff Offered to New Applications

We propose that the RC should have a regular process of review for the tariff to apply to new plants, probably on an annual basis. This will be important for ensuring an efficient feed-in tariff policy. Any changes should be implemented with an adequate notice period, to provide stability to schemes under preparation.

### 3.1.4. Quantity Limitation on Feed-in Tariff Plants in any Period

It is very difficult to estimate what quantity of applications may be forthcoming in response to any particular level of feed-in tariff, and it has been proposed that some annual limit might be desirable, either in terms of number of applications or total MWs.

It is true that, if a very high level of applications is received, this could present problems to the RC in processing them, and to the distribution company in providing connections. On the other hand, imposing a limit on the quantity of applications permitted in any period may distort the process and deter potential applicants. We do not therefore suggest imposing any

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6 Article 156 of the Law on Water suggests that the maximum time period for water concessions for the generation of electricity:

a) hydro-power plants with installed power over 10 MW up to 70 years;
b) hydro-power plants with installed power over 2 MW to 10 MW up to 50 years; and
c) hydro-power plants with installed power under 2 MW up to 30 years.
such limit, at least initially, but rather use the ability to reset the tariff from time to time as the primary means of regulating the flow of applications.

3.1.5. Application of the Feed-in Tariff to Existing Plants

In general, where a hydro plant is already supplying energy to the system when the feed-in tariff is introduced, the tariff should not apply to that plant. This is on the basis that:

- The purpose of the scheme is to incentivise new investment, and that does not apply to existing plants; and
- The plant will have been developed within a different regime, and may have a significantly different cost structure, so applying the tariff will be either unnecessary or inappropriate.

However, we do propose that the tariff should apply to existing plants undertaking major refurbishments or capacity expansions. This will require the development of qualifying conditions that a plant would need to satisfy in order to qualify for the feed-in tariff, and for simplicity we recommend this be based on a capital expenditure threshold, expressed in per kW terms. Since the costs of expansion or refurbishment are likely to be lower than development of an entirely new site, we recommend a differentiated tariff to apply to expanded or refurbished plants.

3.1.6. Other Characteristics for Qualifying Plants

Small SHPPs of the type being considered here would generally be run-of-river plants, though in some cases small storage ponds may be required. Since the construction of dams for water storage often raises environmental and other issues, we recommend that the feed-in tariff arrangement should apply only to run of river plants with minimal storage.

3.2. Determining the Level and Structure of the Feed-in Tariff

As noted in our Options Report, the feed-in tariff needs to be set so that it covers all the likely costs of developers, as well as reflecting “willingness to pay”, in terms of other costs of the system and of other sources of renewables. These and other aspects of the costs of SHPP plants will be considered here.

In considering the methodology and determining the desirable levels of feed-in tariffs, it needs to be recognised that considerable uncertainty exists concerning the level of tariffs that would be acceptable to investors in practice. In addition to the difficulties in forecasting likely costs and capacity factors, there is the fact that this is a new area of enterprise in Macedonia and general concerns about the regulatory and economic environment may influence potential investors. The RC will therefore adopt a cautious approach that

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7 This means a plant that is constructed to operate without any significant dam structure.
recognises these uncertainties, and be prepared to respond flexibly in the light of experience with the tariff.

3.2.1. Overall Level of the Tariff

In principle, the tariff could be set initially just on the basis of costs of other sources of generation, and what is considered to be a reasonable cost for hydro generation. However, we recommend that the level of the tariff be set in a way that also takes account of the estimated construction and operating costs of typical plants, using the agreed duration of the tariff and a suitable discount rate. A typical calculation based on this method and using illustrative data would operate as follows.

Based on an assumed plant with a capacity of 1,200kW and an expected 20 year project life, it is possible to derive estimates of:

- the total investment cost;
- the annual load factor;
- the annual operating costs.

On the basis of these estimates and an assumption about the output price, the cash flows for the project can be calculated, as shown in Table 3.1.

On this basis, the cash flows can then be used to calculate the internal rate of return (IRR) for any given output price. For example, a unit price of MKD 3.5, as is assumed in Table 3.2, would yield an average annual rate of return of 11.2% over the 20 year life. A range of output prices can then be examined, to find the return that they produce, and Table 3.3 shows some typical values. These rates of return are calculated in real terms, that is with no adjustment for inflation, and before tax.
### Table 3.2
**Illustrative SHPP Project Cash Flows**

<table>
<thead>
<tr>
<th>Year</th>
<th>Output (MWh)</th>
<th>Revenue (MKD)</th>
<th>Investment (MKD)</th>
<th>Operating Costs (MKD)</th>
<th>Net Cash Flow (MKD)</th>
</tr>
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<tbody>
<tr>
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<td>-</td>
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<td>-</td>
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</tr>
</tbody>
</table>

*Source: NERA calculations based on costs of a hypothetical plant*

### Table 3.3
**Illustrative Unit Prices and IRRs**

<table>
<thead>
<tr>
<th>Output Price (MKD/kWh)</th>
<th>Rate of Return (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>5.4</td>
</tr>
<tr>
<td>3.0</td>
<td>8.4</td>
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<tr>
<td>3.5</td>
<td>11.2</td>
</tr>
<tr>
<td>4.0</td>
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<tr>
<td>4.5</td>
<td>16.2</td>
</tr>
<tr>
<td>5.0</td>
<td>18.6</td>
</tr>
</tbody>
</table>

*Source: NERA calculation based on costs of a hypothetical plant*
With an estimate of the target required rate of return (that is the weighted average cost of capital, or WACC) for a typical investor, it is then possible to derive the feed-in tariff that would be required to provide an adequate incentive for investment in the plant.

It is noted earlier in this report that a typical loan repayment period is likely to be less than the proposed 20 year duration of the feed-in tariff, and so it is useful to consider the possible cash flow implications for investors using loan finance, to assess the feasibility of the proposed tariff methodology. This also needs to take account of possible variations in the capacity factor of the plant, if the hydrology is less favourable than assumed in the estimates.

In carrying out this analysis, much depends on the details of the financing actually used, in terms of the percentage of the investment that is debt financed, the interest rate, the term of the loan, and any initial repayment holiday. Looking at a typical SHPP investment where the tariff provides an 8% WACC on an assumed capacity factor of 45%, we have analysed the cash flow implications with the following loan terms:

- 50% debt financing;
- a 10 year term, with no repayment holiday;
- a 6% pa interest rate;
- level repayments, including capital and interest;

On that basis, free cash flow is projected at around 24% of annual revenue during the first 10 years, increasing to 74% after repayment is completed. There would therefore be no repayment issues on these assumptions, providing the projected capacity factor is actually achieved. With debt finance of 60%, the free cash flow percentage declines to 14% in years 1 to 10.

