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ISSUE NOTE: Households' production of electricity and heat

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1. The issue

1. Decentralised and sustainable production of energy has rapidly gained in importance over recent years and this type of energy production will likely become an important part of total energy production.⁽¹⁾ One element of this is energy production by households (HHs). In particular, household production of electricity and of heat is spreading fast, especially in some countries. It is more and more common to see solar panels on the roofs, the use of geothermal heat or heat pumps for heating water or a house, or wind power plants on land owned by households.

2. As a new phenomenon quickly gaining importance, households (or specifically created small (legal) units) producing electricity or heat from sustainable sources create a challenge for national accountants. Specifically for electricity, a complication comes from the fact that different production and consumption models exist, ⁽²⁾ often overlapping even within the same production unit. In fact, electricity can be used directly by the producing household for own consumption (e.g., solar panels on the roof of a garage to charge an electric vehicle or to feed domestic appliances), can be sold to the local grid, or a mix of the two (with complicated price structures involved). On the contrary, household production of heat is normally used for own consumption.

3. The treatment of energy production by households in the national accounts is not fully addressed in the 2008 SNA, which probably leads to inconsistencies across countries. Clear rules for a harmonised recording are therefore necessary⁽³⁾ and both conceptual and practical aspects should be addressed.

4. From the **conceptual** side the main aspect to consider is if electricity and heat are goods or services, as this is a main decisive element whether to include households' own account production in the production boundary.

5. From a **practical** perspective, the main consideration regards the possibility that energy products produced by households, as well as the equipment used to produce them, are already included in the national accounts, with the subsequent risk of double counting them.

Therefore, identifying appropriate sources and methods for a reliable estimation of their value will be essential.

(1) See for example: [A European Green Deal \(europa.eu\)](https://european-council.europa.eu/media/en/press-communications/infographic/infographic-green-deal-2020-06-25) and [REPowerEU: affordable, secure and sustainable energy for Europe \(europa.eu\)](https://ec.europa.eu/energy/en/press-room/2020/06/20200625-repower-eu). This document does not deal with less/non-sustainable household generation of heat and light, such as from firewood gathering or charcoal burning.

(2) These models usually depend on local legislation and regulations.

(3) For units that are not in the household sector S.14 and whose main activity is not energy production (i.e. which are not in NACE 35), it seems appropriate that energy production is considered secondary production when sold or supplied to other units. These cases are clear and are out of scope of this paper.

6. Two additional practical issues concern valuation and industry allocation. If own-account production of energy by households is to be included in the national accounts, how should it be valued, considering that no explicit transactions take place for the output that is produced for own final use, or how should negative energy prices, which apply in some countries at some times of the day or the week, be recorded?
7. Secondly, for countries who include the supplementary industry classification of ownership of dwellings, it seems simpler to include electricity production as secondary production of the dwelling unit with the primary production of dwelling services. However, classifying household electricity production into the electric power generation (ISIC 351) could bring more transparency to the issue of possible double counting.
8. With regard to production of heat, there is a question if it should be treated in an identical way to electricity, or whether it merits a different treatment.
9. This note investigates the treatment according to the 2008 SNA and, for inclusion in the 2025 SNA, identifies elements that require clarification, discusses options and recommends a way forward.

1.1 Treatment of Households' production in National Accounts

10. All goods produced by households (HHs) are within the production boundary of national accounts (see SNA §1.42). This generally also includes all goods produced by HHs and retained for their own final consumption or gross capital formation (see SNA §6.27b). Typical examples are the production of agricultural products, shoes or clothes, which the HHs produce and consume themselves. However, in practice these types of production activities are only accounted for when they are quantitatively relevant in a national economy.
11. All services produced by HHs which are supplied to, or intended to be supplied to, other units are also included in the production boundary of the SNA (see SNA §6.27a). This includes services provided by HHs to other units which use them as intermediate consumption in their production activity.
12. However, services produced by HHs for their own final use are generally excluded from the production boundary (see SNA §6.26). Two explicit exceptions from this rule are the production of dwelling services by owner-occupiers and the production of domestic and personal services by employing paid domestic staff (SNA §6.27 d and e).

