Report D4.4-PE,  July 2017

# Auctions for Renewable Support in Peru: Instruments and lessons learnt

AURES

HORIZON 2020

**Short about the project**

**Auctions for Renewable Energy Support: Effective use and efficient implementation options (AURES)**

This project helps assessing the applicability of different auction types to renewable support under different market conditions. It also explores which auction types and design specifications suit particular requirements and policy goals in European countries. By establishing best practices and a knowledge sharing network, we contribute to informed policy decision-making and to the success of auction implementations across Europe.

**Target-oriented analysis:** Through analysis of empirical experiences, experiments and simulation, we will create a flexible policy support tool that supports policy makers in deciding on the applicability of auction types and certain design specifications for their specific situation.

**Capacity building activities:** We undertake specific implementation cases to derive best practices and trigger knowledge sharing amongst Member States. We strive to create a strong network with workshops, webinars, bilateral meetings, newsletters, a website that will serve as capacity building platform for both policy makers and market participants (including project developers, auctioneers,etc.). Wherever required, we can set up specific bilateral and multilateral meetings on specific auction auction issues and facilitate cooperation and knowledge sharing. Additionally, we offer sparring on specific implementation options, drawing from insights gained during the first phases of the project (empirical analysis of previous auctions in Europe and the world), conceptual and theoretical analysis on the applicability of specific designs in certain market conditions and for certain policy goals issues and facilitate cooperation and knowledge sharing. Additionally, we offer sparring on specific implementation options, drawing from insights gained during the first phases of the project (empirical analysis of previous auctions in Europe and the world), conceptual and theoretical analysis on the applicability of specific designs in certain market conditions and for certain policy goals.

**Project consortium:** eight renowned public institutions and private firms from five European countries and combines some of the leading energy policy experts in Europe, with an impressive track record of successful research and coordination projects.

The report contributes to the first and second of three tasks in work package 4 of the AURES project:

T4.1 Providing a characterisation of the different auctions

T4.2 Making an assessment of auctions and case-specific lessons learnt

T4.3 Interpreting and summarising the general lessons learnt and resulting and thereby outline specific recommendations

For further information please contact Pablo del Río pablo.delrio@csic.es

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Authors: Pablo del Río (CSIC)

Reviewed by: Ana Amazo (Ecofys)

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# 1. Characteristics of auctions in Peru

Peru is the fourth largest country in South America after Brazil and Argentina, with a population of 31.3 million and a GDP of 189 billion $ (World Bank 2016). According to the World Bank (2016), over the past decade, Peru has been one of the region's fastest-growing economies, with an average growth rate of 5.9 percent in a context of low inflation (averaging 2.9 percent). As a result, moderate poverty (US$4 a day 2005 PPP) fell from 43 percent in 2004 to 20 percent 2014. Although GDP growth had a 6-year minimum of 2.4 percent in 2014, it slightly recovered to 3.3 percent in 2015. Growth was driven by a strong accumulation of inventories and a recovery in exports. In contrast, investment continued to decline due to weak external economic conditions and slow execution of infrastructure projects at the local level. Private consumption decelerated due to deteriorating labor market conditions.

In 2014, Peru generated almost half of its 45.7 TWh of electricity from non-RES energy sources. Within these, gas was the largest contributor (45.9%), followed by oil (1.2%) and coal (0.7%). Hydro dominates RES production with a 48.7% share, followed by bioenergy (2.84%). The contribution of solar and wind to electricity production was negligible (0% PV, 0.14% solar thermal, 0.45% wind) and the share of the other RES (geothermal and tidal) was non-existent (IEA 2017a). The dominance of hydro is also reflected in the installed capacity of RES, which is mostly based on hydro (90%) and has increased slightly between 2007 and 2014. However, RES installed capacity has experienced a substantial increase in the last couple of years, mostly due to hydro capacity additions and, to a lesser extent, wind capacity additions (table 1).

*Table 1. Installed electricity generation capacity in Peru (accumulated, MW).*

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| Hydro | 3234 | 3242 | 3277 | 3438 | 3451 | 3484 | 3556 | 3662 | 4166 | 4711 |
| Wind | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 143 | 240 | 240 |
| Solar | 0 | 0 | 0 | 0 | 0 | 80 | 80 | 96 | 96 | 96 |
| Biomass | 30 | 40 | 75 | 65 | 70 | 111 | 175 | 175 | 181 | 181 |
| Other | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 3265 | 3283 | 3353 | 3504 | 3522 | 3676 | 3812 | 4076 | 4683 | 5228 |

Source: IRENA (2017).