Some shortfall in the achieved capacity factor could be absorbed by the investor in both cases, without financial viability being threatened. In the case of 50% of debt financing, it would only be if the average capacity factor fell to below 31% that free cash flow would drop to zero. With 60% debt financing, the average capacity factor achieved would have to fall to below 37% before free cash flow fell to zero. In addition, the declining block tariff structure we propose below would mean in many cases that the plant’s revenue would not decline in proportion to the output, and this would provide an additional degree of protection to the plant’s financial viability.

These risk factors would need to be taken into account by a potential investor in structuring the approach to any particular project, but they appear to present acceptable levels of risk. Quite clearly, with a longer repayment term, a lower interest rate relative to the WACC, or a lower debt finance ratio, the degree of risk would be further reduced.

The example presented here is relatively simplified, in the following respects:

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8 This is defined as revenue from tariffs, less operating expenses and debt repayment and interest costs.
No major investment in refurbishment is assumed to be required during the life of the plant;

- Fluctuations in the output from year to year, and deteriorations over the life of the plant are not explicitly taken into account;
- The effects of inflation or exchange rate adjustments are ignored, though these are discussed below;
- Full capital cost recovery over the 20 year duration of the tariff is assumed, and any remaining life of the plant beyond the 20 year period (or its scrap value) is ignored.

However, it will be clear that this approach can readily be adapted to the particular financial circumstances identified for typical plants. In particular, this approach can be used to examine issues such as adjustments to the basic tariff to allow for inflation of domestic costs and for any impact of exchange rate fluctuations, as discussed below.

3.2.2. Structure of the Tariff

A general feature of any hydro plant is that a large proportion of the costs are fixed once the plant is commissioned, and so the costs of production per unit of output can vary widely depending on the level of output. The level of output is itself rather uncertain, partly for hydrological reasons and partly due to the other demands on water resources.

This combination of uncertain levels of output and large fixed costs inevitably imposes risks on the plant operator, and this risk could be mitigated by use of a two-part tariff structure consisting of:

- An annual capacity payment (payable, for example, in monthly instalments), based on the size of the plant, and dependent on physical availability of the plant, regardless of the hydrology; and
- An energy payment that is dependent directly on the MWhs produced.

Though theoretically attractive, in practice there are a number of problems in the application of a two-part tariff to SHPPs. In particular, it would introduce an incentive to overstate the rated value of the plants, and the use of measures to check that the rating is correct and the plant is available would be both difficult and unduly expensive for these small plants. We do not therefore recommend this approach.

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9 Article 11 of the Water Law makes it clear that production of electricity is a relatively low priority, and specifies that waters are used according to the following priority:
- for water supply of the population, for both the medical and the veterinary institutions, for needs of the defense, for both the production and the food industry and for domestic animals;
- for irrigation of agricultural land;
- for water supply of the industry (utility needs);
- for watering parks and other public lands;
- for hydro-energetic needs and
- for other needs
Use of a simple single-part per kWh tariff for the output of SHPPs avoids some of the problems of a two-part tariff, but also potentially introduces others:

- if the price paid per kWh varies with the size of the plant, as indicated earlier, it will be important to avoid this becoming an incentive to understate the true rated capacity of the plant, merely for the plant’s output to fall into a higher price category;
- a single-part tariff can, depending on its design, provide a quite high degree of financial exposure to fluctuations in output levels resulting from unanticipated changes in hydrological conditions, and this can be a concern for both the developer and the purchaser.

To overcome these potential problems, we recommend the use of a “declining block” tariff for all plants, as illustrated in Figure 3.1.

**Figure 3.1**
Illustration of Declining Block Tariff for SHPPs

Figure 3.1 shows an example with three tariff blocks, with prices per kWh of P1, P2, and P3. The quantities shown relate to total annual quantities, and any annual quantity up to Q2 would be purchased at a price of P1. Thus, for example, an annual quantity of Q1 kWh would be sold at a price of P1, and in that case the total revenue received would be equivalent to the dotted area. Any annual quantity of up to Q2 kWh would also be sold at a price of P1. However, for any quantity above Q2 per year, the additional output would be sold at the lower price of P2. Thus, if the total output were Q3, then the quantity Q2 would be sold at P1, and the quantity Q3-Q2 would be sold at the price of P2. This means that for the quantity Q3 the total revenue would be equivalent to the dotted area plus the total grey shaded area. A tariff of this type means that the average price received is dependent on the quantity sold rather than the size of plant, though clearly these two factors are relatively closely correlated. Indeed, the values of Q1, Q2, etc would be set by reference to the expected typical output levels of plants of different capacities, and the prices P1, P2, etc would be set by reference to the costs and revenue requirements of plants of different sizes.
An example of how this tariff would operate is shown in Table 3.4, based on hypothetical average costs per kWh of:

- 10 cents per kWh for plant of up to 1,000 kW capacity;
- 8 cents per kWh for plant of between 1,000 and 2,000 kW capacity;
- 7 cents per kWh for plant of between 2,000 and 3,000 kW capacity;
- 6 cents per kWh for plant of between 3,000 and 5,000 kW capacity;
- 5 cents per kWh for plant of between 5,000 and 10,000 kW capacity.

### Table 3.4

<table>
<thead>
<tr>
<th>Tariff for each output band (cents/kWh)</th>
<th>Notional Capacity of Plant Between (kW)</th>
<th>Annual Output Band Between (kWh) - assumes 50% Cap Factor</th>
<th>Total Revenue at top of band (€)</th>
<th>Average revenue for total output (cents/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0</td>
<td>1</td>
<td>1 4,380,000</td>
<td>438,000</td>
<td>10.00</td>
</tr>
<tr>
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<td>569,400</td>
<td>8.67</td>
</tr>
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<td>2000 6,570,001</td>
<td>700,800</td>
<td>8.00</td>
</tr>
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<td>810,300</td>
<td>7.40</td>
</tr>
<tr>
<td>5.0</td>
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<td>3000 10,950,001</td>
<td>919,800</td>
<td>7.00</td>
</tr>
<tr>
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<td>4000 13,140,001</td>
<td>1,116,900</td>
<td>6.38</td>
</tr>
<tr>
<td>4.5</td>
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<td>5000 17,520,001</td>
<td>1,314,000</td>
<td>6.00</td>
</tr>
<tr>
<td>4.0</td>
<td>5001</td>
<td>10000 21,900,001</td>
<td>2,190,000</td>
<td>5.00</td>
</tr>
</tbody>
</table>

*Source: NERA calculations based on hypothetical costs*

In Table 3.4 the left-hand column shows the tariff per kWh that would be paid for output in each band, and other columns show the resulting revenues, with the right-hand column showing the average revenue that would be received by the plant at each output level. This table illustrates that there is always positive incremental revenue for additional output, but that the average revenue received declines to correspond with the typical average costs per kWh at each plant size.