1.2 Treatment of Energy Production and Production by HHs in National Accounts

13. Energy products, which are potentially relevant for household production, are:
 - Electricity generated by means of solar, wind or water.
 - Heat (or steam) for heating of dwellings or water by means of solar thermal heat, geothermal heat, or heat pumps.
14. Energy production and products can be found in the following statistical classifications:
 - Economic activities: In the **new** International Standard Industrial Classification of All Economic Activities (ISIC Rev 5) energy production is classified in division 35. In particular, we can find classes:

- 35.12 Electric power generation activities from renewable sources
- 35.30 Steam and air conditioning supply
- Products: In product classifications (CPC Ver. 2.1):
 - 171 Electrical energy
 - 173 Steam and hot water
 - 6922 Distribution of steam, hot water and air-conditioning supply through mains (on own account)

15. Rental activities by HHs, including owner-occupied rentals, are classified under:
 ISIC 681 Real estate activities with own or leased property.

This would be a second option to classify own-account production of energy by households. In this case also the production by HHs which is fed into the grid and sold to network operators should be classified here. The advantage would be that industrial production (in ISIC 35) is clearly separated from household production (in ISIC 68).

16. In that case the classification of (secondary) production of energy by sectors other than households would need to be further discussed (see paragraph 40 below).

2. Options considered

2.1 *Are electricity and heating goods or services?*

17. As explained in the previous section, the distinction between good or service is crucial for whether HHs' production for own final use is included in the production boundary of national accounts or not. This distinction is not straightforward for the product 'electricity', which bears characteristics of a good and of a service at the same time. In particular it is arguably intangible, cannot be stored in a classical way (inventories), and (under current technology) has to largely be consumed when created. These are clearly characteristics of a service.

18. Specifically, looking at SNA definition of a good from § 6.15, "goods are physical, produced objects for which a demand exists, over which ownership rights can be established and whose ownership can be transferred from one institutional unit to another by engaging in transactions on markets". Applying this definition to electricity

- ownership rights can be established over electricity, it can be transferred from one institutional unit to another easily;
- electricity may not be physical in that you can't hold it, but it does display physical presence reliant through wires or batteries. Other goods such as beverages and bottled gas are similarly reliant on containers for their mobility and physical presence;
- electricity usefulness to consumers requires complimentary services, e.g., connection to the grid via an electricity retailer. This is the case for most goods, for example food grown on a remote farm requires transport and retailing before reaching a consumer.

19. Further, it can be argued that electricity is traded like a good and in classifications it is dealt together with goods. For example, in the product classification (CPC) electricity is grouped together with gas and water, which are considered as goods.
20. The SNA definition of services is defined in § 6.17: “Services are the result of a production activity that changes the conditions of the consuming units or facilitates the exchange of products or financial assets.” Applying this definition, it is likely electricity fails being a service. In fact, the production of electricity itself doesn’t “change conditions of consuming units”. It requires other inputs to transform it into a different product. For example, to provide heating services it requires a heater.
21. In a discussion at its National Accounts Working Group Meeting in May 2023, almost all EU and EFTA countries agreed to treat electricity as a produced good.
22. The production of heat, mostly in the form of hot water or steam, shows similar ambiguities. While water is clearly a good, the provision of hot water or heat shows characteristics of a service. The same arguments as explained for electricity could be applied for heating as well.
23. In July 2023 Eurostat launched a questionnaire to its National Accounts Working Group members on countries’ practices and opinions on recording the production of energy products by households in national accounts. In total 16 countries replied to the questionnaire. Eleven countries consider produced heat as a good, while three would classify it as a service, and two countries see characteristics of both a good and a service at the same time. Thus, the majority of respondents would classify produced heat as a good, which would imply that own-account production of heat by households would in principle need to be recorded.

