



## **A review of net metering mechanism for electricity renewable energy sources**

**Andreas Poullikkas<sup>\*</sup>, George Kourtis, Ioannis Hadjipaschalis**

Electricity Authority of Cyprus, P.O. Box 24506, 1399 Nicosia, Cyprus.

### **Abstract**

In this work, an overview of the net metering mechanism for renewable energy sources for power generation (RES-E) systems is carried out. In particular, the net metering concept is examined with its benefits and misconceptions. Furthermore, a survey of the current operational net metering schemes in different countries in the world, such as, in Europe, USA, Canada, Thailand and Australia, is carried out. The survey indicated that there are different net metering mechanisms depending on the particularities of each country (or state in the case of USA). Especially, in Europe, only five countries are using net metering in a very simple form, such as, any amount of energy produced by the eligible RES-E technology is compensated from the energy consumed by the RES-E producer, which results to either a less overall electricity bill or to an exception in payment energy taxes. In the USA and the USA territories, any customer's net excess generation is credited to the customer's next electricity bill for a 12-month billing cycle at various rates or via a combination between rates. The actual type of net excess generation (NEG) credit is decided by a number of set criteria, such as the type of RES-E technology, the RES-E capacity limit, the type of customer and the type of utility. Regarding any excess credit at the end of the 12-month billing cycle, this is either granted to the utilities, or carries over indefinitely to the customer's next electricity bill, or is reconciled annually at any rate, or provides an option to the customer to choose between the last two options.

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### **1. Introduction**

A feed-in tariff (FiT) scheme provides a guaranteed premium price to the green electricity producer and put an obligation on the grid operators to purchase the generated electricity output. The price is typically guaranteed for a long period in order to encourage investment in new renewable energy sources for power generation (RES-E) plants. FiT schemes are supply-side measures that push green electricity onto the market and are mostly used for the promotion of RES-E technologies in Europe. These schemes are well known for their success in deploying large amounts of wind, biomass and solar energy (both photovoltaics (PV) and concentrated solar power systems) mainly in Germany, Denmark and Spain [1-3]. The biggest advantage of FiT schemes is the long-term certainty of financial support, which lowers investment risks considerably [4, 5]. An overview of the FiT supporting schemes available in Europe is provided in [6].

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\* Parts of this work were undertaken while the author was a Visiting Professor in the Department of Mechanical Engineering, College of Engineering, American University of Sharjah, PO Box 26666, Sharjah, United Arab Emirates.

In this work, an overview of the net metering mechanism for RES-E systems is carried out. In particular, the net metering concept is examined with its benefits and misconceptions. Furthermore, a survey of the current operational net metering schemes in different countries in the world, is carried out. In section 2, the net metering concept is discussed and in section 3 the net metering benefits and misconceptions are described. The survey of the current operational net metering schemes in different countries in the world is presented in section 3. The conclusions are summarised in section 4.

## 2. The net metering concept

Net metering is an electricity policy which allows utility customers to offset some or all of their electricity use with self produced electricity from RES-E systems [3]. Net metering works by utilizing a meter that is able to spin and record energy flow in both directions. The meter spins forward when a customer is drawing power from the utility grid (i.e., using more energy than they are producing) and spins backward when energy is being sent back to the grid (i.e., using less energy than they are producing) [7, 8]. At the end of a given month, the customer is billed only for the net electricity used. Net metering works only for grid connected systems and what makes it so beneficial, besides offsetting a home's energy consumption with a RES-E system, is that excess energy sent to the utility can be sold back at retail price [9, 10]. If more energy is produced than consumed, producers receive benefit for this positive balance, such as, renewable energy credits (REC), which is credited on the customer's account toward the next billing cycle. If at the end of the year a surplus remains, then the customer depending on the utility policy may (a) paid for the total REC collected at avoidance cost rate or retail cost rate, or, (b) the total REC collected can be transferred and could be used as a compensation for a possible negative balance in the following years, or, (c) the total REC collected are granted back to the utility [11].

An example of how net metering works, can be illustrated by the following description of a typical day of a residential customer. Such a customer would wake up early for his job and usually on most days, will be out of the house before sunrise. In these dark morning hours, the only consumption would concern the making of coffee and breakfast and watching the morning news on TV. Therefore, the electric meter spins forward as the customer consumes electricity from the grid. When the customer leaves the house for work, the solar panels start producing electricity as the sun rises and this electricity is provided to the grid. The meter now spins in reverse. When the customer returns at night to cook dinner and relax in front of the TV, the meter spins forward again as more electricity is consumed than produced. In this typical day, the customer's bill will record only his net consumption of electricity from the grid. Should it be a hot sunny month (when the grid needs the most help), or a month in which the customer's consumption of electricity is low, any excess electricity the system generates is rolled over to the next bill. Net metering allows for the production of electricity that reduces demand on a strained grid. For the utility, this is exactly the same result as if the customer had installed a more efficient refrigerator. The only way the utility would know the difference between using more efficient technologies (such as a refrigerator) and the use of customer sited distributed generation (DG) (such as a PV system), is if the utility installed a costly additional meter at customer's home and undertook the burden and expense of reading both meters and billing the customer for the result of this process [12].

Some variations of the net metering mechanism are the time of use (TOU) metering and the market rate metering. TOU net metering employs a specialized reversible smart meter that is programmed to determine electricity usage any time during the day [13-15]. TOU allows utility rates and charges to be assessed based on when the electricity was used, i.e., day or night and seasonal rates. Typically the production cost of electricity is highest during the daytime peak usage period and low during the night, when usage is low. TOU metering is a significant issue for RES-E, since, for example, solar power systems tend to produce energy during the daytime peak-price period, and produce little or no power during the night period, when price is low. In market rate net metering systems, the user's energy use is priced dynamically according to some function of wholesale electric prices [16]. The users' meters are programmed remotely to calculate the value and are read remotely. Net metering applies such variable pricing to excess power produced by qualifying systems [17]. Market rate net metering systems have been implemented in California since 2006 and under the terms of California's net metering rules are applicable to qualifying PV and wind systems. Under California law the payback for surplus electricity sent to the grid must be equal to the (variable, in this case) price charged at that time. It can never be negative, meaning you cannot make money from selling the electricity back [18]. If you generate more electricity than you use then over a period of a month you will be billed zero and not make any money, in effect you give away your extra energy if you do not use it.

Net metering enables small systems to result in zero annual net cost to the consumer provided that the consumer is able to shift demand loads to a lower price time, such as by chilling water at a low cost time for later use in air conditioning, or by charging a battery electric vehicle during off-peak times, while the electricity generated at peak demand time can be sent to the grid rather than used locally [19]. No credit is given for annual surplus production.

### 3. Benefits and misconceptions

There are benefits that accrue to the utility, the customer, and the community from net metering. For the utility, a well-designed net metering policy provides a simple, low cost, and easily administered way to deal with PV residential systems. Utilities obtain electricity and capacity from small, distributed PV installations. This is electricity they don't have to generate themselves or purchase on the market. For PV systems, this generation takes place every day of the year with a very high correlation with utility peak loads. Utilities call this a high load carrying capability since sunshine is relatively easy to predict. Thus, utilities obtain the benefit of additional capacity in their service territory paid for by their customers [20]. PV residential systems can, also, strengthen the distribution grid, especially in rural areas. This is because voltage tends to drop at the end of long distribution lines when loads are high, and if it drops below a threshold level, the breakers will trip and a temporary blackout occurs. Grid connected PV systems tied to the distribution grid strengthen voltage and improve overall service. And this grid support can defer maintenance and upgrades in the power distribution system, which is a tangible benefit to utilities. Customers benefit from net metering of PV residential systems because they obtain a long-term guarantee of low utility bills. Communities benefit from the investment in local generation. This investment not only increases local property values but increases local business opportunities as well. It is the difference between paying rent and paying a mortgage [21].