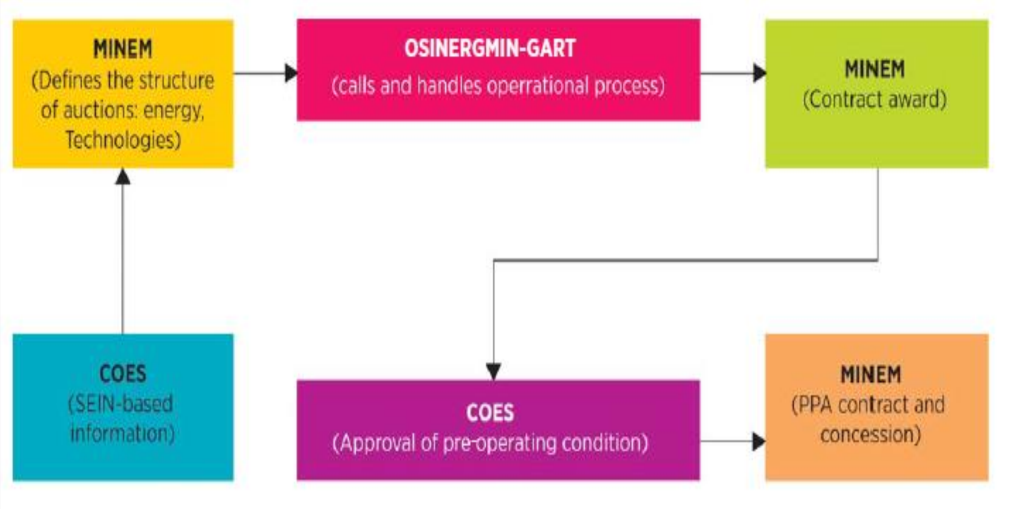
Regarding the energy sector regulatory framework, the Electricity Concessions Law set the legal framework for activities in the electricity sector, unbundling the generation, transmission and distribution utilities and enabling participation by the private sector. As the policy definition body, MINEM (Ministry of Energy and Mines of Peru) develops regulations and standards in the energy and mining sectors, including those related to renewable energy. The policy and regulatory guidelines for conducting auctions for renewable electricity generation are set by MINEM. The Supervisory Agency for Energy and Mining Investment (Organismo Supervisor de la Inversión en Energía y Minas, OSINERGMIN) supervises and regulates activities in the energy and mining sectors, including the renewable energy market. The auction is designed and implemented by OSINERGMIN at the request of MINEM. The Office for Tariff Regulation (GART), part of

OSINERGMIN, calculates and proposes electricity tariffs, which need to ensure the efficient operation of electricity utilities at the lowest cost to the consumer. Finally, the Committee for the Economic Operation of the Electric System (COES) coordinates the operation of the national grid at minimum costs in the short, medium and long terms. In addition, COES plans the development of transmission lines and manages the short-term market (IRENA 2014, p.18).

Legislative Decree (LD) 1002 on the Promotion of Investment in Electricity Generation with Renewable Energy Sources was approved in May 2008. It promotes renewable energy as a national priority. The Decree also contained a non-binding target of up to five per cent of national electricity consumption to be met by renewable energy sources during the 2008–2013 period (excluding hydro). This target was missed by a wide margin (Norton Rose Fulbright 2017). Recently, the government has set two targets: 5% of RES in 2018 (excluding hydro) and 60% of RES in 2018 (including hydro)(IRENA 2015b). The first target was reached by the end of 2016 according to one interviewee. Peru has a “high” potential for wind, solar, hydro and geothermal, a “high-medium” potential for biomass, and an “unknown” potential for ocean-based RES (Norton Rose Fulbright 2017). The Legislative Decree 1002 considers the following as RES: hydro (<20MW), wind, biomass, solar, geothermal and tidal. LD 1002 states that OSINERGMIN will auction the allocation of the premium to RES-E generation projects according to the guidelines set by MINEM (art. 7.1). LD 1002 was regulated by Decree 012 of 2011, which establishes a mechanism were long-term guaranteed tariffs for electricity from renewable energy sources are auctioned biannually (IEA 2017b). According to another interviewee, motivations to implement auctions include perceived technical capacity constraints by the regulator in defining administratively-set FITs, the experience accumulated with auctions in the electricity sector, its advantages in terms of transparency as a mechanism to allocate contracts, the price discovery element inherent of auctions and the fact that auctions allow the government to define the quantities being auctioned and the market sets the price.

*Table 2. Characterisation of auctions in Peru*

| **Characteristics** | **Description** |
|---|---|
| **Country characteristics** | See text |
| **Market characteristics** | See text |
| **Name of auction scheme** | Subastas de Recursos Energéticos Renovables (RER) |
| **Objectives** | To introduce RES-E generation efficiently and effectively, maximising the benefits for the consumer (Mitma 2013). |

| Characteristics | Description |
|---|---|
| **Contracting authority** | The government is the off-taker (represented by the Ministry of Mines and Energy)(IRENA 2015a).<br><br>The renewable energy auction process involves three key entities, MINEM, OSINERGMIN-GART and COES. Their interaction is shown in the figure below.<br><br><br>Source: IRENA (2014).<br><br>MINEM defines the structure of the auction, sets the date for the call, determines the total energy to be auctioned, sets quota for each renewable energy technology (a cap according to technology) and signs the contracts for the supply of electricity with the winners in the auctions.<br>The allocation takes the recommendations of the system operator (COES) into account in relation to the status of grid infrastructure and the variable power injection points in the grid.<br>The regulator OSINERGMIN-GART is responsible for conducting the auction and determines the price cap for each technology (IRENA 2014). It oversees, on behalf of the government, operators' compliance with the legal, technical, and commercial provisions in state contracts and concessions. In addition, OSINERGMIN has responsibility for setting electricity tariffs for regulated consumers (Mwenechanya 2013, Ormaño and Vásquez 2014). |
| **Main features** | -Price-only, multi-item, static technology-specific auctions.<br><br>-Volume auctioned: generation-based (capacity in some small hydro auctions).<br><br>-Geographically neutral. |

