



Connection of the Distributed Generation to the Electrical Grid

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Goals of the Study

- **Analysis of present state in the field of distributed generation (DG) grid connection**
- **Determine potential obstacles and propose solutions for more effective and transparent system for DG grid connection**
- **Propose the base for determination of the DG grid connection expenses (connection charging)**

Current European Practices

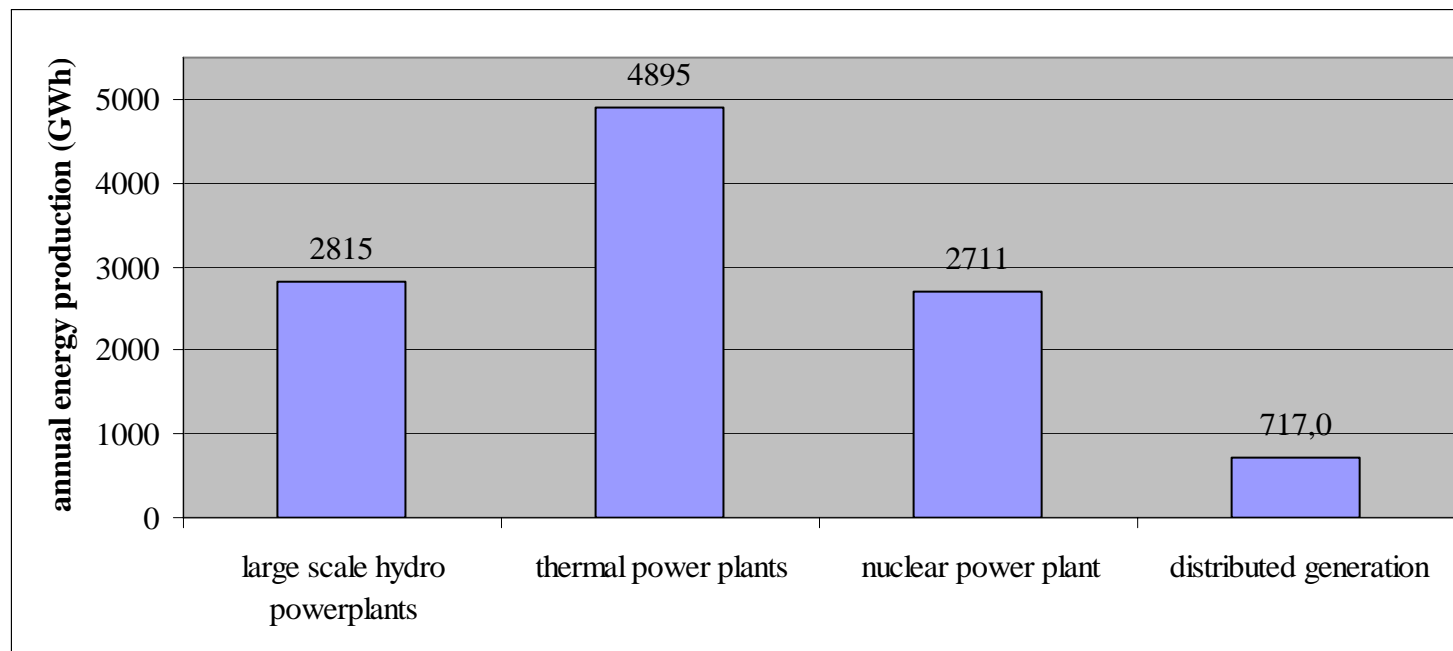
The legislative and regulatory framework relating to connection of the DG varies significantly.

If focused on connection charging we can recognize three main principles regardless previously mentioned differences:

- **shallow connection charging method** – DG pays only for the cost of equipment needed to make the physical connection to the grid (4)
- **mixed connection charging method** – A hybrid of the shallow and deep charging methods (3)
- **deep connection charging method** - DG pays for all costs associated with its connection (8)