There are also some misconceptions about net metering, such as that net metering hurts the utility bottom line by reducing revenues. This argument is similar to the one against energy efficiency that customers reducing their purchases of electricity hurt utility revenues [22-24]. This would be true if all households bought a PV system and put it on their roofs. The current market is small and does not affect even a fraction of a percentage point on a bottom line of any utility that reports these figures publicly. Nevertheless, any net metering policy should receive regular review to monitor progress of the technology and development of the market [25]. If PVs, and especially energy efficiency, which has a much larger potential for impacting rates than PVs, gets to the point where it actually reduces utility revenues, then rates should be restructured to guarantee that service.

Another misconception is that net metering represents a subsidy from one group of customers to another. This argument has to do with the methodology that utilities use to charge customers. The argument is that utilities charge all customers in the same class a single rate, which represents an average cost of doing business plus profit. Thus a household who uses a lot of electricity during the day when the cost of obtaining electricity is higher pays the same as the household who uses electricity at night during off-peak hours. One could argue that one type of consumer subsidizes another based on patterns of consumption, etc. Utilities and their customers have supported this averaging formula for years. For example, building a new home represents a cost for a utility because it must invest in new generating capacity in order to supply this electricity. Therefore, customers subsidize solar systems through net metering no more than they subsidize construction of new homes. Both represent expanding business opportunities, and electric utilities have figured out a way to accommodate this economic growth through existing rate structures for more than a century [26].

A final misconception is that net metering represents a burden for small utilities. The opposite is actually true because large organizations are better equipped to handle more complicated arrangements. Net metering is as simple as it gets to administer because it requires no special equipment, no new rates to establish and no new procedures. All that is required is that the utility adds a line in the ledger for each net metering customer to carry forward credits until the end of the year. Compare this with the alternative of FiT supporting scheme, which requires installation of another meter. Then the utility must make special trips to read this meter and readjust its accounting procedures to keep track of another meter for a single account. A survey found that the cost of reading the extra meters for residential PV systems alone outweighed the cost of net metering [17].

#### 4. Net metering schemes around the world

In this section, the current existing electricity net metering schemes that are in operation in different countries around the world are presented.

##### 4.1 Europe

In Europe, only Belgium, Cyprus, Denmark, Italy and the Netherlands are using net metering. In particular, in Belgium, in the Brussels region small RES-E autoproducers with a capacity up to 5kW are eligible for net metering. In order to benefit from net metering the installation shall be equipped with two different meters, a bi-directional and a green meter, which would measure the electricity produced by the RES-E autoproducer. The compensation applies for the amount of electricity fed into the distribution grid, in the case that this does not exceed the amount of electricity taken from the grid, for the period between two meter readings. However, the amount of electricity fed into the grid cannot be entitled to labels of guaranteed origin [27]. In the Flanders region of Belgium, all RES-E installations up to 10kW are eligible to the net metering scheme. There is no direct financial compensation for the injected electricity, but the financial equivalent of the injected electricity is deducted from the overall electricity bill. However, if an installation feeds more electricity into the grid than it has taken from the grid during a billing period, this amount is not financially reimbursed. In the Wallon region of Belgium small RES-E autoproducers with a capacity up to 10kVA are eligible for net metering. The compensation applies for the amount of electricity fed into the distribution grid, in the case that this does not exceed the amount of electricity taken from the grid, for the period between two meter readings. The compensation mechanism remains valid only during the technical life span of the installation.

In Cyprus, the net metering concept was recently investigated and as a result the net metering scheme will be initially introduced in a pilot phase for residential PV installations at different geographical locations in Cyprus [9]. During the trial period maximum capacity limits will be established, both for the total eligible PV capacity to be installed under the net metering supporting scheme and eligible PV system capacity installed per installation. The evaluation of the net metering scheme at the end of the trial period will carefully consider the effects of network usage fees, long-term reserve and ancillary services and the possibility for additional security network infrastructure installations such as harmonic filters.

In Denmark, the regulation on net metering for the electricity producers for own needs is based on the act on electricity supply and authorizes the exception of certain producers from Public Service Obligation (PSO), which is a surcharge that every consumer is obliged to pay and it depends on each consumer's individual level of consumption [28]. According to this, the RES-E systems that use all or part of the electricity produced for their own needs have a completely or partially exception from PSO. The surcharge for the support of RES-E is part of the PSO. The eligible RES-E systems, which have an exception from the whole PSO, are PV systems up to 50kW, wind energy plants up to 25kW and other RES-E technologies up to 11kW. The eligible RES-E systems, which have an exception from the surcharge for the support of RES-E, are PV systems of more than 50kW, wind energy plants of more than 25kW and other RES-E technologies of more than 11kW.

In Italy, RES-E systems up to 20kW or from 20kW up to 200kW, which have been commissioned after 31 December of 2007, can consume as much energy they produce for free. If more energy is produced than consumed, producers receive RECs for this positive balance, which will be available for an unlimited period of time and could be used as a compensation for a possible negative balance in the following years. If the energy produced is less than their consumption, the difference is subject to a payment.

In the Netherlands, RES-E systems which are connected to the electricity grid through a small scale connection up to 240A are eligible and would have to pay energy taxes only to the net electricity consumption of their systems [29]. However, the RES-E producers have to pay a grid use charge for injecting electricity to the grid [6, 30].

##### 4.2 Australia

In some Australian states, the FiT is actually net metering, except that it pays monthly for net generation at a higher rate than retail. A FiT requires a separate meter, and pays for all local generation at a preferential rate, while net metering requires only one meter [31, 32]. The financial differences are very substantial. From 2009, in the state of Victoria, householders will be paid 60AU\$/kWh for every excess kWh of energy fed back into the state electricity grid. This is around three times the current retail price

for electricity. For the state of Queensland, commencing in 2008, the Solar Bonus Scheme pays 44AU\$/kWh for every excess kWh of energy fed back into the state electricity grid. This is also around three times the current retail price for electricity.

#### 4.3 Canada

Ontario of Canada allows net metering for up to 500kW, however, RECs can only be carried for 12 consecutive months. Should a consumer establish a REC where they generate more than they consume for 8 months and use up the RECs in the 10th month, then the 12-month period begins again from the date that the next credit is shown on an invoice. Any unused RECs remaining at the end of 12 consecutive months of a consumer being in a REC situation are cleared at the end of that billing. Areas of British Columbia are allowed net metering for up to 50kW. At each annual anniversary the customer is paid 9.99CA\$/kWh if there is a net export of power. Systems over 50kW are covered under the Standing Offer Program. South Central British Columbia also allows net-metering for up to 50kW. Customers are paid their existing retail rate for any net energy they produce [33, 34]. New Brunswick of Canada allows net metering for installations up to 100kW. RECs from excess generated power can be carried over until March at which time any excess RECs are lost.

#### 4.4 Thailand

In Thailand, solar, wind, micro hydroelectricity, biomass or biogas generators up to 1MW per installation that produce less than they consume in a monthly period receive the retail tariff rate for electricity fed onto the grid [35]. For net excess production, producers are compensated at the bulk supply tariff, which is the average cost of generation and transmission in Thailand and it is about 80% of the retail rate.

#### 4.5 USA

In the USA, all public electric utilities are required by legislation to make available upon request net metering service to their customers. Details concerning the net metering policies for the US states are tabulated in Table 1. Overall 47 states apply net metering mechanism for the promotion of RES-E technologies, with the exception of Alabama, Mississippi, South Dakota and Tennessee [36]. Most of the states place a capacity limit for the eligible RES-E technologies for net metering, except for the customers of investor-owned utilities (IOU) and the electric cooperatives of the state of Arizona, the state of New Jersey, Ohio and for the customers of Ashland Electric in the state of Oregon. Also, 28 states employ aggregate capacity limit for their net metering mechanism which is expressed as a percentage of the state's utility's peak demand [37].