2.2 Households’ production of energy products provided to other units

24. Following the general national accounts principles, it is clear that all production of energy products by households that is **provided to other units**, and where consequently a transaction is taking place (for money or barter), needs to be recorded in national accounts. This also includes the case when a household produces electricity and delivers it to the local network provider. It seems likely that this concerns a good part of electricity production by HHs (depending on national legislation in countries). The same principle applies to the production of heat. For example, when a HH is the owner of a dwelling with installed capacity for geothermal or solar thermal heat, this can be considered as selling heat to the tenant, although the value of heat will probably be incorporated in the overall rental equivalent of the house, and it may be tricky to disentangle.
25. Consequently, **households’ production of energy products provided to other units** always needs to be recorded in national accounts.
26. In the accounts this requires estimates not only of the output, but also of the intermediate consumption (IC) linked to that part of energy production by households; the gross value added (GVA) created; the use of the created energy as an intermediate use in

other sectors (when sold to the network) or as final use (final consumption expenditure by sectors); and the mixed income for the concerned HHs. ⁽⁴⁾

27. It should be mentioned that whenever a household is identified as a producer of goods or services which needs to be recorded in the system of national accounts, the relevant producing statistical unit is considered an unincorporated enterprise owned by a household.

2.3 Treatment of households' own-account production of energy products

28. When considering produced electricity and heat as goods, and if it is quantitatively significant, households **own-account production of electricity and heat should be included in the production boundary under the SNA.**

29. In the Eurostat questionnaire the issue of small-scale “balcony solar panels” was also discussed. These are panels which produce only very small quantities of electricity and are generally not intended to feed into the grid.

30. In developing countries or remote locations access to an established electricity grid is not always available. This has given rise to off grid energy production. This could be considered similar to “balcony solar panels” but on a more widespread scale.

31. While meeting SNA guidance for inclusion in the production boundary, balcony solar panels and off grid production is likely impractical to measure. In developed countries these will be relatively small values, however this may not be the case in some developing countries where the electricity grid only covers small parts of the country.

32. The issue of ‘balcony solar panels’ was reported to exist in 11 out of the 16 EU/EFTA countries. When asked if this small scale own-account production should be included in national accounts, the views were split – 8 in favour and 8 against.

- The main justification for including was that electricity is a good and therefore the production in principle needs to be included. However, in practice the production might be (at least currently) negligible. Secondly, it should be recorded for reasons of comparability between countries (also for the consumption side). The importance might grow in the future and in some countries it might already have reached a significant size. One proposal was to include it only in an estimate of overall total electricity production, without showing it separately.
- Arguments against were that it is difficult to measure. In addition, these installations do not need to be registered or reported to the electricity grid operator. In particular, only production that can (or is intended to) be fed into the grid should be measured; an analogy to a stand-alone solar lamp was made, which is not intended to be measured.

33. The Eurostat questionnaire also investigated the current recording of electricity production by households.

⁽⁴⁾ It is assumed that no export/import for this activity takes place.

34. On the question whether own-account production of electricity by households is recorded already now, the answers were:

Yes, fully	2 (NL, ES)
Yes, for part of the production	2 (PT, BE)
No	13 (RO, LT, FI, SE, FR, LV, LU, NO, AT, HU, PL, DE)

35. The part of production covered in PT and BE refers specifically to solar panels, while at the same time in the NL and ES solar panels seem to be considered the only relevant own-account production by households. Consequently, these 4 countries can be grouped together.

36. The following table shows the data reported by these countries for own-account production of energy by households:

Country	Reference year	Prod [mEUR]	% of total energy production
NL	2021	536	6%
PT	2022	14.9	0.3%
BE	2021	424	2.8%
ES	2020	251	0.5%

37. From the countries not recording own-account production by households, two intend to start recording it from the next benchmark revision in 2024 (AT, DE), while in France it would most likely be from the benchmark revision 2029. The 9 remaining countries intend not to record it, unless legally required (RO, LT, FI, SE, LV, LU, NO, HU, PL).