It should be clear from these illustrative numbers that the declining block tariff approach has a number of advantages over alternative tariff structures:

- since the same tariff is offered to all qualifying plants, regardless of the rated output of the plant, there are no incentives to over- or under-state the true capacity of a plant;
- if output levels are lower than expected, then the reduced output will be paid on the basis of a higher average tariff, so mitigating the loss in revenue from the low output;
if output levels are higher than expected, then the incremental output will be paid on the basis of the lower incremental tariff, so limiting the additional revenue from high levels of rainfall and mitigating the extra costs incurred by the buyer;

however, as the incremental price paid for energy will generally always exceed the incremental cost, there will always remain an incentive for the plant operator to optimise output.

In order to apply this tariff structure, it will of course be necessary to estimate the annual output level of every plant (and hence the average tariff paid) at the beginning of the year, and then make monthly payments for actual output on that basis. The twelfth payment each year may then need to incorporate a correction to the actual average tariff, based on the year’s actual total output level.

3.2.3. Indexation of the Feed-in Tariff

With the proposed 20-year duration of the feed-in tariff to an individual plant, consideration should be given to whether the tariff should be indexed to take account of likely increases in those operating costs of the plant that may be subject to domestic inflation. Though the cost study shows that such operating costs are a relatively small proportion of total costs, most of these operating costs, in particular labour and the costs of consumable items, are likely to increase with general inflation, and over the 20 year duration this cost increase can be substantial and impose a high degree of risk on the operator. It will therefore be appropriate for an adjustment to be made to reflect the effects of inflation on the relevant proportion of such costs.

If this type of approach is adopted, the proportion of the tariff to which the adjustment should apply would need to be set taking account of the size of operating costs relative to all other costs (including depreciation and return on capital), based on the evidence of typical SHPP costs. Evidence from the cost study suggests that operating costs typically represent around 25% of total costs on an annualised basis.

We have made provision for this type of adjustment in the draft Rules in Appendix A.

3.2.4. Currency Risk Issues

We noted in our Options Report the arguments for some degree of linkage of the tariff to the exchange rate of the MKD with the Euro, the need for this principally arising from financing issues. This is based on the argument that investors would typically seek financing denominated in Euros (at lower interest rates than borrowings in MKD). This would suggest that some degree of linkage is desirable, even if the investors are mainly local. For consistency of approach, the RC would have two options available to it:

- assume that borrowing is in MKD, and allow a cost of capital that reflect the higher rates of interest this implies, but then have no currency adjustment; or
- assume that borrowings are in Euros, allow a correspondingly lower cost of capital in calculation of the tariff, but allow currency adjustment.
We have made provision for a currency adjustment to be applied in the attached draft Rules\textsuperscript{10}, and the RC will need to consider the case for such an adjustment to the tariff. On the basis proposed in the draft Rules, the tariff would be quoted in MKD, but periodic adjustments would be made to the tariff for existing recipients of it, based on a formula that takes account of changes in the MKD/€ exchange rate. It is assumed that adjustments would generally be made on an annual basis, but there is provision for the adjustment to be carried out more frequently in the event that substantial fluctuations take place that may threaten the financial viability of the operators.

It should be emphasised again that if this currency adjustment is used as a means of mitigating the € financing risk, then it would be appropriate to reflect € borrowing costs rather than MKD borrowing costs in the estimation of the cost of capital to be used in the calculations.

The formulation proposed for the adjustment in the draft Rules in Appendix A also includes a percentage weighting factor that takes account of the relative importance of € denominated costs in total costs. This weighting factor would include all costs other than those which are subject to the inflation adjustment mentioned in the previous sub-section, so that the two percentage weighting factors would sum to 100%. Evidence from the cost study suggests that these fixed costs typically represent around 75% of total costs on an annualised basis.

### 3.2.5. Willingness to Pay

Finally, in setting the feed-in tariff the RC will need to consider the demand side, and take into account the willingness to pay for renewable energy of this type. In doing this, the RC will need to take account the Government’s strategy on renewable energy and consider:

- the cost of alternative conventional generation options: this represents an important benchmark against which to consider the size of the premium for renewable generation that can be justified; and
- the costs of other renewable generation options: since small hydro generation is only one of a number of renewable generation options, the feed-in tariff would need to take account of the costs of any other available renewable options that exist in Macedonia

### 3.3. Feed-in Tariff Procedures and Issues

A feed-in tariff of the type discussed above would make an important contribution to the encouragement of SHPPs in Macedonia. However, the existence of the feed-in tariff alone may not be sufficient to ensure that significant quantities of SHPPs are developed going

\textsuperscript{10} Appendix A of this Report proposes a general formulation that applies a retrospective adjustment to take account of the MKD/Euro exchange rate in the previous year. With this general formulation, no adjustment would be made in the first period of operation of the plant, but would be adjusted annually thereafter. There is also provision that, where it appears to the RC that a substantial fluctuation in the MKD/Euro exchange rate is taking place that may threaten the financial viability of generators, it may decide to make interim adjustments based on this formula more frequently than once a year. If the RC decides to adopt an adjustment of this sort, some fine tuning of this formulation may be required to reflect the timing of the introduction of the tariff and of subsequent reviews.
forward, if the procedures for gaining all necessary approvals for the plant are too complex. A number of complementary measures are therefore likely to be desirable, to ensure that favourable conditions exist for potential developers, some of them in the control of the RC and others in the hands of other agencies. Ideally, a “one-stop-shop” arrangement should be introduced, under which a single entity (perhaps the RC) would take responsibility for the administration of all approvals necessary for a SHPP to be established.

3.3.1. RC Procedures

When an applicant wishes to develop a SHPP to qualify for the feed-in tariff it will need to apply to the RC for both:

- approval of the plant as eligible for the feed-in tariff; and
- granting of a licence for the plant.

To simplify the process as much as possible, we recommend that these two could be combined into a single procedure, and this has been incorporated into the attached draft Rules. This needs to be investigated further from a legal perspective, as Article 39 of the Energy Law suggests that a licence can only be issued after a construction permit is obtained. Though it is appropriate that an application fee be charged, this needs to be limited, to reflect the small size of these plants. Some change to the existing procedures may also be necessary.

The attached draft Rules envisage that any potential developer would make such an application to the RC, but that it would not be necessary for public hearings to be held for each application. As a further contribution to simplification of the processes, we recommend that the RC could consider developing a simplified licence template to apply to all SHPP generators.

We also propose that a reasonable time limit (for example 2 years) be imposed by the RC, within which it is necessary for the development to be completed after issue of the licence and approval. This “use it or lose it” approach will help in ensuring that potential sites are not tied up by potential developers who have obtained the necessary rights and licence but are then unable or unwilling to proceed. We also propose that where a licensee fails to complete the development within the time limit, consideration should be given to excluding the developer from future concessions. Such a penalty should probably be on the basis of two or more failures rather than a single failure.

