PERÚ | Ministerio de Energía y Minas

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Peruvian Energy Overview and advances in Geothermal Energy

Ernesto Rimari

General Directorate of Energy Efficiency

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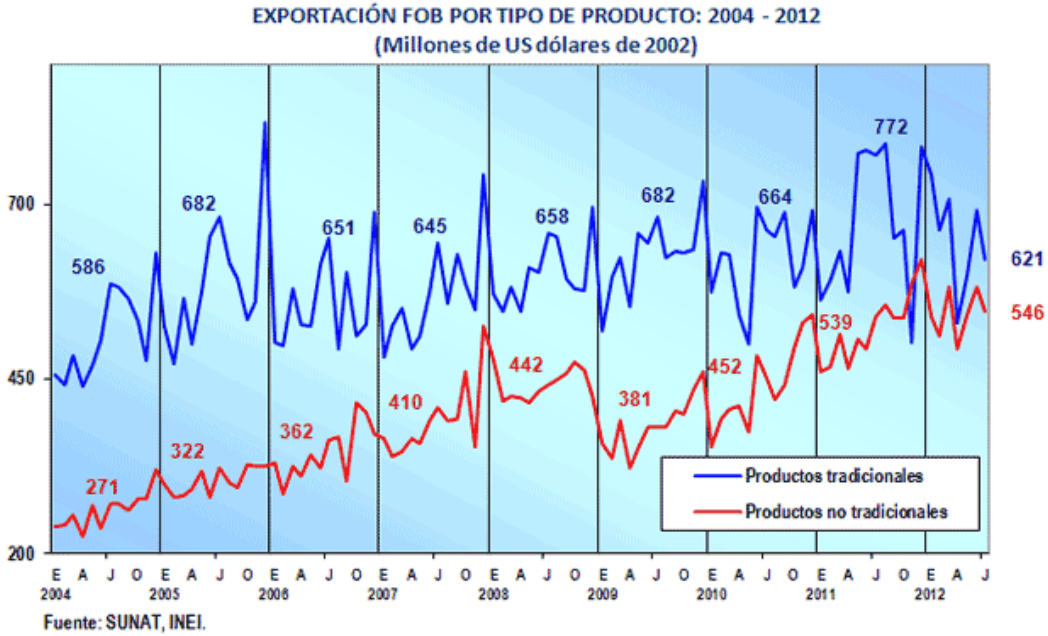
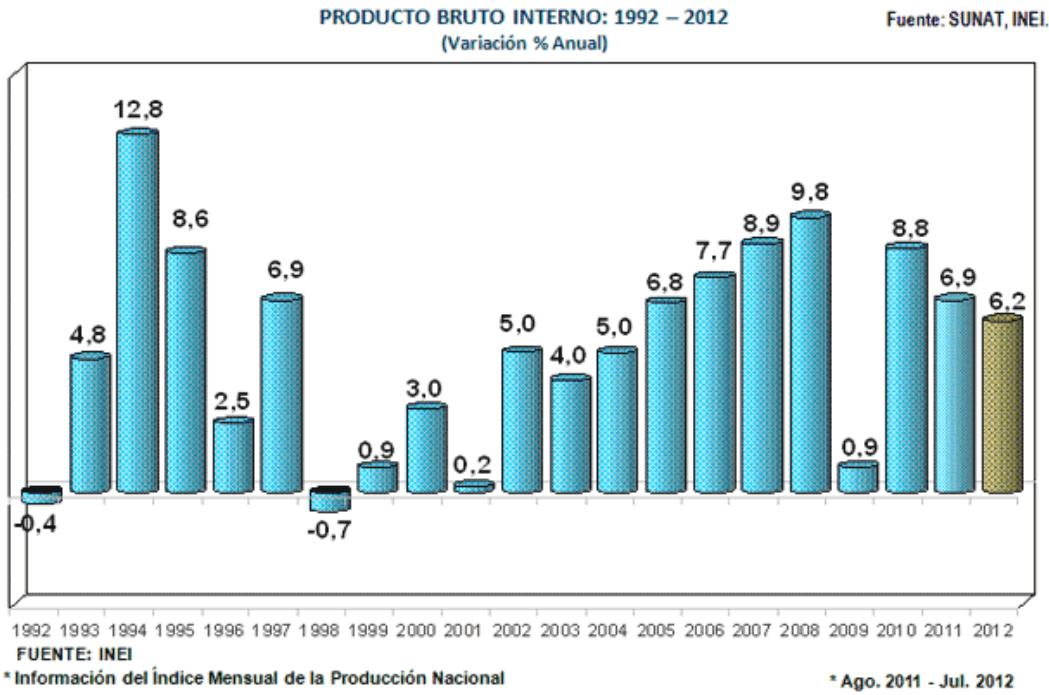
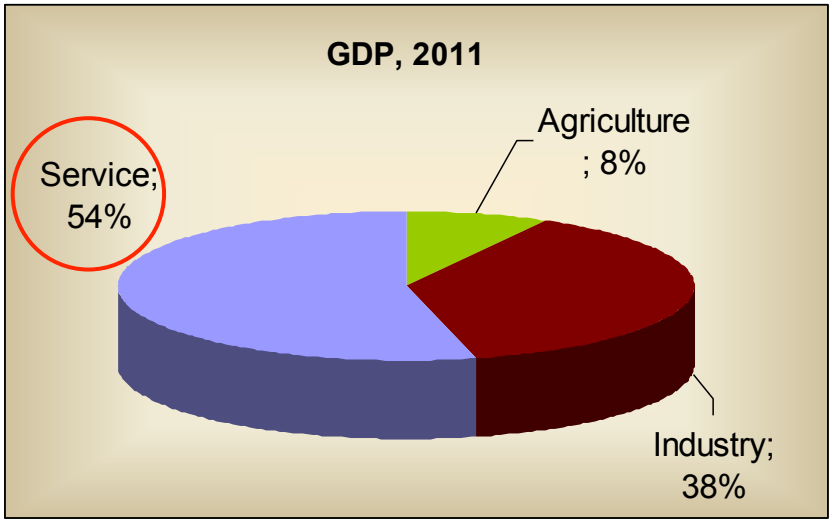
I. Introduction