| Characteristics | Description |
|---|---|
| | -20-year contracts. |
| **Year of introduction** | 2009<br>Four auctions have taken place: 2009 (1st auction, 1st round), 2010 (1st auction, 2nd round), 2011 (2nd auction), 2013 (3rd auction), 2015/2016 (fourth auction, 1st and 2nd rounds). |
| **Technology focus and differentiation** | All RES, but technology-specific auctions (biomass, wind, solar and hydro<20MW).<br>1st 2nd an 4th auctions: biomass, wind, solar and hydro.<br>3rd auction: hydro and biomass.<br>Tidal and geothermal, which are also RES according to Peruvian Law, have not been promoted through auctions. |
| **Lead time before auction** | Around 3 months between the call for auctions and the publication of results, maximum of 4 months (Mitma 2015, p.33).<br>1ST AUCTION (1st round). Call: 15 Oct. 2009. Sealed bids sent on 22nd Dec 2009. Publication of results: 16 jan. 2010.<br>1st AUCTION (2nd round). Call: 12 March 2010. Sealed bids sent on 21st May 2010. Publication of results: 28 June 2010<br>2nd AUCTION. Call: 28 April 2011. Sealed bids sent on 13th June 2011. Publication of results: 2 July 2011<br>3rd AUCTION. Call: 12 Aug 2013. Sealed bids sent on: 27 Sept 2013. Publication of results: Nov 4th 2013.<br>4TH AUCTION. Call: 3 Sept 2015. Sealed bids sent on: 18 Dec 2015. Publication of results: February 2016 |
| **Min./max. size of project** | No (only: hydro<20MW) |
| **What is auctioned?** | Generation (capacity in the first and second rounds of the first hydro auction).<br>Electricity produced above the cap is sold at market prices, and projects that produce less than the amount specified in the bid are penalised by a reduction in the tariff (IRENA 2013). |

| Characteristics | Description |
|---|---|
| **Budgetary expenditures per auction and per year** | According to IRENA, very low: the organisation of the auction ”was achieved with relatively minimal additional institutional costs” (IRENA 2013, p.36) |
| **Frequency of auctions** | Bi-annual tenders. There have been four auctions: 2009/2010, 2011, 2013 and 2015/2016. However, according to IRENA (2015a), they are stand-alone auctions (each auction is organised individually, without the commitment to further bidding rounds in the future). |
| **Volume of the tender** | The volume offered is proportional to 5% of final energy consumption in the previous year (Modelo Energético Sostenible 2016). See section 2 for details on volumes offered and contracted.<br><br>If the whole volume of electricity is not awarded, a second round will be organised, in which the bidder may reduce its bid price (ACERA 2016). In case all the volume is not awarded in the second round, this round will be declared totally or partially void (Factor 2017, p.92). |
| **Auction design elements** | See Table 3 |

## 1.1 Design elements for the assessment of auction schemes for RES-E

*Table 3. Design elements for the assessment of auction schemes for RES-E.*

| **Design elements** | |
|---|---|
| **Single- or multiple-item auctions** | Multiple-item |
| **Auction procedure** | Static auction (sealed bid) |
| **Pricing rules** | Pay-as-bid |

| Design elements | |
|---|---|
| **Ceiling price** | Yes. The ceiling price is only revealed if it is exceeded by at least one bid received in the case where the total volume auctioned is not contracted in a complete auction round. In such an event, there is no restriction on the bids that exceeded the ceiling to re-submit a bid for the same project (IRENA 2013, p.35). The ceiling price was disclosed in the 4th auction for the first time (undisclosed until then).<br><br>The ceiling prices were set by the regulator taking into account the studies commissioned to a consultancy firm and considering, among others, the type of technology, investment costs, O&M costs, a 20-year period, an internal rate of return of 12%, the size of the projects and the connection costs (OSINERGMIM 2010). |
| **Qualification criteria** | Technical requirements (providing affidavits of renewable resource investigations lasting at least one year, compliance with standards and equipment specifications and pre-feasibility studies)(IRENA 2014, p.24). Bid bond (garantía de seriedad de oferta): 50000$/MW of installed capacity, which is lost if the bid is won and the bidder fails to sign the contract (IRENA 2015a). This bid bond was increased from 20000$/MW in the first round (IRENA 2013). Performance (completion) bond (garantía de fiel cumplimiento): 250000$/MW of installed capacity.<br>The connection point has to be included in the bid. |
| **Penalties** | Strict delay penalties apply. After signing the contract, project developers are required to commit to a completion bond of $100000 per MW of capacity installed, and they must submit a progress report on the project's evolution every three months. If delays in the contracted timeline for construction occur for two consecutive quarters, penalties are deducted from the deposited guarantee.<br><br>If there are delays with the start of commercial operation of the plant, the bond is increased by 20% over the outstanding amount from the date of verification. The project developer may request to postpone the date of commercial operation provided that it is within a defined deadline and no longer than three months. If the accumulated delay exceeds one year from the date specified in the bid, the postponing might be accepted, and the performance bond is increased by 50%. Peru has implemented these stringent delay penalties in response to the urgency of operating projects to meet the country's rapidly growing energy demand and economic development needs (IRENA 2015a, p.136). Any shortcoming in the contracted amount of electricity results in a reduction of the guaranteed tariff by the same percentage for that year. For |