In 30 states any customer's net excess generation (NEG) is credited to the customer's next electricity bill for a 12-month billing cycle at the retail rate, whereas in 5 states it is credited at the state's utility's avoided cost rate [38]. Also, in 4 states the NEG is credited at various other rates, such as (a) the TOU rate, (b) a rate predetermined by the utility and (c) as a percentage of either the retail or the avoided cost rate. Furthermore, in 8 states the NEG is credited to the customer's next electricity bill via a combination between retail rate and avoided cost rate or, between retail rate and any one of the other various rates as mentioned above. The actual type of NEG credit is decided by a number of set criteria, such as the type of RES-E technology, the RES-E capacity limit, the type of customer and the type of utility.

Regarding any excess credit at the end of the 12-month billing cycle, in 11 states this is granted to the utilities, whereas in 8 states it carries over indefinitely to the customer's next electricity bill. In 6 states the excess credit is reconciled annually at the avoided cost rate and in 5 states at any one of the various other rates mentioned above. One state grants any excess credit back to the utility every month and two states offer the option to their customers to credit any excess credits at the end of the annualized period at any rate or granted to the utilities. Finally, 8 states offer the option to their customers to credit any excess credits at the end of the annualized period either indefinitely to their next electricity bill or to receive payment at any rate. The net metering mechanism in the state of California, Connecticut, Illinois and Kentucky is described in more detail below.

##### 4.5.1 California

California's net metering applies to all utilities with one exception. Publicly-owned electric utilities with more than 750,000 customers which also provide water are exempt from offering net metering [39, 40]. Net metering applied to wind energy systems, solar-electric systems, hybrid (wind/solar) systems biogas-electric facilities up to 1MW, fuel cells up to 45MW within the service territory of a utility with a peak

demand of at least 10,000MW, or up to 22.5MW within the service territory of a utility with a peak demand of 10,000MW or less. The maximum total capacity of all net-metered fuel cells in all service territories is limited to 500MW. The aggregate limit of net metering systems in a utility's service territory is set at 5% of the utility's aggregate customer peak demand [39].

NEG is carried forward to a customer's next bill at retail price. Customers have two options for the NEG remaining after a 12 month period. Customers have the option of rolling over any remaining NEG from month-to-month indefinitely, or they can receive financial compensation from their utility for the remaining NEG. The California Public Utilities Commission (CPUC) set the compensation rate at the 12-month average spot market price for the hours of 7 am to 5 pm for the year in which the surplus power was generated. The rate making authorities of municipal utilities must develop their own compensation method for the remaining NEG through a public proceeding. The RECs associated with the electricity produced and used on-site remain with the customer-generator. If, however, the customer chooses to receive financial compensation for the NEG remaining after a 12-month period, the utility will be granted the RECs associated with just that surplus they purchase [41].

The local government is allowed, if certain conditions are met, to distribute bill credits from a RES-E system across more than one meter. To be eligible for this billing arrangement all electrical accounts involved must receive electricity under a TOU tariff, and all accounts must be owned by the same entity. California also allows virtual net metering for certain utility customers. Virtual net metering concerns all multi-tenant properties and to all distributed generation technologies. Virtual net metering allows the bill credits associated with the electricity produced by the system to be distributed across all the tenants' electricity bills.

#### 4.5.2 Connecticut

In Connecticut the IOUs are required to provide net metering to customers that generate electricity using RES-E systems, such as, solar, wind, landfill gas, fuel cells, sustainable biomass, ocean-thermal power, wave or tidal power, low-emission advanced renewable energy conversion technologies, and hydropower facilities up to 2MW in capacity. There is no stated limit on the aggregate capacity of net metered systems in a utility's service territory [42]. Any customer NEG during a monthly billing period is carried over to the following month as a kWh credit. At the end of an annualized period, the utility pays the customer for any remaining NEG at the utility's avoided cost rate.

Recently, Connecticut established virtual net metering for municipal customers only. A virtual net metering facility, may serve the electricity needs of the municipal host customer and additional beneficial accounts as long as the beneficial accounts and host account are within the same electric distribution company's service territory. Up to five beneficial accounts may be assigned. If a municipal host customer produces more electricity that it consumes, the excess electricity will be credited to the beneficial accounts for the next billing period at the retail rate. Excess credits rollover monthly for one year. The electric distribution company is to compensate the municipal host customer for excess virtual net metering credits remaining at the end of the calendar, if any at the retail generation rate.

#### 4.5.3 Illinois

In Illinois, net metering is available to electric customers that generate electricity using solar energy, wind energy, dedicated energy crops, anaerobic digestion of livestock or food processing waste, hydropower, and fuel cells and microturbines powered by renewable fuels. Systems up to 40kW in capacity that are intended primarily to offset the customer's own electrical requirements are eligible.

Net metering is provided until the load of net metering customers equals 1% of the total peak demand supplied by the utility during the previous year. For residential customers, net metering is typically accomplished through the use of a single, bi-directional meter. For non-residential customers, net metering is typically accomplished through the use of a dual meter. Dual metering is required for non-residential customers with systems greater than 40kW but not greater than 2MW. The utility must provide the necessary metering equipment for systems up to 40kW in capacity, while customers with systems greater than 40kW but less than 2MW must pay for the costs of installing necessary metering equipment. An electricity provider may choose to allow meter aggregation for community-owned wind, biomass, solar, or methane digesters, or other situations where multiple individual customers are served by the same renewable generating facility, such as, an apartment building.

For systems up to 40kW in capacity, any NEG during a billing period is carried over as a kWh credit to the following billing period. At the end of an annualized period, any remaining NEG credits in the

customer's account expire. Customers may select an annualized period that ends with last day of either their April or October billing period for this purpose. For customers taking service under a TOU tariff, any monthly consumption of electricity is calculated according to the terms of the contract or tariff to which the same customer would be assigned to or be eligible for if the customer was not a net metering customer. When net metering customers under TOU tariffs are net generators during any discrete TOU period, the net kWh produced are valued at the same price per kWh as the utility would charge for retail kWh sales during that same time of use period. Credits for NEG may be used to offset other charges assessed by the electricity provider. In addition, all net metering customers hold ownership and title to all RECs and greenhouse gas credits associated with customer generation.

#### *4.5.4 Kentucky*

In Kentucky utilities offer net metering to customers that generate electricity with PV, wind, biomass, biogas or hydroelectric systems up to 30kW in capacity. Net metering is available to all customers. Kentucky's requires the use of a single, bi-directional meter for net metering. If the electricity fed back to the utility by the customer exceeds the electricity supplied by the utility during a billing period, the customer is credited for excess generation at the utility's retail rate. This credit will appear on the customer's next bill and will carry forward indefinitely. Credits are not transferable. The customer retains ownership of any RECs. If the cumulative generating capacity of net metering systems reaches 1% of a utility's single-hour peak load during the previous year, the PSC may limit the utility's obligation to offer net metering. When time-of-day or TOU metering is used, the electricity fed back to the grid by customers is net metered and accounted for at the specific time it is fed back to the grid in accordance with the time-of-day or TOU billing agreement currently in place.

#### *4.6 USA territories*

Except from the states of USA, there are some territories, which are under the jurisdiction of USA, such as American Samoa, Guam, Puerto Rico and Virgin Islands that apply net metering, as tabulated in Table 2.

##### *4.6.1 American Samoa*

In American Samoa, net metering is available to residential and small commercial customers with wind or solar-energy systems up to 30kW in capacity, Customers with NEG will receive full kWh credits that are carried forward to the next bill for one year. At the end of the year, any existing credits are surrendered to the utility with no compensation for the customer.

##### *4.6.2 Guam*

In Guam net metering is allowed for customers with fuel cells, microturbines, wind energy, biomass, hydroelectric, solar energy or hybrid systems of these RES-E technologies. The system capacity limits are 25kW for residential systems and 100kW for non-residential systems. Bi-directional energy meters are used. If a system has produced net excess generation at the end of the billing period the customer generator is entitled to compensation at a predetermined rate.