38. The following table summarises the reasons given by respondents for not recording own-account production of electricity by households:

Country	a) Methodological reasons	b) Data availability	c) Not explicitly required by ESA 2010	d) Not considered relevant up to now
RO	X	X	X	X
LT		X	X	X
FI				X
SE		X		
LV				X
LU		X		
NO		X		

HU	X	X	X	X
PL		X	X	X

The questionnaire has shown that the majority of responding EU/EFTA countries support the recording of own-account production of electricity and heat by households. It is evident from the above table that methodological considerations do not constitute the main objection of some countries to actually recording own-account production of electricity by households, but rather the arguments are more practical (either difficulty to measure or expectation that the amounts are not considered relevant).

2.4 Industry Allocation

39. SNA § 5.15 – 5.19 indicates the creation of a separate establishment for the household production of energy for own final use or for sale, if it is feasible to compile estimates for all inputs used in production of the energy products. It follows then that this establishment be allocated to the energy industry (ISIC 35). However, for many countries household energy production is likely to be on a small scale when compared to household production of dwelling services. In this case, energy production may be considered secondary production of the establishment that produces dwelling services (2008 SNA § 5.15) and be classified to the industry that dwelling services is allocated. For some countries, this may be the supplementary industry classification “ownership of dwellings”. One of the advantages of secondary production classification is that it may enable a more transparent recording of household production of energy along with the primary production of dwelling services being produced by the household producing unit.

40. This paper focusses on household production of energy, although production of energy, either for sale or for own final use, is becoming more common in schools, community organisations, government buildings and businesses outside the energy industry such as retailers, manufacturers and agricultural holdings. This then raises the question if the chosen treatment for households provides a precedent for other institutional sectors outside the energy industry. An example would be for a retailer who produces electricity for sale, should this be secondary production of the retail industry or allocated to electricity? There is also a fundamental question for measurement of non-market output and value added, which is considered in Annex 1.

41. Whilst this subject would benefit from a further discussion, the following reflections could be useful:

- It would be helpful to have a symmetrical treatment for non-households, so that the supply and use of energy can be followed through the accounts (as either primary or secondary production).
- Own-account production of energy by non-households could be considered as no different to the own-account production of other goods and service used up during the course of production activities. In this case it is not standard practice in national accounts to record small scale intra-flows of own-produced goods and services within

an enterprise, although this may be done in industrial analysis if establishment-level data are available. There is no overall impact on value added.

- Since non-households can equally feed excess energy into the grid, this should certainly be reflected as their secondary production. They may however operate under different pricing and contractual conditions, particularly if their production is substantial.

2.5 GFCF linked to energy production by households

42. In order to produce and use energy, households will need to acquire certain goods, like solar panels, batteries, heat pumps, power lines or pipes. As far as this expenditure is linked to the production of energy provided to other units, and where the energy production for own consumption is classified as a good such equipment would qualify as GFCF.

43. The following guidance from the SNA is supportive of renewable energy installations being classified as GFCF of dwellings, § 9.68, “expenditures on major improvements (that is, reconstructions, renovations or enlargements) to dwellings are not classed in the same way as decoration, minor repairs and maintenance⁵. They are excluded from household consumption expenditure and are treated as gross fixed capital formation on the part of the owners of those dwellings, including owner-occupiers”.

44. Further, §10.68 states that “Dwellings are buildings, or designated parts of buildings, that are used entirely or primarily as residences, including any associated structures, such as garages, and all permanent fixtures customarily installed in residences.” As such the retrofit of solar panels attached to an existing house requires modification in the form of electrical work. They are therefore classified as dwelling alterations and additions, a component of GFCF. If attached to a new house, then solar panels should be included in the total cost of the dwelling (new dwellings).

45. The distinction of households’ expenditure as capital formation or final consumption expenditure does not have an impact on the level of GDP or GNI. A simplification could therefore be agreed to record the full expenditure as GFCF by households..

46. In the Eurostat questionnaire 11 out of the 16 responding countries reported that costs for electricity production installations by households are already now included in GFCF measures, either in full or partly (NL, LT, FI, SE, FR, BE, LV, AT, ES, HU, DE). The costs will be part of total expenditure for construction works or major improvements.

47. Possible double counting in GFCF measures, i.e. in both expenditure on dwellings and expenditure on energy installations, seems not to be an issue. Double counting in practice will depend on the data sources and the estimation method used. However, it seems countries are aware of this risk and take it into account when needed.