| Design elements | |
|---|---|
| | example, if a producer generates only 85% of the contracted electricity in a given year, he/she will receive only 85% of the guaranteed tariff for all electricity sold that year (IRENA 2016, IRENA 2015b). |
| **Monitoring of realisation progress** | Not available |
| **Exceptions from requirements for small plants/developers?** | No (only: hydro <20MW). |
| **Support auctioned** | A guaranteed remuneration level (20 years) for winners, made up of two sources of revenue (Ormeño and Vásquez 2014, IRENA 2014, IRENA 2015b and Díaz 2012): 1) Sales to the electricity spot market ("revenues at marginal costs"), i.e., winners receive the spot market price (short-run marginal costs of the system). 2) A premium: a complementary remuneration collected from final consumers, which covers the differences between the guaranteed remuneration and the spot market price. This subsidy is paid out of the excess charged to the users of the transmission network (IRENA 2014).<br>Electricity above the awarded volumes is remunerated at the spot market price. A penalty is imposed where there is a shortfall in energy produced. The final price to be paid is the price awarded minus any penalty. |
| **Transferability of support right** | They can be transferred. |
| **Other** | -There is a second round if all the electricity offered is not awarded in the first round. There was a 2nd round in the 1st and 4th auctions. Bidders were allowed to adjust their initial bids in the 2nd round.<br><br>-Contracts are both denominated in dollars and indexed to inflation.<br><br>-Winning projects are granted priority of dispatch and access to transmission lines and distribution networks.<br><br>-No local content requirements.<br><br>-No seller concentration rules. |

# 2. Evaluation criteria for the assessment of auction schemes for RES-E

## Actor variety and social acceptability

Different types of actors participated and were awarded in the auction: small and large-scale generators, national and international ones. However, different sources emphasize the dominance of one type of actor. IRENA (2013) states that the auction has promoted large-scale generation vs. small projects, thereby limiting the participation of SMEs. GIZ (2015) argues that most of the new renewable volume contracted through auction rounds has been assigned to independent power producers that were not present on the Peruvian market prior to 2008 and that many international companies were attracted. According to del Río and Linares (2014), winning investors were mostly foreign private companies.

## Policy effectiveness (effectiveness of auctions)

Effectiveness in the AURES project has been defined as the realization rate of projects. However, in line with del Río and Linares (2014) and IRENA (2013) a so-called “a priori effectiveness” has also been considered in this report, i.e., the amount of volume offered in the auction which is being contracted[1]. The following table provides information on the volumes offered and the volumes contracted per technology and auction.

*Table 4. Volumes offered and volumes contracted per technology and auction.*

| | | 1st auction (1st round) | 1st auction (2nd round) | 2nd auction | 3rd auction | 4th auction (1st round) | 4th auction (2nd round) |
|---|---|---|---|---|---|---|---|
| BIOMASS | Volume offered (GWh/year)* | 813 | 419.00 | 828.00 | 320 | 312 | |
| | Volume contracted (GWh/year) | 143.3 | 11.70 | 14.02 | 0 | 29 | |
| SOLAR | Volume offered (GWh/year) | 181 | 8.00 | 43.00 | | 415 | 108.40 |
| | Volume contracted (GWh/year) | 172 | 0.00 | 43.00 | | 415 | 108.40 |

[1] IRENA (2013) defines effectiveness (success rate) as the percentage of volume awarded compared to volume auctioned.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| WIND | Volume offered (GWh/year) | 320 | | 429.00 | | 573 | 165.60 |
| | Volume contracted (GWh/year) | 571 | | 415.76 | | 573 | 165.60 |
| HYDRO | Volume offered (GWh/year)** | | | 681.00 | 1300.00 | 450 | |
| | Volume contracted (GWh/year) | | | 679.93 | 1278.06 | 448.17 | |
| TOTAL | Volume offered (GWh/year) | 1314 | 427.00 | 1981.00 | 1300.00 | 1469 | 283.0 |
| | Volume contracted (GWh/year) | 887.24 | 11.70 | 1152.71 | 1278.06 | 1465.17 | 274.0 |

Source: Own elaboration based on data from OSINERGMIM. * Biomass: Second auction: i) Agrofood residues: 593GWh/year and urban residues: 235 GWh/year; Third auction: agrofood residues only; Fourth auction: i) Forest residues: 125 GWh/year, ii) Solid agrofood residues: 125 GWh/year, iii) Solid urban residues incineration: 31 GWh/year, iv) Solid urban residues biogas: 31 GWh/year (MINEM 2015c). ** In addition, the volumes for small hydro in the first auction were set in capacity terms. In the first auction (1st round), 500 MW of hydro were offered and 161 MW were contracted. In the second round of this first auction, 338 MW were offered and only 19 MW were contracted.

The table shows considerable differences between the volumes offered and the volumes contracted. Overall, about 1/3 of the volumes offered have not been awarded contracts. It is hard to attribute a big success in "the a priori effectiveness" criterion as a result of this, although this problem has been mitigated in the last auctions. Per technology, the largest differences can be observed for biomass (table 4). In some auctions, the large excesses of volumes offered with respect to the volumes contracted for biomass have been reallocated to wind. The initial first call was declared partially unmet. The aggregated energy allocated by the auction was 887 GWh, or about two thirds of the required energy. Biomass, which had been assigned 813 GWh, offered bids for only 143 GWh. Wind, which contributed 571 GWh, exceeded its quota of 320 GWh which was allowed under the auction rules (since the aggregated bids fell below the total required energy)(Mwenechanya 2013). But even with the greater amount awarded to wind, the contracted volume remained below the offered volume (i.e., wind could not offset for the biomass shortfall). Since the ceiling price for biomass was higher than the ceiling price for wind, the volumes auctioned but not covered were contracted to wind projects that were not selected but still below the ceiling price. Another reason for this ineffectiveness might have been the low participation in the first auction, which, according to Novoa (2011), could be related to the "high guarantees required". According to one interviewee, the fact that it is not known in advance which technologies will be included in the call has led to the standstill of biomass projects. A decision was made to move forward with a second round for the capacities not covered in this initial round. This second round included volume offered biomass (419 GWh/year), solar (8 GWh/year), as well as 338 MW of energy from small hydro (IRENA 2014). The volume for biomass was not met since the ceiling price set by OSINERGMIN was below most bids. Similarly, in the third auction, 320 GWh had been allocated to biomass and no GWh was contracted (the bids were above the ceiling price).