##### *4.6.3 Puerto Rico*

Puerto Rico allow customers to use electricity generated by solar, wind or other RES-E technologies to offset their electricity usage. This applies to residential systems with a generating capacity of up to 25kW and non-residential systems up to 1MW in capacity. Customer NEG is carried over as a kWh credit to the following month, but NEG credit is limited to a daily maximum of 300kWh for residential customers and 10MWh for commercial customers. Customers with excess credits remaining at the end of a 12-month period are compensated as follows: 75% of the excess credits are paid at a rate of 10US\$/kWh or the amount resulting from the subtraction of the adjusted fuel fee based on the variable costs incurred by the public corporation exclusively for the purchase of fuel and energy, from the total price charged by the public utility to its customers, converted into kWh, whichever is greater; and the remaining 25% will be granted to the electric utility to distribute as a credit or reduction applied to the electricity bills of public schools.

Table 1. Net metering in USA

State	Applicable utilities	Applicable sectors	Eligible RES/other technologies	System capacity limit	Aggregate capacity limit	Net excess generation
Alaska	Utilities with annual retail sales of 5GWh or more	Commercial, industrial, residential, non-profit, schools, local government, state government, federal government, agricultural, institutional	Solar thermal electric, PVs, landfill gas, wind, biomass, hydroelectric, geothermal electric, municipal solid waste, hydrokinetic, anaerobic digestion, small hydroelectric, tidal energy, wave energy, ocean thermal	25kW	1.5% of average retail demand	Credited to customer's next bill at non-firm power rate; carries over indefinitely
Arizona	Salt River Project (SRP)	Commercial, residential	PVs, wind, geothermal electric	100kW	No limit specified	Credited to customer's next bill at retail rate; excess reconciled annually in April at average annual market price minus price adjustment of 0.00017US\$/kWh
Arizona	IOU, electric cooperatives	Commercial, industrial, residential, non-profit, schools, local government, state government, institutional	Solar thermal electric, PVs, landfill gas, wind, biomass, hydroelectric, geothermal electric, municipal solid waste, combined heat and power (CHP)/ cogeneration, hydrogen, biogas, anaerobic digestion, small hydroelectric, fuel cells using renewable fuels	No capacity limit specified, but system must be sized to meet part or all of customer's electric load and may not exceed 125% of customer's total connected load	No limit specified	Credited to customer's next bill at retail rate; excess reconciled annually at avoided cost rate
Arkansas	IOU, electric cooperatives	Commercial, industrial, residential, general public/ consumer, non-profit, schools, local government, state government, federal	Solar thermal electric, PVs, landfill gas, wind, biomass, hydroelectric, geothermal electric, microturbines using renewable fuels, small	300kW for non-residential, 25kW for residential	No limit specified	Credited to customer's next bill at retail rate; granted to utility at end of 12-month billing cycle



Table 1. (continued)

State	Applicable utilities	Applicable sectors	Eligible RES/other technologies	System capacity limit	Aggregate capacity limit	Net excess generation
California	All utilities except LADWP	government, agricultural, institutional Commercial, industrial, residential, agricultural	hydroelectric, fuel cells using renewable fuels, microturbines Solar thermal electric, PV's, landfill gas, wind, biomass, geothermal electric, fuel cells, municipal solid waste, biogas from manure methane production or as a byproduct of the anaerobic digestion of biosolids and animal waste, anaerobic digestion, small hydroelectric, tidal energy, wave energy, ocean thermal, fuel cells using renewable fuels	1MW; 5MW for systems owned by, operated by, or on property under the control of a local government or university	5% of utility's peak demand (statewide limit of 500MW for fuel cells)	Credited to customer's next bill at retail rate; After 12-month cycle, customer may opt to roll over credit indefinitely or to receive payment for credit at a rate equal to the 12-month average spot market price for the hours of 7 am to 5 pm for the year in which the surplus power was generated (If customer makes no affirmative decision, credit is granted to utility with no compensation for customer) Credited to customer's next bill at retail rate
California	LADWP	Commercial, industrial, residential, general public/ consumer, non-profit, schools, local government, state government	PV's, wind	1MW	No limit specified	Credited to customer's next bill at retail rate
Colorado	All utilities except certain small municipal utilities	Commercial, industrial, residential	Solar thermal electric, PV's, wind, biomass, hydroelectric, geothermal electric, recycled energy, small hydroelectric, fuel cells using renewable fuels	IOU customers: 120% of the customer's average annual consumption. Municipality and co-op customers: 25kW for non-residential, 10kW for residential.	No limit specified	Credited to customer's next bill at retail rate. After 12-month cycle, IOU customers may opt to roll over credit indefinitely or to receive payment at average hourly incremental cost.

Table 1. (continued)

State	Applicable utilities	Applicable sectors	Eligible RES/other technologies	System capacity limit	Aggregate capacity limit	Net excess generation
Connecticut	IOU	Commercial, industrial, residential, non-profit, schools, local government, state government, federal government, multi-family residential, agricultural, institutional	Solar thermal electric, PVs, landfill gas, wind, biomass, hydroelectric, fuel cells, municipal solid waste, small hydroelectric, tidal energy, wave energy, ocean thermal, fuel cells using renewable fuels	2MW	No limit specified	Municipality and co-ops provide annual reconciliation at a rate they deem appropriate. Credited to customer's next bill at retail rate; excess reconciled annually at avoided cost rate
Delaware	All utilities	Commercial, industrial, residential, non-profit, schools, local government, state government, federal government, agricultural, institutional	PVs, wind, biomass, hydroelectric, fuel cells, anaerobic digestion, small hydroelectric, fuel cells using renewable fuels	2MW for non-residential Delmarva customers; 500kW for non-residential Delaware Electric Co-op and municipal utility customers; 25kW for all residential customers; 100kW for all farm customers on residential rates	5% of peak demand (utilities may increase limit)	Credited to customer's next bill at retail rate. After 12-month cycle, customer may opt to roll over credit indefinitely or to receive payment for credit at the energy supply rate.
District of Columbia	IOU	Commercial, residential	Solar thermal electric, PVs, wind, biomass, hydroelectric, geothermal electric, fuel cells, CHP/cogeneration, anaerobic digestion, small hydroelectric, tidal energy, fuel cells using renewable fuels, microturbines	1MW	No limit specified	Credited to customer's next bill indefinitely at retail rate for systems 100kW or less, and at generation rate for larger systems up to 1MW
Florida	IOU	Commercial, industrial, residential, non-profit, schools, local	Solar thermal electric, PVs, wind, biomass, hydroelectric	2MW	No limit specified	Credited to customer's next bill at retail rate; excess reconciled

Table 1. (continued)

State	Applicable utilities	Applicable sectors	Eligible RES/other technologies	System capacity limit	Aggregate capacity limit	Net excess generation
Georgia	All utilities	government, state government, tribal government, federal government, agricultural, institutional Commercial, industrial, residential, non-profit, schools, local government, state government, federal government, agricultural, institutional	geothermal electric, CHP/ cogeneration, hydrogen, small hydroelectric, tidal energy, wave energy, ocean thermal PVs, wind, fuel cells, fuel cells using renewable fuels	100kW for non-residential; 10kW for residential	0.2% of utility's peak demand during previous year	annually at avoided cost rate  Credited to customer's next bill at a predetermined rate filed with the Public Service Commission (PSC)
Hawaii	All utilities	Commercial, residential, local government, state government, federal government	PVs, wind, biomass, hydroelectric, small hydroelectric	100kW for Hawaiian Electric Company, Maui Electric Company, Hawaiian Electric Light Company customers; 50kW for Kauai Island Utility Cooperative customers 100kW for large commercial and agricultural; 25kW for all others	15% per circuit distribution threshold for distributed generation penetration	Credited to customer's next bill at retail rate; granted to utility at end of 12-month billing cycle
Idaho	Idaho Power	Commercial, residential, agricultural	Solar thermal electric, PVs, wind, biomass, hydroelectric, fuel cells, small hydroelectric, fuel cells using renewable fuels	100kW for non-residential; 25kW for commercial and small agricultural; 25kW for all others	0.1% of utility's peak demand in 2000 (in Idaho)	Credited to customer's next bill at retail rate for residential and small commercial customers; avoided cost rate for large commercial and agricultural customers Credited to customer's next bill at retail rate for residential and small commercial customers; credited at 85% of avoided cost rate for large commercial and agricultural customers
Idaho	Rocky Mountain Power	Commercial, residential, non-profit, schools, local government, state government, federal government, agricultural, institutional	Solar thermal electric, PVs, wind, biomass, hydroelectric, fuel cells, small hydroelectric, fuel cells using renewable fuels	100kW for non-residential; 25kW for commercial and small agricultural; 25kW for all others	0.1% of utility's peak demand in 2002 (in Idaho)	Credited to customer's next bill at retail rate for residential and small commercial customers; avoided cost rate for large commercial and agricultural customers