Slovenian Electricity Production in Figures

Slovenian electricity production (2007) was 11,14 GWh

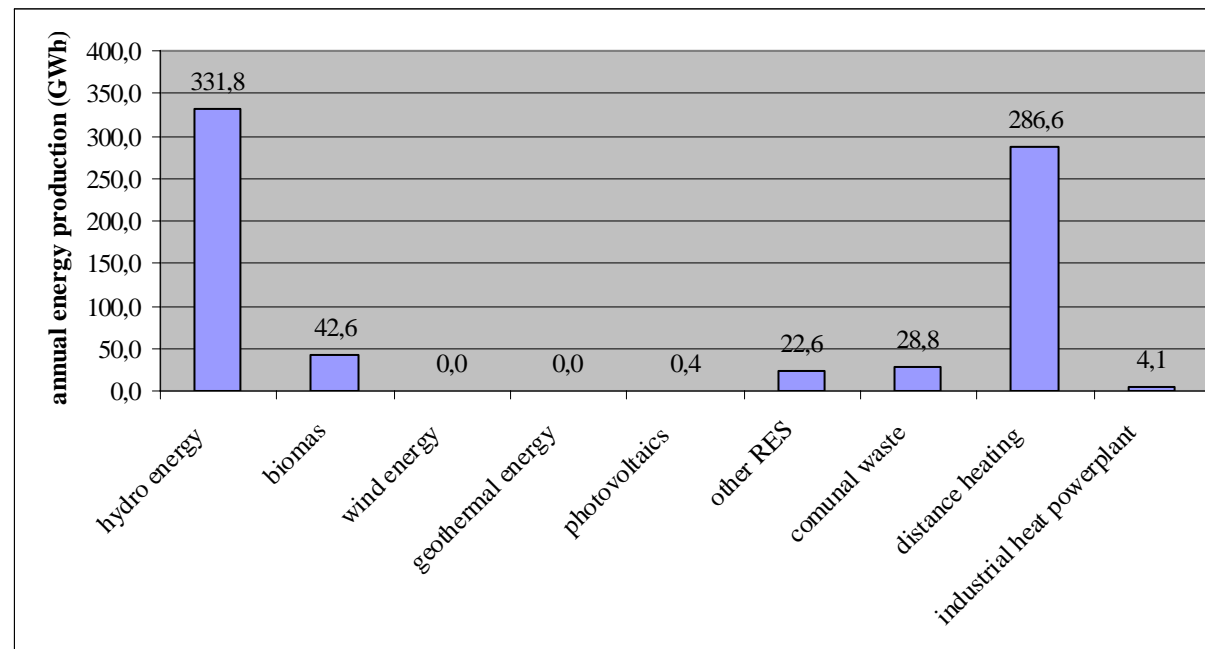


* data for 2007

Slovenian Distributed Generation in Figures

Installed capacity of DG power plants in the system – 148 MW

Number of DG power plants in the system – 461



* data for 2007

Required Steps for Installation of the DG

1. Elaboration of the Basic Technical Design of the PV plant.
2. Request for the criteria for connection to the electrical grid.
3. Obtaining of criteria for connection by the grid operator.
4. Elaboration of the Feasibility study for the PV plant.
5. Decision for construction.
6. Elaboration of the Project for construction permit made by and authorised institution.
7. Basic design for Connection to electrical grid.
8. Application for Consent for the connection to the electrical grid.
9. Obtaining of the Consent for the connection by the grid operator.
10. Application for the Construction Permit has to be made
11. Obtaining of construction permit (for bigger PV plants) by the Regional Regulatory Authorities.
12. Tendering for selection of a qualified Supplier and Installer of the PV plant.
13. PV plant construction.
14. Elaboration of the project of the Executed works and for Operation
15. Request for inspection for connection
16. Inspection by DSO regarding connection, protection and measuring devices.
17. Temporary Connection to the electrical grid and temporary operation.
18. Request for inspection by the authorised state Inspectorate.
19. Inspection of the Inspectorate of RS for Energy and Mining.
20. Issuing of the Permit for operation.
21. Request for the contract for connection.
22. Signing of the contract with the grid operator for connection to the grid.
23. Request for the offers for selling of the produced electricity.
24. Signing of the contract with the selecting Electricity trading company.
25. For getting the feed in price the following procedure is required after the PV plant construction:
 26. Application for the Declaration of the plant.
 27. Getting the Declaration of the plant by the Regulatory Energy Agency (AE).
 28. Application and registration for Certificate of Origin.
 29. Getting the Certificate of Origin by the Regulatory Energy Agency (AE) in collaboration with the Centre for Subsidies (CS).
 30. Getting the formal Order by Energy Agency (AE) for the subsidy (higher electricity price).
 31. Signing of the contract with the Centre for Subsidies (CS) for guaranteed higher price or operational support.
 32. Provisional payments by the Centre for Subsidies according the provisional Certificates of Origin.
 33. Submission of the Certificate of Origin verified by Energy Agency (AE).
 34. Final payment at the end of each year by the Centre for Subsidies, according the final issued Certificates of Origin.
 35. With this operation the Certificates of Origin are consumed.