⁵ It may be noted that SNA Update Guidance Note WS.12 proposes to introduce an “of which” item in the assets classification for renewable energy installations. One may imagine that this is aimed at larger structures than solar panels on dwellings, however it would be important to clarify the distinction with dwelling assets.

2.6 Valuation of households' own-account production of electricity and heat

48. From a conceptual point of view, valuation of own account production of energy products does not bring any specific problems, as the general rule established in SNA §3.123 applies:

“When market prices for transactions are not observable, valuation according to market-price-equivalents provides an approximation to market prices. In such cases, market prices of the same or similar items when such prices exist will provide a good basis for applying the principle of market prices”.

49. Further, SNA § 6.124 states that ‘output for own final use should be valued at the basic price at which the goods or services could be sold on the market’.

50. The issue is more of a practical nature, as market prices for energy products bought and sold to the grid can largely vary during a day, and even become negative at some sunny or windy days, during the weekend, and in general when supply exceeds demand. This entails two practical issues:

- How to identify the ‘right’ price. In principle, own-produced energy should be valued at the price that applies at the moment (day and hours) at which it is produced and consumed. The valuation issue is not only related to energy used and consumed directly from solar panels but also through batteries. The price and time of the feed in tariff (FiT) ⁽⁶⁾ received for feeding energy to the grid is another important issue especially for households with solar and battery set ups. These issues would require availability of detailed data of when electricity is produced and stored by households and of the corresponding market prices.
- How to deal with negative prices ⁽⁷⁾. This might be observed when there is excess supply over demand on the grid and as a result grid operators charge households to place electricity into the grid, and equally when households are paid to take electricity

⁽⁶⁾ FiT is the price that the producer would receive directly for feeding electricity to the grid (i.e., the amount not consumed). If households are on a time varied FiT plan, they can also earn additional income by storing electricity in batteries during the day and selling it at a higher rate at night. The FiT rate includes costs on top of the forecasted wholesale price, these may be seen as economic benefits linked directly to the product of renewable electricity and included as a component of the basic price. The retailer also has economic incentive to pay a FiT for renewable electricity higher than wholesale prices due to the benefit they receive from government policies linked to renewable energy uptake.

⁽⁷⁾ Solar is a primary factor for the existence of negative spot price on the wholesale energy market. During the daytime, when solar customers increase their feed of solar to the grid, it increases the market supply of electricity. At the same time, the production of solar energy in the daytime is at the highest level, less electricity is accessed from the grid, and results in a reduction in the market demand for electricity. The increase supply accompanied by reduction in demand represent downward pressure on daytime wholesale prices. In some cases, when solar feeds are at their highest level during the day, the wholesale/spot prices could be negative. During the evening ‘peak’ period, when electricity demand from the grid is at its highest and solar production is minimal, wholesale and retail prices increase. The solar energy feed to the grid in the evening is very small as household consumption is high and any excess energy feeds require batteries which currently only a small percentage of households own.

from the grid ⁽⁸⁾⁽⁹⁾. Application of negative prices to quantities generated would give negative output.

2.6.1 Valuation of households' own-account production of electricity and heat

51. For the price for solar electricity consumed (directly through solar panels or batteries) by household the price options reflect the SNA principle stated in § 6.124 that own consumption should be valued “at time and place goods and services produced” (10). The following options (11) may be considered:

- Option 1 - the Feed in Tariff (FiT) that the household receives for electricity fed to the grid.
- Option 2 – The wholesale electricity contract price, this is reliant on the possibility the household can negotiate a supply contract with a wholesaler or retailer.
- Option 3 -the electricity wholesale spot rate on the electricity market.

2.6.2 Valuation of exports of electricity to the grid through batteries

52. The use of batteries allows households to feed excess electricity during peak times in the evenings, where the FiT rate is generally higher. The difference between the FiT rates between day and evening could be seen as holding gains. However, application of SNA Appendix 6a, rejects the holding gains treatment.