Table 1. (continued)

State	Applicable utilities	Applicable sectors	Eligible RES/other technologies	System capacity limit	Aggregate capacity limit	Net excess generation
Idaho	Avista utilities	Commercial, residential, agricultural	Solar thermal electric, PVs, wind, biomass, hydroelectric, fuel cells, small hydroelectric, fuel cells using renewable fuels	100kW	0.1% of utility's peak demand in 1996 (in Idaho)	Credited to customer's next bill at retail rate; granted to utility at end of 12-month billing cycle
Illinois	IOU, alternative retail electric suppliers	Commercial, industrial, residential, non-profit, schools, local government, state government, federal government, agricultural, institutional	PVs, wind, biomass, hydroelectric, anaerobic digestion, small hydroelectric, fuel cells using renewable fuels, microturbines	Current rules: 40kW New rules: 2MW	Current rules: 1% of utility's peak demand in previous year New rules: 5% of utility's peak demand in previous year	Current rules: Credited to customer's next bill at retail rate; granted to utility at end of 12-month billing cycle New rules: Only non-hourly tariff customers in non-competitive classes; Credited to customer's next bill at retail rate; granted to utility at end of 12-month billing cycle; Hourly customers receive energy credit and delivery service credit based on the hourly rate.
Indiana	IOU	Commercial, industrial, residential, non-profit, schools, local government, state government, federal government, multi-family residential, low-income residential, agricultural, institutional	Solar thermal electric, PVs, wind, biomass, hydroelectric, fuel cells, hydrogen, small hydroelectric, fuel cells using renewable fuels	1MW	1% of utility's most recent peak summer load	Credited to customer's next bill at retail rate; carries over indefinitely
Iowa	IOU	Commercial, industrial, residential	Commercial, industrial, residential	500kW	No limit specified	Credited to customer's next bill at retail rate; carries over indefinitely
Kansas	IOU	Commercial, industrial,	Solar thermal electric,	200kW for non-	1% of utility's	Credited to customer's

Table 1. (continued)

State	Applicable utilities	Applicable sectors	Eligible RES/other technologies	System capacity limit	Aggregate capacity limit	Net excess generation
Kentucky	IOU, electric cooperatives (except Tennessee Valley Authority distribution utilities) All utilities	residential, schools, local government, state government, federal government, agricultural, institutional Commercial, residential, non-profit, schools, local government, state government, agricultural, institutional	PVs, landfill gas, wind, biomass, hydroelectric, small hydroelectric, fuel cells using renewable fuels PVs, wind, biomass, hydroelectric, biogas, small hydroelectric	residential; 25kW for residential 30kW	retail peak demand during previous year 1% of utility's single-hour peak load during previous year	next bill at retail rate; granted to utility at end of the calendar year Credited to customer's next bill at retail rate; carries over indefinitely
Louisiana	All utilities	Commercial, residential, agricultural	PVs, wind, biomass, hydroelectric, geothermal electric, small hydroelectric, fuel cells using renewable fuels, microturbines	Commercial and agricultural: 300kW Residential: 25kW	0.5%	Credited to customer's next bill at retail rate; carries over indefinitely
Louisiana City of New Orleans	Entergy New Orleans	Commercial, residential, agricultural	PVs, wind, biomass, hydroelectric, small hydroelectric, fuel cells using renewable fuels, microturbines	300kW for commercial and agricultural; 25kW for residential	No limit specified	Credited to customer's next bill at retail rate; carries over indefinitely
Maine	All utilities	Commercial, industrial, residential, non-profit, schools, multi-family residential, low-income residential, agricultural, institutional	Solar thermal electric, PVs, wind, biomass, hydroelectric, geothermal electric, fuel cells, municipal solid waste, CHP/cogeneration, small hydroelectric, tidal energy, fuel cells using renewable fuels	660kW for IOU customers; 100kW for muni and co-op customers (although they may offer up to 660kW voluntarily)	No limit specified	Credited to customer's next bill at retail rate; granted to utility at end of 12-month billing cycle
Maryland	All utilities	Commercial, industrial, residential, non-profit,	PVs, wind, biomass, fuel cells,	2MW (30kW for micro-CHP); also limited to	1500MW (~8% of peak demand)	Credited to customer's next bill at retail rate;

Table 1. (continued)

State	Applicable utilities	Applicable sectors	Eligible RES/other technologies	System capacity limit	Aggregate capacity limit	Net excess generation
Massachusetts	IOU	schools, local government, state government, federal government, agricultural, institutional Commercial, industrial, residential, non-profit, schools, local government, state government, federal government, agricultural, institutional	CHP/cogeneration, anaerobic digestion, small hydroelectric, fuel cells using renewable fuels Solar thermal electric, PVs, wind, biomass, hydroelectric, geothermal electric, fuel cells, municipal solid waste, CHP/cogeneration, anaerobic digestion, small hydroelectric, fuel cells using renewable fuels, other DG technologies PVs, landfill gas, wind, biomass, hydroelectric, municipal solid waste, anaerobic digestion, small hydroelectric, tidal energy, wave energy	that needed to meet 200% of baseline customer electricity usage 10MW for net metering by a municipality or other governmental entity; 2MW for all other Class III systems; 1MW for all other Class II systems; 60kW for all other Class I systems	3% of utility's peak load for private entities; 3% of utility's peak load for municipalities or governmental entities	reconciled annually in April at the commodity energy supply rate Varies by system type and customer class
Michigan	IOU, electric cooperatives, alternative electric suppliers	Commercial, industrial, residential, non-profit, schools, local government, state government, federal government, agricultural		150kW	0.75% of utility's peak load during previous year	Credited to customer's next bill at retail rate for systems 20kW or less; credited to customer's next bill at power supply component of retail rate for larger systems. Carries over indefinitely Reconciled monthly; customer may opt to receive payment or credit on next bill at the retail utility energy rate
Minnesota	All utilities	Commercial, industrial, residential	PVs, landfill gas, wind, biomass, hydroelectric, municipal solid waste, CHP/cogeneration, anaerobic digestion, small hydroelectric, other DG technologies Solar thermal electric, PVs, wind, hydroelectric, small hydroelectric, fuel cells using renewable fuels	Less than 40kW 100kW	No limit specified 5% of utility's single-hour peak load during previous year	
Missouri	All utilities	Commercial, industrial, residential, non-profit, schools, local government, state government, federal				

Table 1. (continued)