Legislations Which Influence the DG Connection (1)

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| <p>1. Energetski zakon - uradno prečiščeno besedilo (EZ-UPB2) s spremembami (EZ-C) – Ur. l. RS, št. 27/2007 in 70/2008;</p> <p>2. Zakon o graditvi objektov – Ur. l. RS, št. 102/04, 14/05 – popravek 92/05, 111/05 – odločba US, 93/05, 120/06 – odločba US in 126/07;</p> <p>3. Zakon o prostorskem načrtovanju – Ur. l. RS, št. 33/07 in 70/08;</p> <p>4. Zakon o varstvu okolja – Ur. l. RS, št. 39/06, 28/06, 49/06, 66/06 – odločba US, 33/07, 57/08 in 70/08;</p> <p>5. Pravilnik o načinu označitve in organizacije ureditve gradbišča, o vsebini in načinu vodenja dnevnika o izvajanju del in o kontroli gradbenih konstrukcij na gradbišču – Ur. l. RS, št. 66/2004;</p> <p>6. Pravilnik o projektni in tehniški dokumentaciji – Ur. l. RS, št. 66/2004;</p> <p>7. Pravilnik o dokazilu o zanesljivosti objekta – Ur. l. RS, št. 55/2008;</p> <p>8. Resolucija o nacionalnem energetskem programu (ReNEP) – Ur. l. RS, št. 57/2004;</p> <p>9. Uredba o vzdrževalnih delih v javno korist na področju energetike – Ur. l. RS, št. 125/2004;</p> <p>10. Uredba o vrstah objektov glede na zahtevnost – Ur. l. RS, št. 37/2008;</p> <p>11. Uredba o splošnih pogojih za dobavo in odjem električne energije (prenosno omrežje) – Ur. l. RS, št. 117/02 in 21/03;</p> <p>12. Splošni pogoji za dobavo in odjem električne energije iz distribucijskega omrežja električne energije – Ur. l. RS, št. 126/07;</p> <p>13. Sistemska obratovalna navodila za prenosno omrežje električne energije – Ur. l. RS, št. 49/2007;</p> <p>14. Pravilnik o sistemskem obratovanju distribucijskega omrežja za električno energijo – Ur. l. RS, št. 123/2003;</p> | <p>15</p> <p>16</p> <p>17</p> <p>18</p> <p>19</p> <p>20</p> <p>21</p> <p>22</p> <p>23</p> <p>24</p> | <p>Uredba o načinu izvajanja gospodarske javne službe dejavnost sistemskega operaterja distribucijskega omrežja električne energije in gospodarske javne službe dobava električne energije tarifnim odjemalcem - Ur. l. RS, št. 117/04 in 23/07;</p> <p>Uredba o koncesiji gospodarske javne službe dejavnost sistemskega operaterja distribucijskega omrežja električne energije - Ur. l. RS, št. 39/2007;</p> <p>Sklep o določitvi upravljalcev distribucijskih omrežij električne energije v RS – Ur. l. RS, št. 54/2000;</p> <p>Sklep o določitvi cen za dobavo električne energije za gospodinjstva odjemalce in cene za pokritje stroškov dobavitelja pri dobavi električne energije – Ur. l. RS, št. 27/2007;</p> <p>Uredba o pravilih za določitev cen in za odkup električne energije od kvalificiranih proizvajalcev električne energije – Ur. l. RS, št. 25/2002;</p> <p>Sklep o cenah in premijah za odkup električne energije od kvalificiranih proizvajalcev električne energije – Ur. l. RS, št. 65/08, 98/08 in 105/08;</p> <p>Pravilnik o dodeljevanju sredstev za spodbujanje učinkovite rabe energije in izrabe obnovljivih virov – Ur. l. RS, št. 49/03 in 38/05;</p> <p>Pravilnik o spodbujanju učinkovite rabe energije in rabe obnovljivih virov energije – Ur. l. RS, št. 89/2008;</p> <p>Uredba o načinu določanja in obračunavanja prispevka za zagotavljanje podpor proizvodnji električne energije v soproizvodnji z visokim izkoristkom in iz obnovljivih virov – Ur. l. RS, št. 2/2009;</p> <p>Sklep o določitvi višine prispevka za zagotavljanje podpor proizvodnji z visokim izkoristkom in iz obnovljivih virov – Ur. l. RS, št. 8/2009;</p> |
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Legislations Which Influence the DG Connection (2)