*Table 5. Volumes offered and volumes awarded in all the auctions in Peru.*

| | BIOMASS | SOLAR | WIND | HYDRO | TOTAL |
|---|---|---|---|---|---|
| Volume offered (GWh/year) | 2692 | 755,404 | 1487.6 | 2431 | 7366 |
| Volume contracted (GWh/year) | 198 | 738.4 | 1725.3 | 2406.1 | 5067 |
| % | 7.3 | 97.7 | 115.9 | 98.9 | 68.8 |

Source: Own elaboration based on data from OSINERGMIN.

Delays have occurred in the past. Regarding the realization rate of projects, according to data from the Ministry of Energy and OSINERGMIN, 6 of the 28 projects being awarded in the first auction (1st and 2nd rounds) were not producing energy in 2014, despite the fact that they should have been operational by 2012 at the latest (table 6). They are all hydro projects. 7 of the 10 of the projects awarded in the 2nd auction had not produced electricity in 2014, although they should have all started commercial operation by December 31st 2014 at latest.[2] According to MINEM (2015b), only 46.4% of the volume offered in the first auction (both 1st and 2nd rounds) was in operation in the intended date (December 31st 2012). In 2014, 52.5% was still under construction. Likewise, out of the 27 projects awarded in the first auction (selected in 2010 and scheduled to start operation in December 2012), only 19 were operating. Of the remaining eight projects, one was cancelled following payment of the completion bond, one suffered a force majeure incident (flood) and the other six were delayed for different reasons, such as environmental permitting delays and problems in reaching agreements with local communities (IRENA 2015a). However, looking at what had been realized of the first round by 2014, GIZ (2015) argued that the realization rate was relatively high in Peru (compared to past auctions)[3]. Low levels of prequalification requirements increase the risk of delays and non-execution, which might explain the suboptimal rate of projects starting operations on time. Other realization hurdles include problems with environmental permits and access to finance (Ecofys & GIZ 2013). Mwerechanya (2013) argues that the auction process obviates the necessity for many of the standard requirements for

[2] The three projects producing electricity in 2014 were Runatullo and Chanchayllo (hydro) and Moquegua (PV). The seven projects not producing electricity in 2014 were La Grinja (biomass), Tres Hermanas (wind) and Huatziroki, Manta, RenovAndes, 8 de agosto and El Carmen (hydro)(MINEM 2015).

[3] Out of 27 projects selected in the first Peruvian auction 21 projects are operating on schedule. These Projects were selected in 2010 and scheduled to start operating in December 2012. They amount to 236 MW or 55% of the capacity adjudicated in this auction. In comparison, the realisation rate under the UK's NFFO programme was only 26%, whereas France achieved a mere 20% and Brazil only 30% in its first three auctions (GIZ 2015, p.11).

market entry such as feasibility studies, planning permits or lengthy legal documentation. The process relies rather on stringent and substantial financial guarantees at every stage, thus placing on the prospective investor the responsibility to determine project feasibility and viability and to secure all the necessary permits, including environmental impact approvals.

*Table 6. Situation (as of 2014) of the projects in the first auction being awarded contracts*.

| Project | Technology. | Date for starting operation | Did the project produce electricity in 2014? |
|---|---|---|---|
| CUPISNIQUE | Wind | June 2012 | Yes |
| MARCONA | Wind | Dec. 2012 | Yes |
| TALARA | Wind | June 2012 | Yes |
| PARAMONGA | Biomass | March 2010 | Yes |
| LAS PIZARRAS | Hydro | Dec 2012 | Yes |
| PANAMERICANA | Solar | June 2012 | Yes |
| MAJES | Solar | June 2012 | Yes |
| TACNA | Solar | June 2012 | Yes |
| REPARTICION | Solar | June 2012 | Yes |
| LA JOYA | Hydro | Oct 2009 | Yes |
| POECHOS II | Hydro | May 2009 | Yes |
| CARHUAQUERO IV | Hydro | May 2008 | Yes |
| HUASAHUASI I | Hydro | Oct 2012 | Yes |
| HUASAHUASI II | Hydro | April 2012 | Yes |
| SANTA CRUZ II | Hydro | July 2010 | Yes |
| SANTA CRUZ I | Hydro | May 2009 | Yes |
| CAÑA BRAVA | Hydro | February 2009 | Yes |
| HUAYCOLORO | Biomass | July 2011 | Yes |
| YANAPAMPA | Hydro | Dec 2012 | Yes |
| NUEVO IMPERIAL | Hydro | May 2012 | Yes |
| RONCADOR | Hydro | Dec 2012 | Yes |
| PURMACANA | Hydro | July 2012 | Yes |
| PATAPO I | Hydro | Nov 2012 | No |

| | | | |
|---|---|---|---|
| CHANCAY | Hydro | Dec 2012 | No |
| ANGEL I | Hydro | Dec 2012 | No |
| ANGEL II | Hydro | Dec 2012 | No |
| ANGEL III | Hydro | Dec 2012 | No |
| SHIMA | Hydro | Sept 2012 | No |

Source: Own elaboration from OSINERGMIM and MINEM (2015).