State	Applicable utilities	Applicable sectors	Eligible RES/other technologies	System capacity limit	Aggregate capacity limit	Net excess generation
Montana	IOU	government, agricultural, institutional Commercial, industrial, residential	PVs, wind, hydroelectric, small hydroelectric	50kW	No limit specified	Credited to customer's next bill at retail rate; granted to utility at end of 12-month period
Montana	Electric cooperatives (Montana Electric Cooperatives Association members) All utilities	Commercial, residential	Solar thermal electric, hydroelectric, geothermal electric, fuel cells, small hydroelectric, fuel cells using renewable fuels PVs, landfill gas, wind, biomass, hydroelectric, geothermal electric, anaerobic digestion, small hydroelectric	10kW	No limit specified	Credited to customer's next bill at retail rate; granted to utility at end of 12-month period
Nebraska	All utilities	Commercial, industrial, residential, agricultural	hydroelectric, fuel cells using renewable fuels PVs, landfill gas, wind, biomass, hydroelectric, geothermal electric, anaerobic digestion, small hydroelectric	25kW	1% of utility's average monthly peak demand	Credited to customer's next bill at avoided cost rate; excess reconciled annually at avoided cost rate
Nevada	IOU	Commercial, industrial, residential	Solar thermal electric, PVs, wind, biomass, hydroelectric, small hydroelectric	The lesser of 1MW or 100% of the customer's annual requirements for electricity	Statewide cap of 2% of total peak capacity of all utilities in the state	Credited to customer's next bill at retail rate; carries over indefinitely
Nevada	Valley Electric Association	Commercial, industrial, residential, agricultural	small hydroelectric PVs, wind, biomass, geothermal electric, small hydroelectric	30kW (larger systems on case-by-case basis)	0.5% of utility's annual peak load	Credited to customer's next bill. After 12-month cycle customer may opt to roll over credit indefinitely or to receive payment for credit at the avoided cost rate.
New Hampshire	All utilities	Commercial, industrial, residential, non-profit, schools, local government, state government, federal government,	Solar thermal electric, PVs, landfill gas, wind, biomass, hydroelectric, geothermal electric, fuel cells, CHP/cogeneration, hydrogen,	1MW	50MW	Credited to customer's next bill and carried forward indefinitely. Customer may elect to receive payment (at the utility's avoided-cost

Table 1. (continued)

State	Applicable utilities	Applicable sectors	Eligible RES/other technologies	System capacity limit	Aggregate capacity limit	Net excess generation
New Jersey	IOU (electric distribution companies), electric suppliers	agricultural, institutional Commercial, industrial, residential, non-profit, schools, local government, state government, tribal government, federal government, agricultural, institutional	anaerobic digestion, small hydroelectric, tidal energy, wave energy, renewable fuels, biodiesel, fuel cells using renewable fuels other DG technologies Solar thermal electric, PVs, landfill gas, wind, biomass, geothermal electric, anaerobic digestion, tidal energy, wave energy, fuel cells using renewable fuels	No capacity limit specified, but system must be sized so that energy production does not exceed customer's annual on-site energy consumption	No limit specified (Board of Public Utilities may limit to 2.5% of peak demand)	rate) for any excess credit remaining at the end of an annual period.  Credited to customer's next bill at retail rate; excess reconciled annually at avoided cost rate
New Mexico	IOU, electric cooperatives	Commercial, industrial, residential	Solar thermal electric, PVs, landfill gas, wind, biomass, hydroelectric, geothermal electric, fuel cells, municipal solid waste, CHP/cogeneration, small hydroelectric, fuel cells using renewable fuels, microturbines	80MW	No limit specified	Credited to customer's next bill at avoided cost rate or reconciled monthly at avoided cost rate
New Mexico	Farmington Electric	Residential	PVs, wind, small hydroelectric, other DG technologies	10kW	No limit specified	Credited to customer's next bill at retail rate. After 12-month cycle, customer may opt to roll over credit indefinitely or to receive payment for credit at a rate determined by utility. Credited to customer's next bill at retail rate, except seasonal avoided
New York	Long Island Power Authority	Commercial, industrial, residential, non-profit, schools, local	PVs, wind, fuel cells, CHP/cogeneration, anaerobic digestion,	2MW for non-residential solar or wind; 500kW for	150MW for solar, agricultural	



Table 1. (continued)

State	Applicable utilities	Applicable sectors	Eligible RES/other technologies	System capacity limit	Aggregate capacity limit	Net excess generation
		government, state government, agricultural, institutional	fuel cells using renewable fuels, microturbines	agricultural wind and 1MW for agricultural biogas; 25kW for residential solar or wind; 10kW for residential micro-CHP and fuel cells	biogas, residential micro-CHP and fuel cells; 0.3% (15.3MW) of utility's 2005 demand for wind	cost for micro-CHP and fuel cells; excess generally reconciled annually at seasonal avoided cost rate, except annual excess for micro-CHP and fuel cells carries forward indefinitely
New York	IOU	Commercial, industrial, residential, non-profit, schools, local government, state government, federal government, agricultural, institutional	PVs, wind, biomass, fuel cells, CHP/cogeneration, anaerobic digestion, small hydroelectric, fuel cells using renewable fuels, microturbines	Solar: 25kW for residential; 2MW for non-residential Wind: 25kW for residential; 2MW for non-residential; 500kW for farm-based Micro-hydroelectric: 2.5kW for residential; 2MW for non-residential Fuel Cells: 10kW for residential; 1.5MW for non-residential Biogas: 1MW (farm-based only) Micro-CHP: 10kW (residential only) 1MW	1% of utility's 2005 demand for solar, farm-based biogas, fuel cells, micro-hydroelectric, and residential micro-CHP; 0.3% of utility's 2005 demand for wind	Credited to customer's next bill at retail rate (except avoided cost rate for micro-CHP and fuel cells); excess generally reconciled annually at avoided cost rate (except excess for micro-hydroelectric, non-residential wind and solar, residential micro-CHP and fuel cells carries over indefinitely)
North Carolina	IOU	Commercial, industrial, residential, non-profit, schools, local government, state government, tribal government, federal government, agricultural, institutional	PVs, landfill gas, wind, biomass, hydroelectric, hydrogen, anaerobic digestion, small hydroelectric, tidal energy, wave energy, fuel cells using renewable fuels		No limit specified	Credited to customer's next bill at retail rate; granted to utility at beginning of summer billing season
North Dakota	IOU	Commercial, industrial, residential	Solar thermal electric, PVs, wind, biomass,	100kW	No limit specified	Reconciled monthly at avoided cost rate

Table 1. (continued)

State	Applicable utilities	Applicable sectors	Eligible RES/other technologies	System capacity limit	Aggregate capacity limit	Net excess generation
Ohio	IOU	Commercial, industrial, residential	hydroelectric, geothermal electric, municipal solid waste, CHP/ cogeneration, small hydroelectric Solar thermal electric, PVs, landfill gas, wind, biomass, hydroelectric, fuel cells, small hydroelectric, fuel cells using renewable fuels, microturbines	No capacity limit specified, but system must be sized primarily to offset part or all of customer's electricity requirements	No limit specified	Credited to customer's next bill at unbundled generation rate; customer may request payment for excess at end of 12-month billing period Credited to customer's next bill at avoided cost or granted to utility monthly (varies by utility)
Oklahoma	IOU, regulated electric cooperatives	Commercial, industrial, residential, general public/ consumer	Solar thermal electric, PVs, wind, biomass, hydroelectric, geothermal electric, municipal solid waste, CHP/ cogeneration, small hydroelectric	100kW or 25MWh/year (whichever is less)	No limit specified	Credited to customer's next bill at avoided cost or granted to utility monthly (varies by utility)
Oregon	Ashland Electric	Commercial, residential	PVs, wind	No limit specified	No limit specified	Credited to customer's next bill at retail rate; reconciled at end of year in December at 1.25 times the highest residential rate block (1MWh limit), after 1MWh, purchased at wholesale rate Credited to customer's next bill at retail rate for IOU customers; varies for muni, co-op and PUD customers
Oregon	All utilities (except Idaho Power)	Commercial, industrial, residential, non-profit, schools, local government, state government, federal government, agricultural, institutional	Solar thermal electric, PVs, landfill gas, wind, biomass, hydroelectric, fuel cells, anaerobic digestion, small hydroelectric, fuel cells using renewable fuels	2MW for non-residential and 25kW for residential Portland General Electric (PGE) and PacifiCorp customers; 25kW for residential muni, co-op and People's Utility District Association (PUD) customers	No limit specified for PGE and PacifiCorp; 0.5% of utility's historic single-hour peak load for munis, co-ops, PUDs	Credited to customer's next bill at retail rate for IOU customers; varies for muni, co-op and PUD customers