25	Uredba o načinu določanja in obračunavanja prispevka za zagotavljanje zanesljive oskrbe z električno energijo z uporabo domačih virov primarne energije – Ur. l. RS, št. 8/2008;	37	Standard SIST HD 637 S1 za elektroenergetske naprave nad 1 kV izmenične napetosti – standard kot pravilnik še ni izšel v Ur. l. RS;
26	Sklep o določitvi višine prispevka za zagotavljanje zanesljive oskrbe z uporabo domačih virov primarne energije za proizvodnjo električne energije – Ur. l. RS, št. 8/2009;	38	Standard SIST EN 50160 za kvaliteto proizvoda električna energija;
27	Uredba o izdaji deklaracij za proizvodne naprave in potrdil o izvoru električne energije – Ur. l. RS, št. 8/2009;	39	Pravilnik o tehniških predpisih za strelovode – Ur. list SFRJ, št. 13/1968;
28	Uredba o izvedbi javnega razpisa za zagotavljanje zanesljive oskrbe z električno energijo z uporabo domačih virov primarne energije – Ur. l. RS, št. 19/2009;	40	Pravilnik o spremembah in dopolnitvah pravilnika o požarni varnosti v stavbah – Ur. l. RS, št. 31/04, 10/05 in 83/05;
29	Uredba o obveznih meritvah na proizvodnih napravah, ki prejemajo za proizvedeno električno energijo potrdila o izvoru in podpore – Ur. l. RS, št. 21/2009;	41	Pravilnika o tehničnih normativih za varstvo elektroenergetskih postrojev in naprav pred požarom – Ur. list SFRJ, št. 74/1990;
30	Uredba o tarifnem sistemu za prodajo električne energije – Ur. l. RS, št. 36/2004;	42	Tehniški predpisi za obratovanje in vzdrževanje elektroenergetskih postrojev – Ur. list SFRJ, št. 19/1968;
31	Uredba o energetske infrastrukturi – Ur. l. RS, št. 62/2003;	43	Nova Zelena knjiga za nacionalni energetske program Slovenije
32	Pravilnik o tehničnih normativih za NN električne inštalacije – Ur. l. SFRJ, št. 53/1988;	44	Osnutek Sistemskih obratovalnih navodil za distribucijsko omrežje s strani SODO
33	Pravilnik o zaščiti stavb pred delovanjem strele – Ur. l. RS, št. 28/2009;		
34	Navodila za priključevanje in obratovanje elektrarn inštaliranih moči do 10 MW (navodila DES, sprejeta na GIZ DES oktobra 2007);		
35	Tehniški predpisi za zaščito elektroenergetskih postrojev pred prenapetostjo – Ur. list SFRJ, št. 7/1971;		
36	Pravilnik o tehniških normativih za elektroenergetske postroje nazivne napetosti nad 1000 V – Ur. list SFRJ, št. 4/1974;		

Conclusions About the Procedure for Grid Connection of the DG

**Procedure often too complicated and long-lasting
(35 required steps from the idea to the operation of the DG)**

Extensive legislation (44 documents)

Steps toward the changes:

- **Find the possibilities to reduce or merge parts of the procedure.**
- **Changes in legislations (problem could occur as change of legislation could be long and effect could be negative if changes are not prepared cautiously).**
- **Therefore we must seek common interests of all involved parties (DG investor, TSO/DSO, government) and emphasise them.**

Breaking Up the Problem

During the connection of the DG to the electrical grid several different aspects of responsibilities, interests and rights occurs (for all parties involved).