3.3.2. Allocation of the Water Concession

Development of a SHPP requires the granting of a concession for a suitable period, and this has been discussed above. We noted above that we understand that the granting of a concession eliminates the need for a further authorisation for the building of the plant. This means that the water concession is the principal formal hurdle to be crossed that is outside the RC’s control. We therefore recommend that the RC works together with the relevant Ministries to ensure that this process is made as simple as possible.
3.3.3. Connection to the system and connection costs

Similarly, the successful development of a SHPP requires that a connection to the nearest network be arranged, and this is likely to be a distribution connection it will probably mean signing a connection agreement with ESM.

We note that Article 78 of the 2006 Energy Law imposes an obligation on the distributor to provide connections to “users” of the system “pursuant to the distribution Grid Code”, and this is reinforced by Article 115. However, we also understand that the Grid Code is not yet finalised, so the RC will need to consider what interim or other changes may be necessary to licence conditions to ensure this process operates smoothly and does not represent an onerous burden on the developers.

Connection costs are also likely to arise as an important issue. The principle assumed here is that the developer should bear the connection costs, at least to the extent that other new generators are made to bear connection costs. This is important in order not to distort the cost signals faced by developers. However, costs are likely to vary widely, and in some circumstances issues of connection cost sharing may arise, and it important that a developer faces a simple and fair connection cost policy.

We therefore recommend that the RC works with ESM to establish clear and simple rules on procedures and costs for dealing with these connections.
4. **Summary of Results of the Study of Typical Costs of SHPPs**

As part of this project, NERA commissioned Professor Predrag Popovski to carry out a study of costs for typical SHPPs in Macedonia. The report containing the detailed results of this study is attached in Appendix B. The primary objective of this Study was to produce estimates of the investment and operational costs of a selection of small hydro power plants (SHPPs), across a range of sizes, in order to inform decisions about a feed-in tariff for SHPPs. It looks at the full range of factors, from basic hydrological conditions and the technical characteristics of SHPP sites. It produces estimates of the costs of infrastructure works and mechanical and electrical equipment as well as the estimated capacity and energy production potential.

According to a pre-feasibility study for investigation of possible sites for mini HPP in Macedonia carried out some years ago, over 400 possible sites suitable for SHPP development are thought to exist in Macedonia. The task set for Professor Popovski’s study was to select a sample of 20 to 30 sites for more detailed analysis, based on a number of criteria. In order to be relevant to a potential SHPP programme, it was decided that the criteria for the selected sites should be:

- New facilities, not renovations;
- Those about which most is known regarding site conditions and hydrology;
- The cheapest and most straightforward to develop;
- Only sites with generating capacities between 250kW and 5,000 kW;
- Those with no damming works required; and
- Relatively easy to connect to the distribution system.

The 24 SHPP sites selected were arranged into two groups:

- 12 HPPs in the range up-to 1,000 kW;
- 12 HPPs in the range between 1,000 kW and 5,000 kW.

The basic design parameters appropriate for development of the plants were calculated for these two groups of SHPP sites. The detailed technical parameters are described in Chapters 2 to 5 of the study, and these design assumptions were then converted into estimates of the necessary investment costs in Chapter 6. These include all relevant costs, including project management costs and the costs of connection to the system.

Chapter 7 of the report then derives estimates for each site of the capacity of the plant and the expected average energy output, based on the specifics of the sites and comparison with international norms for plants of this type.

Chapter 8 of the report in Appendix A then combines these cost estimates for the investment required with rules of thumb for operating and other factors, to derive estimates of the overall cost of the energy, per kWh. Though useful approximations, these estimates are not fully
consistent with the tariff methodology proposed in this report, and so these data have been recalculated on a consistent basis, using the following standard assumptions:

- a plant life of 20 years;
- use of the discounted cash flow technique recommended earlier in this report, using a discount rate of 8%\(^{11}\);
- operating costs that average 3.5% over the life of the plant;

Though calculated on a somewhat different basis, our own estimates of the typical unit costs are closely comparable with those obtained by Professor Popovski’s study. The estimates are shown for the purposes of comparison in Table 4.1 for the plants with capacity of under 1,000 kW, and in Table 4.2 for the plants between 1,000 kW and 5,000 kW.

### Table 4.1
**Comparison of Estimated Costs per kW – Plants under 1,000 kW**

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Plant Capacity (kW)</th>
<th>Load Factor (%)</th>
<th>Unit Cost (€Cents/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Study</td>
<td>NERA</td>
<td></td>
</tr>
<tr>
<td>Bregalnica</td>
<td>264</td>
<td>48.56%</td>
<td>15.31</td>
</tr>
<tr>
<td>Crna reka</td>
<td>349</td>
<td>43.93%</td>
<td>13.36</td>
</tr>
<tr>
<td>Kriva reka</td>
<td>341</td>
<td>51.96%</td>
<td>10.00</td>
</tr>
<tr>
<td>Crn Drim</td>
<td>451</td>
<td>49.26%</td>
<td>8.18</td>
</tr>
<tr>
<td>Pena</td>
<td>516</td>
<td>48.58%</td>
<td>8.54</td>
</tr>
<tr>
<td>Crn Reka</td>
<td>522</td>
<td>43.96%</td>
<td>12.15</td>
</tr>
<tr>
<td>Pcinja</td>
<td>613</td>
<td>51.92%</td>
<td>10.63</td>
</tr>
<tr>
<td>Topolka</td>
<td>615</td>
<td>43.79%</td>
<td>11.54</td>
</tr>
<tr>
<td>Bosava</td>
<td>732</td>
<td>45.94%</td>
<td>8.28</td>
</tr>
<tr>
<td>Dosnica</td>
<td>772</td>
<td>45.94%</td>
<td>6.73</td>
</tr>
<tr>
<td>Crn Drim</td>
<td>921</td>
<td>45.93%</td>
<td>5.40</td>
</tr>
<tr>
<td>Crna Reka</td>
<td>982</td>
<td>43.95%</td>
<td>5.70</td>
</tr>
</tbody>
</table>

*Source: Project team calculations based on estimated project costs*

It can be seen from the details in Appendix B that conditions vary quite widely between plants. In particular, the investment costs per kW of capacity and the load factors expected to be achieved by the plants vary quite widely. These variations mean that there is no precise correlation between size of plant and unit costs, though Tables 4.1 and 4.2 do show a general trend for unit costs to fall as plant size increases.