“SNA 6.15 Value that is not attributable solely to holding gains and losses is when goods are placed in storage to take advantage of changes in the pattern of supply and demand over a year.”

53. SNA focusses on examples of agricultural products such as wheat or hay for fodder stored in silos to manage price changes in agricultural seasons. It could be argued that this provides a conceptual precedent for the treatment of electricity stored by batteries if seasonal price change is extended to daily price change seen in the electricity market. However batteries are usually very short term instruments, with their charge used within 24 hours of its generation. Therefore it seems sensible to ignore the intra-day variation in prices for the purposes of national accounts recording.

⁽⁸⁾ In Australia, in 2024 there is a proposal to introduce a feeding charge for the delivery of electricity from solar panels to the grid. This charge is to help address the problem of ‘traffic jams’ on the network (which constrain customers from feeding all the extra energy generated). The charge is likely to be implemented for electricity feed during daylight hours.

⁽⁹⁾ Whilst negative prices are observed in some countries, for some periods of time, it is debatable if the impact would be seen in national accounts on a quarterly or annual basis. And negative prices may become less important over time as battery technology develops, thereby allowing households to economically store electricity themselves.

⁽¹⁰⁾ Therefore, this implies that the valuation from consumption via batteries should be a daytime wholesale price or Feed in Tarrif (FiT) rates when the electricity is generated, not when consumed. Any own consumption during peak times (e.g. evenings) from a battery should not be valued at the higher wholsale prices or FiT rate.

⁽¹¹⁾ The retail price has not been put forward as an option for valuing own account consumption because it is inconsistent with the 2008 SNA concept of basic prices (which exclude trade and other margins included in the retail price consumers pay).

2.6.3 *Valuation of charges to feed electricity to the grid.*

54. For the issue of charges to feed to the grid the following options may be considered:
- a. Option 1 – treat feed charges as an increase in intermediate consumption of feeding to the grid.
 - b. Option 2⁽¹²⁾ – reduction in the basic price of electricity generated from solar panels for own use or fed to the grid.
55. In case the feed charge is treated as intermediate consumption (of feeds to the grid), output from electricity production for the notional unit is larger than if the feed charge is treated as a reduction in basic price¹³. For electricity fed to the grid, feed charges treated as a reduction in basic price or treated as intermediate consumption, there is no change in GVA. For own account consumption of electricity, feed charges - if treated as a reduction in the basic price - will produce lower consumption than if treated as intermediate use (of feeds to the grid).
56. Here, it is recommended to apply option 2. The justification for a lower basic price for own consumption is that the feed charge lowers the potential price that could be received for electricity. This is similar to own consumption of agricultural products which use a “farm gate” price excluding any cost of transport to market.

2.7 *The issue of double counting*

57. The issue of double counting might in theory appear for the recording of GFCF when expenditure is included in both the expenditure on dwellings and the expenditure on energy installations, though evidence from Europe suggests that it may not be so important in practice.
58. It might also happen, that installations for the use of regenerative energy (electricity or heat) might lead to higher market rentals for the relevant dwellings, or a “rent premium”, which could lead to double-counting for production and consumption.
59. Depending on the estimation and stratification model, owner-occupied rentals may also include this rent premium. This will depend on the proportion of rented dwellings that have renewable energy installations, as well as if this is explicitly included as a parameter in the estimation and stratification model. For example, as well as dwelling type, size and location, renewable energy installation could also be included in estimation of imputed rental.
60. Any observable actual, or imputed, rent premiums on renewable energy installations is potentially double counting production and consumption. This is because the resident of the household consumes additional consumption of both dwelling services and energy.

⁽¹²⁾ A Solar feed t charge could be treated like transport charges in the 2008 SNA, in that these will be excluded from basic prices.

¹³ Treatment as intermediate consumption also generates impacts from “negative prices”, as discussed elsewhere in this document.