Division of the DG grid connection into three aspects:

- **technical**
- **economic**
- **system**

Technical Aspect

According to this aspect we must not neglect the influence of the DG onto the grid operation and electrical power quality.

Rational way of division of different DG is according to operational regime and operational characteristic such as:

- **connected power**
- **annual energy production**
- **voltage level**
- **existent grid characteristic**

Economic Aspect

Economical aspect are mainly influenced by:

- **construction and operation of the DG**
- **connectional to the electrical network and necessity of electrical network reinforcement**

Expenses occurred due to the connection of DG to the electrical grid can be divided into two categories:

- **direct connection expenses (connection equipment, measurements, protection,...)**
- **subsidiary connection expenses (reinforcement of the network, new lines,...).**

Economic Aspect

Occurred expenses can be determined by the direct and normalised method.

Direct method:

- **expenses are determined for each case individually**
- **this way could be just, but it is time consuming**
- **due to the case to case principle transparency suffers**
- **often leads to negotiation, where conditions for small DG are usually unfair**
- **future network development could not be easily considered**

Normalised method:

- **more transparent procedure**
- **les time consuming**
- **easier way to determine final expenses of DG in planning phase**

Economic Aspect

Expenses for the connection of DG can be paid by:

- **DG investor or**
- **TSO/DSO**

In shallow approach the direct costs are charged to DG investor while subsidiary connection costs are charged to TSO/DSO.

Expenses charged to DG investor increase the investment costs.

Expenses charged to TSO/DSO can be obtained by rates charged to consumers.

By obliging the TSO/DSO to bare costs subsidiary government can stimulate investments into the DG.

System Aspects

Three parties are involved in the process of DG grid connection:

- **DG investor**
- **TSO/DSO**
- **government**

Substantial reduction of the procedure (toward the plug in/plug out principle) for small DG (households, small businesses) connected to the existent connection point.

Merging and reducing of necessary steps for the DG connection procedure (especially concerning smaller systems with relatively small impact to the network).

System Aspects

In case of need for long connection power lines for new DG the burden sharing should be considered.

TSO/DSO should include new power lines and reinforcements due to the occurrence of new DG in its annual plans which are approved by the government.

Seeking common goal

GOVERNMENT

Tasks

- legislation changes
- introduction of ecological zones
- adjustment of tariffs

achieving of planed shares of "green" electricity

TSO/DSO

Tasks

- preparation of technical guidelines for DG connection
- planning of network reinforcements
- steps toward the smart grid

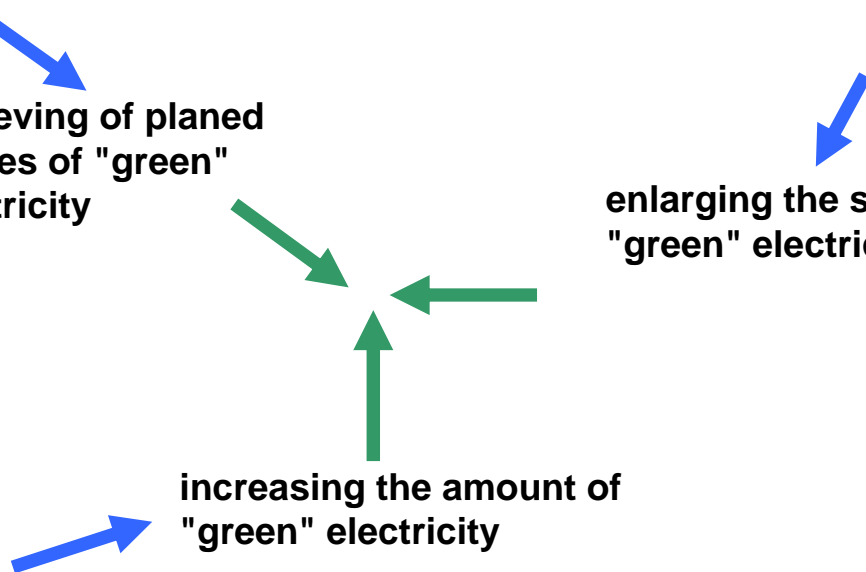
enlarging the share of "green" electricity

DG investor

Tasks

- constructing the DG according to the legislations and technical demands

increasing the amount of "green" electricity



Thank you for your attention.

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