\(^{11}\) This equates to a weighted average cost of capital of 8%, pre tax, based on the assumption of foreign currency borrowing costs of 6% to 7%.
### Table 4.2
Comparison of Estimated Costs per kW – Plants between 1,000 kW and 5,000 kW

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Plant Capacity (kW)</th>
<th>Load Factor (%)</th>
<th>Unit Cost (€Cents/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Study</td>
<td>NERA</td>
<td></td>
</tr>
<tr>
<td>Dosnica</td>
<td>1,000</td>
<td>45.94%</td>
<td>7.27</td>
</tr>
<tr>
<td>Topolka</td>
<td>1,247</td>
<td>43.94%</td>
<td>7.33</td>
</tr>
<tr>
<td>Crna Reka</td>
<td>1,298</td>
<td>43.94%</td>
<td>4.54</td>
</tr>
<tr>
<td>Pena</td>
<td>1,799</td>
<td>48.56%</td>
<td>5.90</td>
</tr>
<tr>
<td>Crna Reka</td>
<td>1,870</td>
<td>46.64%</td>
<td>5.97</td>
</tr>
<tr>
<td>Pena</td>
<td>2,198</td>
<td>48.61%</td>
<td>4.32</td>
</tr>
<tr>
<td>Treska</td>
<td>2,600</td>
<td>40.39%</td>
<td>5.03</td>
</tr>
<tr>
<td>Crna Reka</td>
<td>2,800</td>
<td>31.96%</td>
<td>6.88</td>
</tr>
<tr>
<td>Strumica</td>
<td>2,903</td>
<td>43.95%</td>
<td>4.58</td>
</tr>
<tr>
<td>Crn Drim</td>
<td>3,360</td>
<td>34.31%</td>
<td>3.60</td>
</tr>
<tr>
<td>Crna Reka</td>
<td>3,840</td>
<td>49.65%</td>
<td>4.76</td>
</tr>
<tr>
<td>Kadina Reka</td>
<td>4,684</td>
<td>51.94%</td>
<td>3.13</td>
</tr>
</tbody>
</table>

Source: Project team calculations based on estimated project costs

If the plants studied are placed in order according to their unit costs, the estimated relationship between unit cost and potential capacity is as shown in Figure 4.1.

It should be noted that the plants studied were not randomly chosen, so it is not possible to extrapolate from the results obtained to the more general situation. But these results do suggest that significant SHPP capacity is potentially available at what could be acceptable cost. If we ignore the higher cost plants in each size category\(^\text{12}\), and examine the remaining 14 of the 24 plants, the relationship between plant capacity and unit cost that emerges is as shown in Table 4.3.

---

\(^{12}\) We define the higher cost plants as those whose unit cost exceeds the average by more than 20%.
Figure 4.1
Costs per kW and Estimated Potential Capacity from Studied Plants

Table 4.3
Plant Capacity and Comparison of Estimated Costs per kW
Excluding Higher Cost Plants

<table>
<thead>
<tr>
<th>Plant Capacity (kW)</th>
<th>Price (€ cents per kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>341</td>
<td>9.77</td>
</tr>
<tr>
<td>451</td>
<td>7.99</td>
</tr>
<tr>
<td>516</td>
<td>8.34</td>
</tr>
<tr>
<td>732</td>
<td>8.09</td>
</tr>
<tr>
<td>772</td>
<td>6.57</td>
</tr>
<tr>
<td>921</td>
<td>5.28</td>
</tr>
<tr>
<td>982</td>
<td>5.57</td>
</tr>
<tr>
<td>1298</td>
<td>4.44</td>
</tr>
<tr>
<td>2198</td>
<td>4.23</td>
</tr>
<tr>
<td>2600</td>
<td>4.92</td>
</tr>
<tr>
<td>2903</td>
<td>4.48</td>
</tr>
<tr>
<td>3360</td>
<td>3.51</td>
</tr>
<tr>
<td>3840</td>
<td>4.65</td>
</tr>
<tr>
<td>4684</td>
<td>3.06</td>
</tr>
</tbody>
</table>

Source: Project team calculations based on estimated project costs
Allowing for the likely range of variations, and based on the assumed parameter values used in this report, the estimated costs for these plants suggest that a feed-in tariff based on the price ranges shown in Table 4.4 would be attractive to a number of plants in each of the size categories.

<table>
<thead>
<tr>
<th>Plant Capacity (kW)</th>
<th>Price per kWh (€ cents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 1,000</td>
<td>5.5 to 8.0</td>
</tr>
<tr>
<td>1,001 to 3,000</td>
<td>4.5 to 5.0</td>
</tr>
<tr>
<td>3,001 to 5,000</td>
<td>3.5 to 4.5</td>
</tr>
</tbody>
</table>

Source: Project team calculations based on estimated project costs

As noted earlier, the final decision on this tariff structure is, to some degree, a policy decision, as it depends to what extent special provision should be made for the smaller plants. In particular it will be necessary to consider whether the higher-cost plants of less than 1,000 kW should be encouraged, or the whether the feed-in tariff offered should be based only on the costs of larger plants of over 1,000 kW.

Once final decisions on this approach are made, it would then also be necessary to convert the tariff from a capacity-based tariff to a kWh declining block tariff of the sort recommended in sub-section 3.2.2 of this report.
5. Summary of Conclusions and Recommendations

This report deals with a range of aspects of the introduction of a feed-in tariff scheme for small hydro plants and for other forms of renewable generation. In this final section we bring together a summary of the various conclusions and recommendations which have come out of this work.

5.1. The Policy Framework

We note in Section 2 that the 2006 Energy Law gives the RC the power to set SHPP tariffs, and to regulate the other entities in the power sector, though we also note that some change to the role of the Energy Agency in certifying SHPPs as preferential producers would be desirable, in the interests of streamlining the process. Another key issue that arises is that the power to issue water concessions, and hold associated tenders for construction and operation of hydro facilities, rests with the Government. It therefore appears that, to make the policy framework for hydro feed-in tariffs clearer, it may be desirable to make some amendments to the law. However, in the shorter term it may be possible to work within the existing law, in which case it would be desirable for the Government to issue a formal decision or decree, announcing the new policy framework for feed-in tariffs.

Based on our analysis of the legal and regulatory framework, we recommend that a SHPP feed-in tariff policy with the following elements be introduced, whether through changes in the law, a policy statement or decree, or a combination of both:

1. in future, for all hydro sites with an estimated capacity of less than 10MW, their development as SHPPs would be on the basis of a feed-in tariff arrangement to be established and monitored by the RC, as follows:
   - any site with estimated capacity below 1MW would automatically be eligible to acquire the water rights under simplified arrangements, and for the feed-in tariff;
   - any site of between 1MW and 10MW may be eligible, providing it is not named by the Government on a published list of sites that will be tendered. Sites can be added or removed from this list, with a suitable notice period;
2. the RC would be delegated with the powers currently held by the EA to declare any categories of plants or plant as preferential plant that can be offered the special feed-in tariff rate;
3. the allocation of the water rights at sites eligible for the feed-in tariff would continue to be the responsibility of the Government, through the Ministry of Agriculture, and it is expected that these would be allocated in a simplified and transparent basis where there is no tendering. Developers will need to obtain the rights from the Ministry before becoming eligible to receive the feed-in tariff;
4. to become eligible actually to receive the feed-in tariff, a developer would need to make an application to the RC;
5. when a particular hydro plant is confirmed by the RC as qualifying under the feed-in tariff arrangements, all its output will be sold to the Market Operator, METSO, at the specified tariff, and METSO would be allowed by the RC to recover the extra costs it incurs;

6. the Government will continue to be responsible for the tendering or other arrangements that will apply in specific cases, including all sites with a capacity of more than 10MW and some sites with a capacity of between 1MW and 10MW;

7. steps would be taken to introduce “one-stop-shop” arrangements for the whole process of establishing a SHPP, including obtaining the water rights, obtaining other necessary permissions, licensing, and confirmation of eligibility for the feed-in tariff.