61. The final consumption product of the renewable energy installation to the resident is energy (not dwelling services¹⁴). The household dwelling is producing additional output due to the renewable energy installation, but it is transformed into energy for final consumption.
62. This can be remediated by splitting out the renewable energy contribution to total dwelling services and excluding it from final household consumption of dwelling services. Conceptually the renewable energy installation could be viewed as being leased from the dwelling for the production of energy, and is therefore intermediate consumption of energy production.
63. Empirical evidence is that renewable energy installations are overwhelmingly installed by owner occupiers¹⁵. In the methodology applied in Australia the amount of rent premium is not significant, simply because very few leased dwellings have renewable energy installations. This impacts owner occupiers, as the leased dwellings from which imputed rent is calculated don't include renewable energy installations. As such even if renewable energy installations are part of the owner-occupied dwelling there is no mechanism for a rent premium to be implicitly added. The lack of renewable energy installations of leased dwellings is dependent on the current regulatory environment in most countries, where there is little or no incentive to install renewable energy installations on leased dwellings. This will likely change in the future.
64. From the countries already now recording own-account production of electricity none adjusts for possible double counting in imputed rentals (possible higher rental prices for dwellings with equipment to generate electricity). As in Australia, in Spain it is considered that installation of solar panels is normally carried out in owner-occupied homes – rental prices of rented houses would usually not include this type of facility and therefore double counting is not an issue when rents are used to estimate production of dwelling services.
65. The Eurostat questionnaire also investigated GFCF in the production of heat. Eleven countries consider that the costs for installations by households to produce heat are partly or fully already included in their GFCF measures (NL, LT, FI, SE, FR, BE, LV, AT, ES, HU, DE). The main reason was that the costs are part of construction costs for new dwellings or major improvements for existing houses.
66. For the five countries answering that this is not the case (RO, PT, LU, NO, ES), the main reason seems to be that this type of installation is not relevant in their country.

3. Recommended approach

3.1 Conceptual aspects

3.1.1 Energy products are goods

¹⁴ Though one can consider if electricity and heat should be treated in the same way. There are arguments that renewable generation of heat should be included in dwelling services, as such heat generation is usually tied to the property and not exported. One author of this paper feels that this would be a suitable approach.

¹⁵ Independent studies from Australia (2018) indicated only 4% of rented dwellings have solar panels installed compared to 29% of owner-occupied dwellings.

67. Considering all the characteristics of energy products listed in section 2.1, the drafting team considers that **electricity and heat should be considered as goods and as such should be included in the national accounts production boundary even when produced by households for own final consumption**. This is in line with some countries' practice, while other countries deem that their national accounts already include estimates for households' own-account production or are conducting studies to include such estimates in the near future.

3.2 Practical aspects

3.2.1 Industry Allocation

68. If it is feasible to compile estimates for all inputs used in household production of the energy products, it is recommended to allocate household energy production to the energy industry.

69. If it is not feasible to compile separate estimates for household energy production, or it is assessed that it is more practical to consider it as secondary production of the establishment that produces dwelling services, it is recommended to allocate the energy production to industry where dwelling services is classified.

3.2.2 Valuation of households' own-account production of electricity and heat

70. The Feed in Tariff (FIT) rate (Option 1) is recommended as the price for valuing own account consumption directly from solar panels and batteries as it aligns with the SNA definition of basic prices and captures additional economic benefits of consuming renewable energy¹⁶.

3.2.3 Valuation of exports of energy to the grid through batteries

71. The additional value of electricity at peak time is notionally a storage of electricity service of the battery. It is recommended to capture this electricity storage service implicitly through the higher FiT rate that grid feeds receive at peak periods.

3.2.4 Valuation of charges to export energy to the grid.

72. It is recommended that charges for feeding into the grid be treated as a reduction in the basic prices of output (Option 2) from the household producing unit.

3.2.5 Avoiding double-counting

73. Where necessary, the additional final consumption of dwelling services (due to the rent premium for renewable energy installations) should be removed and recorded as intermediate consumption (representing the rental of renewable energy installations) of household energy production. This removes any double counting of dwelling services and energy consumption. Where GFCF may be double-counted between dwellings and energy generation equipment, due to data sources, appropriate adjustments should be made to avoid double-counting.

¹⁶ In the case of volatility in the FiT rate due to e.g., flexible contracts, the recommended method would be to use average FiT rate over the period (quarterly or annual).