Table 1. (continued)

State	Applicable utilities	Applicable sectors	Eligible RES/other technologies	System capacity limit	Aggregate capacity limit	Net excess generation
Pennsylvania	IOU	Commercial, industrial, residential, non-profit, schools, local government, state government, federal government, agricultural, institutional	Solar thermal electric, PVs, landfill gas, wind, biomass, hydroelectric, fuel cells, municipal solid waste, CHP/cogeneration, waste coal, coal-mine methane, anaerobic digestion, small hydroelectric, fuel cells using renewable fuels, other DG technologies	5MW for micro-grid and emergency systems; 3MW for non-residential; 50kW for residential	No limit specified	Credited to customer's next bill at retail rate; reconciled annually at price-to-compare
Rhode Island	IOU	Commercial, industrial, residential, non-profit, schools, local government, state government, federal government, multi-family residential, agricultural, institutional	Solar thermal electric, PVs, wind, biomass, hydroelectric, geothermal electric, anaerobic digestion, small hydroelectric, ocean thermal, fuel cells using renewable fuels	5MW (systems must be reasonably designed to generate only up to 100% of annual electricity consumption)	3% of peak load (2MW reserved for systems under 50kW)	Credited at avoided cost; rolled over to next bill or purchased by utility
South Carolina	Duke Energy	Commercial, industrial, residential, non-profit, schools, local government, state government, tribal government, federal government, agricultural, institutional	PVs, landfill gas, wind, biomass, hydroelectric, small hydroelectric	100kW for non-residential; 20kW for residential	0.2% of utility's South Carolina jurisdictional retail peak demand for previous calendar year	Credited to customer's next bill at applicable TOU rate or less; granted to utility annually on June 1
South Carolina	Progress Energy	Commercial, industrial, residential, non-profit, schools, local government, state government, tribal government, federal government, agricultural, institutional	PVs, landfill gas, wind, biomass, hydroelectric, small hydroelectric	100kW for non-residential; 20kW for residential	0.2% of utility's South Carolina jurisdictional retail peak demand for previous calendar year	Credited to customer's next bill at applicable TOU rate or less; granted to utility annually on May 31

Table 1. (continued)

State	Applicable utilities	Applicable sectors	Eligible RES/other technologies	System capacity limit	Aggregate capacity limit	Net excess generation
South Carolina	South Carolina Electric and Gas	institutional Commercial, industrial, residential, non-profit, schools, local government, state government, tribal government, federal government, agricultural, institutional Commercial	PVs, wind, biomass, hydroelectric, small hydroelectric	100kW for non-residential; 20kW for residential	0.2% of utility's South Carolina jurisdictional retail peak demand for previous calendar year	Credited to customer's next bill at applicable TOU rate or less; granted to utility annually on June 1
Texas	Austin Energy	Commercial	Solar thermal electric, PVs, landfill gas, wind, biomass, geothermal electric, municipal solid waste, anaerobic digestion, small hydroelectric, tidal energy, wave energy PVs, wind, biomass, microturbines, other DG technologies	20kW	No limit specified (program will be re-evaluated after 1% of load is met)	Credited to customer's next bill at avoided cost rate
Texas	City of Brenham	Commercial, industrial, residential, general public/ consumer, non-profit, schools, state government, agricultural, institutional Residential	PVs, wind, biomass, microturbines, other DG technologies	10MW	No limit specified	Monthly excess credited at utility's avoided cost rate
Texas	Green Mountain Energy	Residential	PVs, landfill gas, wind, biomass, hydroelectric, geothermal electric, anaerobic digestion, tidal energy, wave energy	25kW	No limit specified	First 500kWh/month of grid exports: Renewable rewards retail rate. Exports beyond 500kWh/month: 50% of retail rate
Utah	IOU, electric cooperatives	Commercial, industrial, residential, non-profit, schools, local government, state government, federal government, agricultural,	Solar thermal electric, PVs, landfill gas, wind, biomass, hydroelectric, geothermal electric, fuel cells, hydrogen, waste gas and waste heat capture or recovery,	2MW for non-residential; 25kW for residential	20% of 2007 peak demand for Rocky Mountain Power; 0.1% of utility's 2007 peak demand for co-ops	For Rocky Mountain Power residential and small commercial customers, excess kWh credits are applied to customer's next bill at retail rate; any credits

Table 1. (continued)

State	Applicable utilities	Applicable sectors	Eligible RES/other technologies	System capacity limit	Aggregate capacity limit	Net excess generation
		institutional	anaerobic digestion, small hydroelectric, fuel cells using renewable fuels			remaining at end of 12-month billing cycle are granted to utility. For Rocky Mountain Power large commercial and industrial customers with demand charges, customers may choose between valuing net excess generation at an avoided-cost-based rate or at an alternative rate based on utility revenue and sales. For co-op customers, net excess generation is credited at avoided cost rate.
Utah	City of St. George	Commercial, residential, general public/ consumer	PVs	250 kW; larger systems may be allowed on a case-by-case basis	No limit specified	Credited to customer's next bill at retail rate. After 12-month cycle, excess credited to next bill at avoided cost rate. Credited to customer's next bill at retail rate; granted to utility each April
Utah	Murray City Power	Commercial, residential, general public/ consumer	PVs, wind, small hydroelectric	10kW	No limit specified	Reconciled monthly at avoided cost rate
Utah	Washington City Power	General public/ consumer	PVs, wind	10kW	1% of utility's most recent annual peak load	Credited to customer's next bill at retail rate; excess credits not used within 12 months of generation granted to utility
Vermont	All utilities	Commercial, residential, non-profit, schools, local government, state government, federal government, agricultural, institutional	Solar thermal electric, PVs, landfill gas, wind, biomass, hydroelectric, CHP/ cogeneration, anaerobic digestion, small hydroelectric, fuel cells using renewable fuels	Current Rules: 2.2MW for military systems; 20kW for micro-CHP, 250kW for all other systems New Rules: 2.2MW for military systems; 20kW for micro-CHP, 500kW for all other systems	2% of utility's 1996 peak demand or peak demand during most recent calendar year	

Table 1. (continued)

State	Applicable utilities	Applicable sectors	Eligible RES/other technologies	System capacity limit	Aggregate capacity limit	Net excess generation
Virginia	Danville utilities	Commercial, residential	Solar thermal electric, PVs, landfill gas, wind, biomass, hydroelectric, geothermal electric, municipal solid waste, CHP/ cogeneration, small hydroelectric, tidal energy, wave energy	10kW residential and 500kW non residential	Less than 1% of the utility's most recent peak load for all inter-connected renewable energy generators	A customer that would otherwise be a net metering customer shall receive no compensation for excess generation unless a power purchase agreement has been entered into with the utility
Virginia	IOU, electric cooperatives	Commercial, residential, non-profit, schools, local government, state government, agricultural, institutional	Solar thermal electric, PVs, wind, biomass, hydroelectric, geothermal electric, municipal solid waste, small hydroelectric, tidal energy, wave energy	500kW for non-residential; 20kW for residential	1% of utility's adjusted Virginia peak-load forecast for the previous year	Credited to customer's next bill at retail rate. After 12-month cycle, customer may opt to roll over credit indefinitely or to receive payment at avoided cost rate.
Washington	All utilities	Commercial, industrial, residential	Solar thermal electric, PVs, wind, hydroelectric, fuel cells, CHP/ cogeneration, small hydroelectric, fuel cells using renewable fuels	100kW	0.25% of utility's 1996 peak demand (increases to 0.5% on 1/1/2014)	Credited to customer's next bill at retail rate; granted to utility at end of 12-month billing period
Washington	Grays Harbor PUD	Commercial, industrial, residential	Solar thermal electric, PVs, wind, hydroelectric, fuel cells, CHP/ cogeneration,	100kW	0.25% of utility's 1996 peak demand (increases to 50% of retail rate	Credited to customer's next bill at retail rate; reconciled annually at 50% of retail rate