Finally, some authors criticize the effectiveness of the scheme in other respects (Ríos 2016, Modelo Energético Sostenible 2016). A main limitation might be the low volumes tendered with respect to those which would be in accordance with an energy transition to a more sustainable energy model (Modelo Energético Sostenible 2016, Ríos 2016). Ríos (2016) argues that, despite the large increase in electricity demand in the last 8 years, the volumes tendered have been constant. The fourth auction (in 2016) includes again the solar and wind technologies in the auction, five years after they were included for the last time (in 2011)(Ríos 2016).

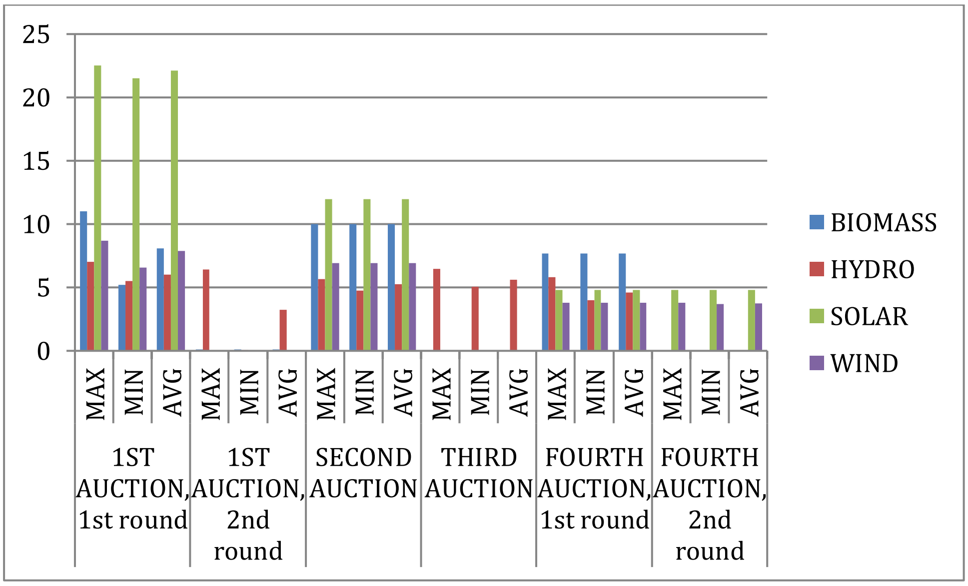
## Static efficiency or cost effectiveness (including transaction and administrative costs)

Figure 1 shows the maximum, minimum and average bid prices for the different technologies over successive auctions and rounds. Several conclusions can be inferred from the data.

First, wind and solar PV have been awarded at very competitive prices in the last auction. Their average bid prices in the fourth auction have clearly been below biomass. The average bid prices for wind are even lower than those for solar. Solar PV and small hydro show similar average bid prices for the awarded projects. This suggests that, perhaps, too much emphasis was put on biomass from an static efficiency and support cost perspective, i.e., the volumes auctioned could have been redistributed per technology (less biomass, more wind), leading to overall lower generation and support costs.

A second conclusion is that prices have gone down over time, suggesting that auctions have been able to capture the reductions of technology costs over time. The prices of wind and PV electricity have gone down by 43% and 78%, respectively, from the first to the last auction. The average prices for biomass have not experienced a substantial reduction from the first to the fourth auction (from 8.1 $cents/kWh to 7.7 $cents/kWh). Competition in biomass has been rather low, as suggested by the fact that the projects in the fourth auction were awarded at the ceiling price (Factor 2017, p.90)(see also the ”distributional effects and minimisation of support costs” section of this report). According to one interviewee, the fact that the ceiling price was disclosed for the first time in the 4th auction would have contributed to bids close to such price (in a context of relatively low competition). However, the disclosure of the ceiling price has not led to ”anchoring” in the rest of technologies, given the existence of healthy competition levels. It may make sense not to reveal the ceiling price in markets at earlier stages, when the degree of competition is low or uncertain. However, when the market is mature, with high competition levels, the disclosure of the price is unlikely to have negative effects on the auction. The same interviewee argues that the price might have been disclosed in order to facilitate the deployment of biomass projects because uncertainty about ceiling prices would have kept biomass promoters from participating in the auction or their bids would have been above such ceiling.

*Figure 1. Maximum, minimum and average prices of auctions in Peru (awarded projects)($cents/kWh).*




Source: Own elaboration based on data from OSINERGMIM.

According to data from OSINERGIM, the load factors have generally been higher for the projects being awarded in the auction than for those being discarded. The load factors, which have increased over time, have been higher for wind than for solar, although (as expected) they are below those of biomass and hydro.[4]

The winning bids have generally been much lower than the ceiling price, except in the case of biomass (table 7). For example, in the first auction (1st round), the average prices for solar were 12.1 cents$/KWh, significantly lower than the ceiling price of 26.9 cents$/kWh. In the case of wind, 7.9 cents$/kWh and 11 cents$/kWh, respectively (biomass: 8.1 cents$/kWh and 12 cents$/kWh; hydro: 6 cents$/kWh and 7.4 cents$/kWh).