5.2. The Tariff Methodology

Though a feed-in tariff is a relatively simple concept, a number of issues arise in its design and implementation, and in Section 3 we make proposals for a methodology for setting the tariff, and for the process that the RC would follow for considering and granting approvals of eligibility for the tariff. In addition, in Appendix A, we present a set of draft Rules for the RC to adopt relating to the feed-in tariff.

With regard to the scope of the tariff, we have recommended that:

- the feed-in tariff should apply to plants with capacities of up to 10 MW;
- the feed-in tariff, once granted, should apply to individual plants for a period of 20 years. During this period, the tariff actually paid may vary in accordance with any pre-specified adjustments, for example adjustments for inflation;
- the RC should have a regular process of review for the tariff that should apply to new plants, probably on an annual basis;
- no quantity limit should be imposed, at least initially, but instead the ability to reset the tariff from time to time could be used as the means of regulating the flow of applications;
- the tariff should apply principally to new plants, but that a differentiated tariff could also apply to any existing plants that undertake major refurbishments or capacity expansions; and
- the feed-in tariff arrangement should apply only to run of river plants with minimal storage, to avoid any problematic issues.

We also considered the level and structure of the tariff in some detail. We note that it needs to be recognised that considerable uncertainty exists concerning the level of tariffs that would be acceptable to investors in this activity in Macedonia. In addition to the difficulties in forecasting likely costs and capacity factors, there is the fact that this is a new area of enterprise in Macedonia and general concerns about the regulatory and economic environment may influence potential investors. The RC will therefore adopt a cautious
approach that recognises these uncertainties, and be prepared to respond flexibly in the light of experience with the tariff.

Based on our research, we make a range of recommendations. In particular, we recommend:

- that the level of the tariff be set in a way that takes account of the estimated construction and operating costs of typical plants, using the agreed duration of the tariff and a suitable discount rate, and we present typical calculations to support this;
- with regard to structure, that a “declining block” tariff be applied to all plants – this will provide appropriate incentives for efficient construction and operation, and help overcome uncertainties about plant capacity factors;
- an adjustment should be included in the tariff to reflect the impact of inflation on the relevant proportion of plant costs that are affected by domestic inflation;
- that provision be made for a currency adjustment to be applied, as a means of mitigating the € financing risk, and that this should reflect the relative importance of € denominated costs in typical plant costs; and
- that in setting the feed-in tariff the RC should also consider willingness to pay for renewable energy of this type, in comparison with the costs of alternative conventional generation options and the costs of other renewable generation options.

Finally, we also considered the issue of procedures in relation to plants wishing to obtain the feed-in tariff. The existence of the feed-in tariff alone may not be sufficient to ensure that significant quantities of SHPPs are developed going forward, if the procedures for gaining all necessary approvals for the plant are too complex.

We recommend that a “one-stop-shop” arrangement should be introduced, under which a single entity (perhaps the RC) would take responsibility for the administration of all approvals necessary for a SHPP to be established. We also make recommendations with regard to:

- simplifying the process for applications to the RC, so that approval of the plant as eligible for the feed-in tariff and granting of a licence for the plant are combined into a single procedure;
- the RC developing a simplified licence template to apply to all SHPP generators;
- use of a reasonable time limit (for example 2 years) within which it is necessary for an SHPP development to be completed after issue of the licence and approval, to avoid applications from parties who have no serious intent to proceed on a timely basis;
- granting of water concessions, which is the other principal hurdle to be overcome, where we recommend that the RC works together with the relevant Ministries to ensure that this process is made as simple as possible; and
- the need for the RC to work with ESM to establish clear and simple rules on procedures and costs for dealing with connections of SHPP to the network.
5.3. Summary of Results of the Study of Typical SHPP Costs

As part of this project, NERA also commissioned a study of costs for typical SHPPs in Macedonia, and the detailed results of this study are attached in Appendix B. The primary objective of this Study was to produce estimates of the investment and operational costs of a selection of small hydro power plants (SHPPs), across a range of sizes, in order to inform decisions about a feed-in tariff for SHPPs.

In order to be relevant to a potential SHPP programme, it was decided that the criteria for the selected sites should be:

- New facilities, not renovations;
- Those about which most is known regarding site conditions and hydrology;
- The cheapest and most straightforward to develop;
- Only sites with generating capacities between 250kW and 5,000 kW;
- Those with no damming works required; and
- Relatively easy to connect to the distribution system.

A total of 24 SHPP sites were selected, ranging in size from 250 kW up to 5,000 kW. Conditions varied quite widely between plants, in particular the investment costs per kW of capacity and the load factors expected to be achieved by the plants. These variations mean that there is no precise correlation between size of plant and unit costs, though the results show a general trend for unit costs to fall as plant size increases. Placed in order according to their unit costs, the estimated relationship between unit cost and potential capacity is as shown in Figure 5.1.

Figure 5.1
Costs per kW and Estimated Potential Capacity from Studied Plants
The plants studied were not randomly chosen, so it is not possible to extrapolate from the results obtained to the more general situation. But these results suggest that significant SHPP capacity is potentially available at what could be acceptable cost. Ignoring the higher cost plants in each size category, and allowing for the likely range of variations the estimated costs for these plants suggest that a feed-in tariff based on the price ranges shown in Table 5.1 could be attractive to a number of plants in each of the size categories.

**Table 5.1**

**Illustrative Feed-in Tariff - Excluding Higher Cost Plants**

<table>
<thead>
<tr>
<th>Plant Capacity (kW)</th>
<th>Price per kWh (€ cents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 1,000</td>
<td>5.5 to 8.0</td>
</tr>
<tr>
<td>1,001 to 3,000</td>
<td>4.5 to 5.0</td>
</tr>
<tr>
<td>3,001 to 5,000</td>
<td>3.5 to 4.5</td>
</tr>
</tbody>
</table>

*Source: Project team calculations based on estimated project costs*
Appendix A. Draft Rules on Feed-in Tariff Methodology

These Rules shall regulate the method of establishing published feed-in tariffs, approving those tariffs for specific plants, and periodic adjustment of those tariffs according to a specified methodology.