Table 1. (continued)

State	Applicable utilities	Applicable sectors	Eligible RES/other technologies	System capacity limit	Aggregate capacity limit	Net excess generation
West Virginia	All utilities	Commercial, industrial, residential, agricultural	small hydroelectric, fuel cells using renewable fuels Solar thermal electric, PV's, landfill gas, wind, biomass, hydroelectric, geothermal electric, fuel cells, small hydroelectric, renewable fuels, fuel cells using renewable fuels	IOUs with more than 30,000 customers: 2MW for industrial, 500kW for commercial, 25kW for residential. IOUs with fewer than 30,000 customers, municipal utilities and co-ops: 50kW for commercial and industrial; 25kW for residential.	0.5% on 1/1/2014) 3% of peak demand during the previous year	Credited to customer's next bill at retail rate with no annual true-up (perpetual rollover)
Wisconsin	IOU, municipal utilities	Commercial, industrial, residential	Solar thermal electric, PV's, wind, biomass, hydroelectric, geothermal electric, municipal solid waste, CHP/ cogeneration, small hydroelectric, other DG technologies	20kW Some utilities allow up to 100kW	No limit specified	Varies by utility, Generally credited to customer's next bill at retail rate for renewables and avoided cost rate for non-renewables Xcel Energy: Credit is carried over monthly and reconciled annually, at the avoided cost rate Credited to customer's next bill at retail rate; excess reconciled annually at seasonal avoided cost rate
Wyoming	IOU, electric cooperatives, irrigation districts	Commercial, industrial, residential	PV's, wind, biomass, hydroelectric, small hydroelectric	25kW	No limit specified	

Table 2. Net metering in USA territories

State	Applicable utilities	Applicable sectors	Eligible RES/other technologies	System capacity limit	Aggregate capacity limit	Net excess generation
American Samoa	American Samoa Power Authority	Commercial, residential, non-profit, schools, agricultural, institutional	PVs, wind	30kW; larger systems on case-by-case basis	5% of utility's peak demand	Credited to customer's next bill at retail rate; granted to utility at end of 12-month billing cycle
Guam	Guam Power Authority	Commercial, industrial, residential, non-profit, schools, agricultural, institutional	PVs, wind, biomass, hydroelectric, fuel cells, small hydroelectric, fuel cells using renewable fuels, microturbines	Residential: 25kW Non-residential: 100kW	No limit specified	Determined by PUC
Puerto Rico	Puerto Rico Electric Power Authority	Commercial, residential, non-profit, schools, local government, state government, multi-family residential, agricultural, institutional	PVs, wind, other renewable sources, other DG technologies	5MW for non-residential in transmission system; 1MW for non-residential in the distribution system; 25kW for residential	No limit specified	Credited to customer's next bill at retail rate (with certain limitations); excess reconciled annually
Virgin Islands	Virgin Islands Water and Power Authority	Commercial, residential, schools, local government, state government, tribal government, federal government, institutional	Commercial, industrial, residential	500kW for government; 100kW for commercial; 20kW for residential	5MW for St. Croix; 10MW for St. Thomas, St. John, Water Island and other territorial islands	Credited to customer's next bill at retail rate; granted to utility at end of 12-month billing cycle



#### 4.6.4 Virgin Islands

In the USA Virgin Islands net metering is limited to residential and commercial PV, wind energy or other RES-E systems up to 10kW in capacity. The capacity limits are up to 20kW for residential systems, 100kW for commercial systems, and 200kW for public, which includes government, schools and hospitals. The aggregate capacity limit of all net metering systems is 5MW on St. Croix, and 10MW on St. Thomas, St. John, Water Island and other territorial islands. These limits are equal to 10% of the peak load of the Virgin Islands electric system. Any NEG produced by a customer is credited at the utility's full retail rate and carried forward to the customer's next monthly bill. At the end of a 12-month period, any remaining NEG is granted to the utility.

### 5. Conclusions

In this work, an overview of the net metering mechanism for RES-E systems has carried out. In particular, the net metering concept was examined with its benefits and misconceptions. Furthermore, a survey of the current operational net metering schemes in different countries in the world, such as in Europe, USA, Canada, Thailand and Australia has carried out. The survey indicated that there are different net metering mechanisms depending on the particularities of each country (or state in the case of USA). Especially, in Europe, only four countries are using net metering in a very simple form, such as, any amount of energy produced by the eligible RES-E technology is compensated from the energy consumed by the RES-E producer, which results to either a less overall electricity bill or to an exception in payment energy taxes. In the USA and the USA territories, any customer's NEG is credited to the customer's next electricity bill for a 12-month billing cycle at various rates or via a combination between rates. The actual type of NEG credit is decided by a number of set criteria, such as the type of RES-E technology, the RES-E capacity limit, the type of customer and the type of utility. Regarding any excess credit at the end of the 12-month billing cycle, this is either granted to the utilities, or carries over indefinitely to the customer's next electricity bill, or is reconciled annually at any rate, or provides an option to the customer to choose between the last two options.

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**Andreas Poullikkas** holds a Bachelor of Engineering (B.Eng.) degree in mechanical engineering, a Master of Philosophy (M.Phil.) degree in nuclear safety and turbomachinery, a Doctor of Philosophy (Ph.D.) degree in numerical analysis and a Doctor of Science (D.Tech.) higher doctorate degree in energy policy and energy systems optimization from Loughborough University, U.K. His present employment is with the Electricity Authority of Cyprus where he holds the post of Assistant Manager of Research and Development; he is also, a Visiting Professor at the American University of Sharjah and at the University of Cyprus. In his professional career he has worked for academic institutions such as a Visiting Fellow at the Harvard School of Public Health, USA. He has over 20 years experience on research and development projects related to the numerical solution of partial differential equations, the mathematical analysis of fluid flows, the hydraulic design of turbomachines, the nuclear power safety, the analysis of power generation technologies and the power economics. He is the author of various peer-reviewed publications in scientific journals, book chapters and conference proceedings. He is the author of the postgraduate textbook: *Introduction to Power Generation Technologies* (ISBN: 978-1-60876-472-3), of the book *Renewable Energy: Economics, Emerging Technologies and Global Practices*, (ISBN: 978-1-62618-231-8), of the book: *The Cyprus Energy Future* (ISBN: 978-9963-9599-4-5) and of the book: *Sustainable Energy Development for Cyprus*, ISBN: 978-9963-7355-3-2. He is, also, a referee for various international journals, serves as a reviewer for the evaluation of research proposals related to the field of energy and a coordinator of various funded research projects. He is a member of various national and European committees related to energy policy issues. He is the developer of various algorithms and software for the technical, economic and environmental analysis of power generation technologies, desalination technologies and renewable energy systems.

E-mail address: apoullik@eac.com.cy



**George Kourtis** holds a Diploma and a Master Degree in Electrical and Computer Engineering from the Polytechnic School of Aristoteleio University of Thessaloniki (AUTH) and a Master Degree on Electrical Engineering from the University of Cyprus. During 2007 he has worked as a technician for LOGICOM LTD, where he was responsible for the maintenance of 3G Mobile stations. He joined Electricity Authority of Cyprus Research and Development Department in 2008, where he works on European funded research programs as an electrical engineer.



**Ioannis Hadjipaschalis** holds a B.Eng (Electrical Engineering), from the University of Sheffield, an M.Sc from the London School of Economics and an MBA. During 1996-2000 he worked at the Electricity Authority of Cyprus as Electrical Engineer, while during the period 2001-2005 he worked at ACNielsen Market Research. He joined EAC Research and Technological Development team in 2006, where he has been working on European funded research involving RES, Distributed Generation (DG), Electricity distribution networks, Hydrogen and CO2 capture and storage (CCS) technologies.