*Table 7. Ceiling prices (cents$/kWh).*

| | 1st auction (1st round) | 1st auction (2nd round | 2nd auction | 3rd auction | 4th auction (1st round) | 4th auction (2nd round) |
|---|---|---|---|---|---|---|
| BIOMASS | 12.0 | 5.5 | Undisclosed* | Undisclosed | 7.7-10.6** | N.A. |

[4] In fact, the equivalent full-load hours of the winning projects were very high. This has been the case in the second round of the 4th auction. The bidders of the wind farms Huambos and Dunas, both with an installed capacity of only 18MW, but with a very high number of equivalent full-load hours (4500 and 4700 hours, respectively) offered the most competitive prices: 3.783 cents$/kWh and 3.779 cents$/kWh, respectively (Ríos 2016). The "discarded" projects have either participated in the auction and not received a contract (e.g., because the offered price was higher than the winning projects) or have not participated for failing to meet at least one of the administrative requirements. Data on load factors are not available for the fourth auction.

| | | | | | | |
|---|---|---|---|---|---|---|
| SOLAR | 26.9 | 21.1 | Undisclosed | Undisclosed | 8.8 | N.A |
| WIND | 11 | - | Undisclosed | Undisclosed | 6.6 | N.A |
| HYDRO | 7.4 | 6.4 | Undisclosed | Undisclosed | 6.0 | N.A |

Source: Own elaboration based on data from OSINERGMIM.*Except for agroindustrial wastes (6.5 cents$/kWh) **Forest residues: 9; Agrofood solid residues: 6.8; Urban solid wastes (incineration): 10.6; Urban solid residues (biogas): 7.7

Recall that the ceiling price is only revealed if it is exceeded by at least one bid received in the case where the total volume auctioned is not contracted in a complete auction round. In such an event, there is no restriction on the bids that exceeded the ceiling to re-submit a bid for the same project (IRENA 2013, p.35). However, in the 1st auction the ceiling prices were published before the auction and most bids were marginally close to that price (Mitma 2015, p.174).

### Dynamic efficiency

As shown above, considerable reductions in the winning bids have been experienced over successive auctions, especially in wind and PV. This suggests that the auctions have been able to capture the cost reductions in the technologies. Another issue is whether the auctions have impacted the local renewable energy supply chain. This is dubious, given the weak domestic industry and the fact that the country imports a significant part of its renewable energy-related products (Jochamowitz 2012, IRENA 2016). Finally, a relevant fact from a dynamic efficiency perspective is that the least mature / more expensive renewable energy options (tidal and geothermal) have not been promoted in any of the auctions, i.e., auctions for those two technologies have not been organized. Auctions may not be an appropriate instrument for these technologies. Geothermal has several barriers, which should be removed or mitigated before considering its inclusion in an auction[5]. Likewise, the low success rate for biomass (low awarded volumes with respect to offered volumes) makes us wonder whether biomass technologies should better be promoted with another instrument.

### Compatibility with market principles and integration

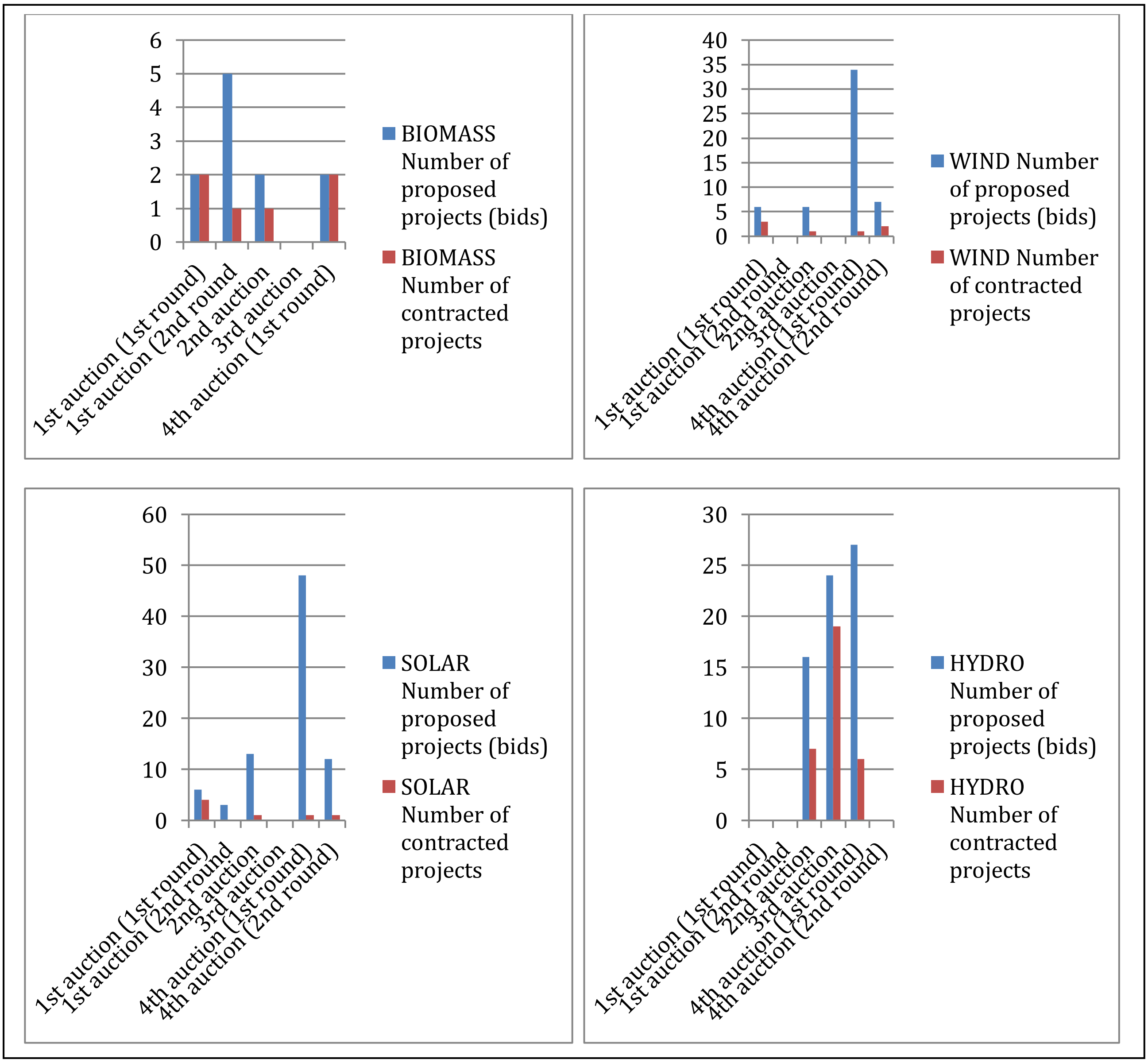
The generated electricity from RES is sold on the short-term electricity markets and (partly) remunerated at the spot price.