4. Required changes to the SNA

74. The required changes to SNA would mainly relate to clarification of the status of electricity and heat, their specific inclusion in own-account production of households, their relation to dwelling services, and the recording of the installations used to generate the energy.

Annex 1 – Treatment of energy production by non-market producers

Overview

1. Household production of energy, either for own use or for sale is covered extensively in the paper. For units that are not in the household sector S.14 and whose main activity is not energy production (i.e. which are not in ISIC 35), it seems appropriate that energy production is considered secondary production when sold or supplied to other units.
2. Similarly, own account production - while potentially of analytical interest - has no impact on GVA with additional own account production completely offset by the intermediate consumption.
3. How to treat both own production and market sale of energy of non-market producers such as general government (GG) and NPISH is less clear and is discussed below.

Non market production for own final use

1. SNA gives some guidance for own account production. “6.134 - When production for own final use is undertaken by a unit in the general government or NPISHs sector it is treated as being undertaken by a non-market producer.”
2. This appears to indicate that energy produced for own usage should be included the production boundary like any other non-market production. This interpretation could be taken further that the electricity should be valued as sum of costs.
3. Sum of cost approach for energy installations output would largely be CFC as well as maintenance costs. In the case that the non-market unit that replaced purchased energy with own account energy it is possible that output will remain unchanged or even fall.
4. In this scenario GVA of non-market producers will not be impacted as own usage should also be recorded as intermediate consumption at the same sum of costs value. Likewise, any change in energy consumption will also be perfectly offset between output and intermediate consumption.
5. However, an imputed price similar to household production (as discussed in the solar paper) is likely more appropriate as well as more practical to implement. This is clearly inconsistent with current SNA guidance.

Non market production for market sale

6. Where GG or NPISH sell energy to the grid, this is a market transaction, rather than production for own use. Non-market producers engaging in market transactions is covered in the SNA 6.132. Of note is that SNA recommends that a separate establishment be created for the market activity if feasible. But SNA also recommends that despite the existence of a market price for the transactions, the combined market and non-market output should be valued as sum of costs.
7. In general, with the sum of costs approach is used it will not be possible to separate the costs relating to market (sales) and non-market output, for example it is not clear what part of the CFC or maintenance relates to what element of production.

Key questions for the treatment of energy production by non-market producers

8. *To what extent should the “sum of cost” approach be followed to value total government output, in the context of sold and own consumed energy?*

9. This is a fundamental question about the valuation of total government (or NPISH) output. Already many sales from non-market units are valued at their transaction price, but total government/NPISH output remains as the sum of costs. Were a separate entity to be distinguished in national accounts for production of energy (see below), then that entity itself could be considered as a market producer if it fulfils the usual criteria.
10. *Should a separate establishment be created for the market sales of energy? Or should it be secondary production as proposed for market producers outside the energy industry discussed in paragraph 1.*
11. Here it would be logical to follow the same approach as for market producers and to record secondary production.

Implications for Use and Consumption

12. Inclusion of energy production for own use and for market sale by the non-market sector has further implications for Government Final consumption expenditure (GFCE), as well as NPISH Consumption.
13. SNA states (para 9.105) that treatment of consumption expenditures incurred by NPISHs is very similar to that for general government. A key difference is around treatment of market sales.
14. SNA is fairly clear that production for own use is by definition also final consumption, which is valued at sum of costs (para 9.87). As such the value of energy produced by the non-market sector for own use will add to GFCE and NPISH consumption.
15. GFCE will differ from government output by the amount of sales revenue received from market transactions (SNA para 9.88). This is to account for the fact this usage will occur as household consumption or other usage for sales to other sectors.
16. SNA does not prescribe the same treatment for NPISH, where output is assumed to be the same as consumption, however it is presumed that the same approach applies as for government in the context of sales.
17. In summary SNA indicates that the use side in terms of GFCE and NPISH consumption should include energy consumption produced for own use by the non-market sector. Any market sale of energy by GG units should reduce GFCE similar to other revenue from market sales received by GG units.