I. GENERAL PROVISIONS

1. Qualifying Plants

1.1 The feed-in tariff provided for in these Rules may apply to any hydro-power generation facilities that:

(i) have an estimated maximum capacity of 10MW or less, based on an assessment of the potential capacity using standard methodology based on normal hydrological data; and

(ii) is a run of river plant, without any significant storage capacity.

1.2 To qualify for the feed-in tariff provided for in these Rules, any hydro-power generation facilities must be:

(i) newly constructed and commissioned on or after [date]; or

(ii) rehabilitated or expanded, with an expenditure of more than [Euros] per MW of nominal capacity, and with the rehabilitated or expanded plant commissioned and constructed on or after [date];

1.3 A specific plant may be declared by the Regulatory Commission as qualifying for a feed-in tariff in accordance with these Rules (a “Qualifying Plant”) where:

(i) the owner or operator of the plant, or the person who intends to develop the plant (the Applicant), makes an application to the Regulatory Commission in accordance with these Rules; and

(ii) the Applicant has received notice from the Regulatory Commission that it has issued a decision that the plant is a Qualifying Plant, and that a feed-in tariff will apply to the plant.

2. Rights and Obligations of the Qualifying Plant Under the Tariff

2.1 Where an Applicant is notified of a decision of the Regulatory Commission that its plant is a Qualifying Plant, that plant shall have the right to sell all its output at the tariff specified in the decision. The plant shall have this right throughout the period
specified in the decision, or for as long as the plant remains in operation, whichever is the shorter period. This right is subject to the following conditions:

(i) that the plant is commissioned and begins production within the time limit specified by the Regulatory Commission; and

(ii) that the plant shall not be permitted to sell any of its output in any other way during the period in which the tariff applies.

2.2 Where the application of a feed-in tariff has been confirmed for a plant, and the plant has commenced in operation, no other decisions or rules of the Regulatory Commission shall have the effect of making any change to the tariff for that plant, except in accordance with the procedures set out in these Rules.

2.3 At the end of the period for which the feed-in tariff applies to a plant, the owner or operator of the plant may either:

(i) submit an application to the Regulatory Commission for another feed-in tariff, if such a tariff is available to the plant at that time; or

(ii) sell its output in any way that the electricity market arrangements existing at that time may allow.

3. Obligations to Purchase at the Feed-in Tariff

Where the Regulatory Commission publishes a decision confirming that the feed-in tariff applies to a plant:

(i) the Market Operator shall be obliged to purchase all the output of that plant at the feed-in tariff; and

(ii) the [distribution licensee] shall take all reasonable steps to provide a connection for the plant to the distribution system, at its published terms and in accordance with the Distribution Grid Code.

4. Changes to the Published Feed-in Tariff

4.1 The Regulatory Commission may review and revise the feed-in tariff from time to time, where it considers that the circumstances in the power sector justify such a change. Such a review shall not be carried out more frequently than once in each year, but shall be carried out at least once every two years. Any change to the tariff shall only become effective after:

(i) the revised tariff has been confirmed by a decision of the Regulatory Commission in accordance with the Regulatory Commission’s procedures at the time; and
(ii) the Regulatory Commission has published details of the new tariff and has given at least [3] months notice of this intention and has allowed Applicants to submit applications for the existing tariff during the notice period.

4.2 Where the Regulatory Commission changes the published feed-in tariff in accordance with these Rules, any such revised tariff shall not apply to any Qualifying Plant that is already subject to a valid feed-in tariff decision.

5. Publication of the Feed-in Tariff

5.1 The RC shall publish from time to time details of the feed-in tariff that will be available to any plant that is confirmed as a Qualifying Plant in accordance with these Rules, including the period for which the tariff will apply to a plant.

5.2 The Regulatory Commission shall also publish any proposed change to the feed-in tariff at least [3] months before the change is intended to take effect.

II. FEED-IN TARIFF PROCEDURES

6. Applications for a Feed-in Tariff

6.1 Applications under these Rules for a feed-in tariff to apply to a plant shall be submitted in accordance with the format specified from time to time by the Regulatory Commission, and shall include all the data [specified in Article 20 of the rulebook]

6.2 Where the Applicant is not licensed as a generator, and would require a licence for the plant under the Law, the application for the feed-in tariff shall also be accompanied by an application for a licence.

6.3 All applications received by the Regulatory Commission under these Rules must, within 14 days of the receipt of the application, be published by the Regulatory Commission on its web site and, at the expense of the Applicant, in two newspapers that circulate in the area to which the application relates. The published notice must:

(i) Contain sufficient details of the application as the Regulatory Commission considers necessary; and

(ii) Invite any interested person to make a submission to the Regulatory Commission on the application.

6.4 Within [1] month of the receipt of an application by the RC, it shall either:

(i) confirm that it considers the application is a valid application and will be considered in accordance with these Rules; or
(ii) return the application to the Applicant, specifying the reasons why it considers that the application is not valid in accordance with these Rules.

6.5 An Applicant may withdraw its application for a feed-in tariff at any time up to the decision of the RC on the application is published, and need not provide any reason for such a withdrawal.

6.6 Applications may be submitted at any stage of development of a project, including before the Applicant has obtained a valid water concession or other necessary permissions. Where an Applicant has not obtained all necessary permissions, the Regulatory Commission may issue a decision that is conditional on all such permissions being obtained.

7. RC Decisions on Applications for a Feed-in Tariff

7.1 Where an Applicant has submitted a valid application for a feed-in tariff to apply to a plant, the Regulatory Commission shall consider the application, and in doing so shall take account of any views submitted to it on the application. Within [3] months of the date of the application, the Regulatory Commission shall make and publish in the Official Gazette of the Republic of Macedonia a decision that either:

(i) confirms that a feed-in tariff applies to the plant, and give details of the tariff and any terms and conditions that apply; or

(ii) rejects the application for the tariff, specifying the reasons it has been rejected.

7.2 Any decision by the Regulatory Commission on the application of a feed-in tariff to a plant must specify:

(i) that the tariff for the plant is the published feed-in tariff that was applicable at the time the application was submitted; and

(ii) the period from the date of the decision within which the plant must be completed and commence the sale of power to qualify for the feed-in tariff.

8. Applicant’s Right not to Proceed

8.1 Where a decision on the feed-in tariff for a plant has been published by the Regulatory Commission, that decision shall not be construed as an obligation on the Applicant to proceed with the construction and operation of the plant.

8.2 However, the feed-in tariff will only be available to a plant where it is completed and the sale of power commenced within the period specified in the Regulatory Commission’s decision on the plant.
9. No Change in Feed-in Tariff for a Plant

Where the Regulatory Commission has published a decision on the application of a feed-in tariff for a plant, and the plant has commenced operation, no change shall be permitted to that feed-in tariff during the period for which the tariff applies as specified in the decision, except where the plant undergoes a major rehabilitation or extension as specified in Article 1.