[5] Barriers to the development of geothermal energy in Peru include: 1) the fact that, although resources for exploration (including drilling) are significant, they involve a very high risk; 2) Geothermal legislation has only affected the utilization of geothermal energy for electricity generation purposes regardless of their multipurpose use (district heating, greenhouses, etc.); 3) Location of some geothermal fields in national parks or protected areas. 4) The location of geothermal fields in areas of indigenous populations delays the development (Claros 2015). An unclear regulatory framework for this renewable energy source and a lack of financing have been mentioned as development barriers for this technology in Peru (Casallas 2014).

## Distributional effects & minimization of support costs

The level of competition is obviously a main factor behind the level of bid prices. The following figures provide information on the number of projects bidding in the auctions (blue columns) and the number of projects awarded for the different technologies and auctions (red columns). This ratio of the number of proposed projects to the number of contracted projects could be taken as a proxy of the level of competition in the auctions for the different technologies and years. It can be observed that: 1) the level of competition for biomass has been low with respect to the other technologies. 2) The levels of competition have generally been higher in more recent auctions. In other words, the level of competition has increased over the different auctions and rounds for solar PV, wind and small hydro.

*Figure 2. Number of projects bidding and awarded in the auctions.*



Source: Own elaboration based on data from OSINERGMIM.

The high guarantees required may have led to low participation and competition in the first auction (Novoa 2011, IRENA 2013).[6] But it is also often stressed that the simplicity and clarity of the regulations were main factors influencing the participation of actors (IRENA 2013, Mwenechanya 2013).

A main issue in this context is the impact of RES support on the consumers' electricity bills. Some authors provide a proxy of these costs. According to Quintanilla (2016), the share of RES support costs in the household electricity tariffs increased from 0.5% in 2011 to 5.9% in 2015[7]. For Ormeño and Vásquez (2014), however, the impact on residential electricity rates is much more modest. The authors calculate that, without RES support, the rates in Lima in 2014 would have been 39.06 cents$/kWh. These rates were in fact 39.73 cents$/kWh with RES, i.e. about 1.7% higher (the increase is the same for other Peruvian regions). This is in line with the calculations of Mitma (2013), which estimates that RES-E support through auctions leads to an increase in the end-user tariffs of between 2.1% and 2.4% for electricity consumers in different regions.

# 3. Lessons learnt: key best practices and pitfalls identified

Overall, the Peru case study shows that auctions can be an appropriate instrument to capture the cost reductions in the technologies leading to lower support costs over time. Several lessons can be inferred from this case study.

- There have been signs of regulatory learning by doing over the years. Since the auctions have been implemented for a relatively long period (2009-2016), the government has made a few changes which aimed to improve the functioning of the scheme (e.g., the increase in the bid bond after the first auction and the disclosure of the ceiling price).
- However, the main strength of the scheme, as suggested by many stakeholders, is its simplicity and transparency, which are arguably main factors which have attracted the participation of different types of actors, particularly foreign ones, and led to healthy levels of competition in the auction. Proof of compliance with the technical requirements relied only on affidavits, whereas the bid bonds were made more stringent (Mitma 2015, Mwenechanya 2013). All the information has been publicly available in OSINERGMIM website before, during and after the auction.
- However, although the short-term targets for RES are relatively ambitious (5% in 2018, excluding hydro), the absence of long-term renewable energy targets as well as the lack of a long-term schedule of auctions induce elements of unpredictability of RES deployment in the country. It is not known whether and when a new auction for a given technology will be organised in the future. This has also been the case in the past. For example, there was arguably a long time between the second (2011) and the fourth auction (2015) for solar and wind. The future volumes offered are also

[6] According to IRENA (2015, p.20) in the case of the 2009 auction, "strict compliance rules limited the participation in the bid to only 27 bidders".
[7] This calculation refers to rates in Lima and it does not include the results of the 4th auction.

uncertain. Furthermore, in the past, the volumes offered for the different technologies have been fluctuating substantially over different auctions and rounds. A consistent, predictable pattern has been missing. In fact, given the success of the wind and solar auctions with respect to the biomass auctions, we could wonder whether the volumes for these technologies should have been different, i.e., more volumes for the first two technologies and lower volumes for biomass. This could have increased the static efficiency of the auction and reduced the support costs accordingly.

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