III. CALCULATION OF THE FEED-IN TARIFF

10. Scope of the Feed-in Tariff

The Regulatory Commission shall calculate the feed-in tariff from time to in accordance with the methodology set out in the Annex, and in accordance with that methodology:

(i) the feed-in tariff is an inclusive tariff, that covers all the energy of the plant and is intended to cover all the costs of the plant, including the costs of providing any ancillary services, backup, or other services that the plant may provide.

(ii) the feed-in tariff shall apply to the quantity of energy that is measured at the metering device provided at the plant, and such metering device shall be subject to any provisions of the Distribution Code, Metering Code or other relevant provisions governing such meters.

(iii) the owner or operator of the plant shall be responsible for covering the costs of any distribution connection or use of system charges from the revenue received from the feed-in tariff.

11. General Principles in the Calculation of the Feed-in Tariff

11.1 The feed-in tariff calculated by the Regulatory Commission from time to time should:

(i) reflect the costs of typical plants, or relevant categories of plants, calculated over the expected lives of the plants;

(ii) take account of the costs of other forms of generation, in particular the costs of other forms of renewable energy, and of policy decisions by the Government on renewable energy.

11.2 The structure of the calculated feed-in tariff may differentiate between:

(i) new plants and existing plants that have undergone significant investment for rehabilitation or expansion;

(ii) the size or output level of plants; or
(iii) such other factors as the RC considers desirable.

11.3 Where the RC considers it desirable, the feed-in tariff may take account of:

(i) expected inflation in the operating costs of the plant;

(ii) the typical breakdown of costs between fixed costs and variable costs

(iii) changes in the value of the MKD relative to the Euro

ANNEX

Methodology for calculation of feed-in tariffs for SHPPs and periodic adjustments to those tariffs

1. Estimated Annual Average Revenue for SHPPs

The Annual Average Revenue (AAR) for SHPPs shall be estimated using available evidence of the costs of SHPPs of different types, and shall cover all the costs of generating electricity, including a level of regulated return on capital. More than one AAR may be calculated, where the Regulatory Commission considers there is evidence that the value of the AAR differs significantly by type or size of plant. A separate AAR may also be calculated in respect of plants that have been rehabilitated or expanded.

The AAR shall be calculated in real terms on the basis of MKD per kW per year, using the discounted cash flow method over a [20] year period. It shall be calculated using a discount rate equal to the WACC, so that over the [20] year period all the following costs are covered:

- Operating and maintenance costs;
- Capital employed.

1.1 Operating and maintenance costs

These shall be the estimated annual costs of the operation and maintenance of the plant that are expected to be incurred to maintain the plant in production in accordance with normal technical standards that are applied in the Republic of Macedonia. These costs will include
the costs of materials, spare parts and other maintenance items, salaries of staff and management, and other miscellaneous costs.

### 1.2 Capital employed

This shall be the value invested in the acquisition of the relevant assets that are necessarily employed in the development and operation of the plant. The capital employed shall include the costs of the connection of the plant to the distribution system or transmission system, as incurred by the plant owner or operator. The cost of this capital employed shall be fully recovered over the [20] year period.

### 1.3 WACC

The weighted average cost of capital is the rate of return that is estimated to be needed to attract capital investments in SHPPs in Macedonia, taking into account the risk level of SHPPs under the feed-in tariff scheme.

The weighted average cost of capital is calculated according to the following formula:

\[ \text{WACC} = \sum \text{Weighted Capital} \times \text{Cost of Capital} \]

[as in the Rulebook for electricity generating companies – but it should be clarified that the cost of debt is to be the cost of debt in Euros ]

### 2. Conversion of the AAR to a Published Feed-in Tariff

The AAR for each plant type shall be converted by the Regulatory Commission into a published feed-in tariff applicable to specific plants using levels of plant utilisation that are estimated to be achievable in the conditions that exist for such plants in Macedonia. The conversion of the AAR into a tariff may be on the basis of:

1. a price in MKD per kWh produced; or
2. a combination of a price in MKD per kWh produced, plus a fixed annual payment in MKD per kW of capacity, where the Regulatory Commission considers such a fixed payment to be desirable to reduce the risks faced by plant operators.

But where a fixed payment per kW of capacity is determined as part of the tariff, the Regulatory Commission shall ensure that the price paid per kWh is sufficiently large to provide an incentive to the plant operator to operate the plant efficiently.

### 3. Periodic Adjustments to the Feed-in Tariff

The published feed-in tariffs payable to qualified SHPPs may include annual adjustments that are determined according to the following methodology.

#### 3.1 Exchange rate adjustments
To calculate the adjustment to the feed-in tariff applying to a plant to take account of the change of the value of the MKD relative to the Euro, the following formula will be used.

\[ FIT_t = FIT_{t-1} \left( 1 + \frac{(ER_t - ER_{t-1})}{ER_{t-1} \times WER} \right) \]

Where:

- \( FIT_t \) = feed-in tariff in year \( t \)
- \( FIT_{t-1} \) = feed-in tariff in year \( t-1 \)
- \( ER_t \) = the weighted average MKD/Euro exchange rate in period \( t \), expressed in terms of MKD per Euro
- \( ER_{t-1} \) = the weighted average MKD/Euro exchange rate in period \( t-1 \), expressed in terms of MKD per Euro
- \( WER \) = a weighting factor [to be determined by the RC] reflecting the importance of Euro denominated borrowings in the costs of a typical SHPP

Where it appears to the RC that a substantial fluctuation in the MKD/Euro exchange rate is taking place that may threaten the financial viability of generators, it may decide to make interim adjustments based on this formula more frequently than once a year.

*Note: this formulation applies a retrospective adjustment to take account of the MKD/Euro exchange rate in the previous year. No adjustment would be made in the first period of operation of the plant, but would be adjusted annually thereafter.*

**3.2 Inflation adjustment**

To calculate the adjustment to the feed-in tariff applying to a plant to take account of domestic inflation, the following formula will be used.

\[ FIT_t = FIT_{t-1} \left( 1 + \frac{(CPI_t - CPI_{t-1})}{CPI_{t-1} \times WI} \right) \]

Where:

- \( FIT_t \) = feed-in tariff in year \( t \)
- \( FIT_{t-1} \) = feed-in tariff in year \( t-1 \)
- \( CPI_t \) = the value of the consumer price index for Macedonia at the end of period \( t \), from the official data published by the State Statistical Office
- \( CPI_{t-1} \) = the value of the consumer price index for Macedonia at the end of period \( t-1 \), from the official data published by the State Statistical Office
- \( WI \) = a weighting factor [to be determined by the RC based on evidence from typical cost structures of plants] reflecting the importance domestic inflation in the costs of a typical SHPP
Appendix B.  Detailed Results of the Cost Study

Please see the results of the Cost Study that are submitted as a separate document.