- Pop. 2007 census : 28 million,
  8 million in Lima.
- GDP grow rate 2011: 6,9%
- GDP per capita 2011: US$ 10 200
- Inflation rate 2011: 3,4%
- Pop. below poverty line 2010: 34%



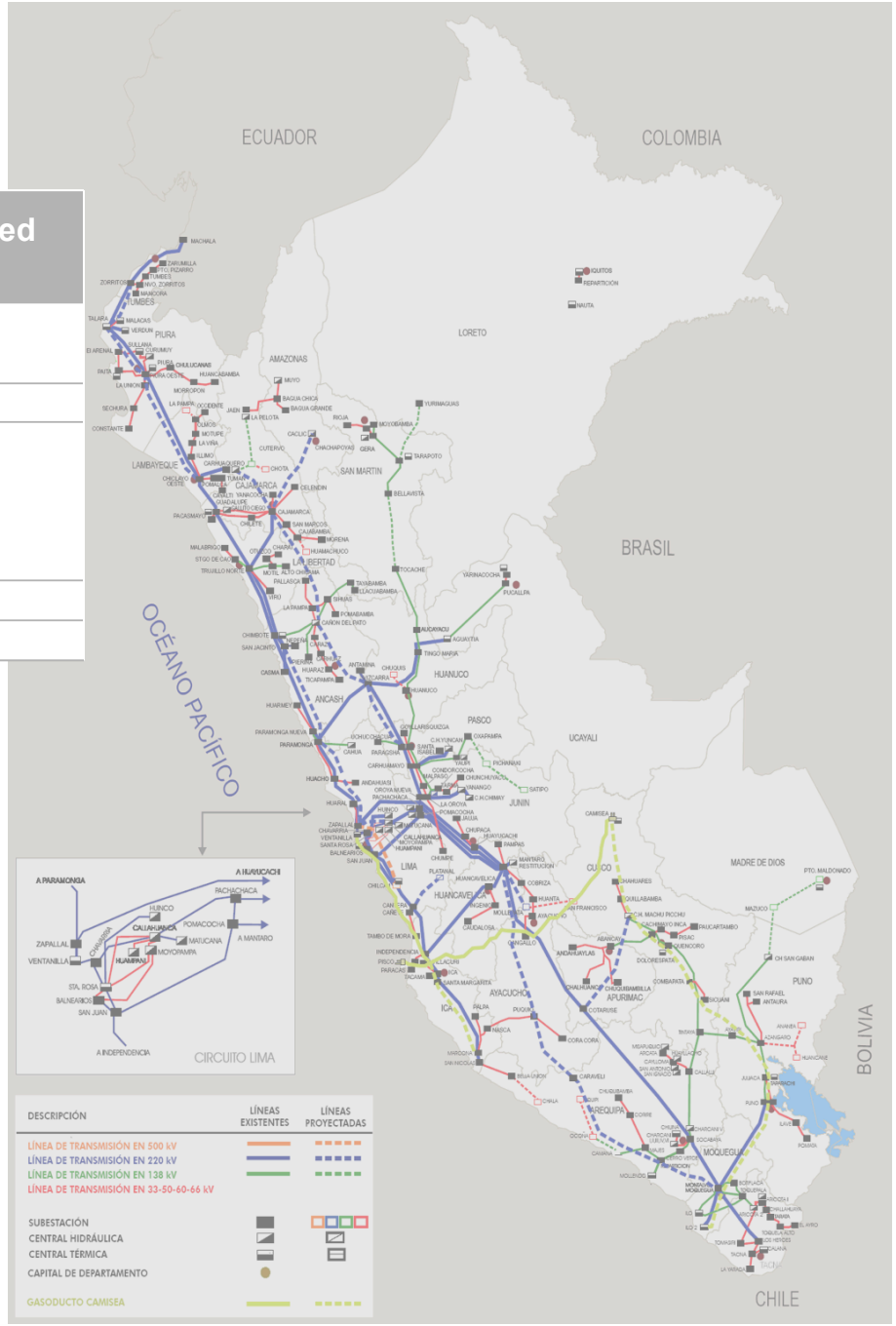




I. Introduction

Energy source	Exploitable Potential (MW)	Capacity Used (MW)
Hydroenergy	**70 000** (c)	**3 438** (a) **283** (b)
Wind	**22 000** (d)	**232** (b)
Solar (e)		**96** (b)
Coast	**6,0 a 6,5 kWh/m²**	
Highland	**5,5 a 6,0 kWh/m²**	
Jungle	**4,5 a 5,0 kWh/m²**	
Biomass	**272 MM t** (f)	**31** (b)
Geothermal	**2 860**(g)	**0**

(a) Does not include projects under construction.
(b) Subasta RER DL 1005 (2012 – 2013).
(c) Source: MEM DGE, 2011. Referential Plan of Electricity 2009.
(d) Source: MEM, 2008. Wind Atlas.
(e) Source: MEM, 2003. Solar Atlas.
(f) Source: FAO, 2010.
(g) Source: MEM, 2011. Geothermal Master Plan.



INSTALLED CAPACITY 2010

MW	Hydro	Thermal	Wind	Total
SEIN	**3 305** 45%	**4 026** 55%		**7 331** 85%
SSAA	**132** 10%	**1 148** 90%	**1**	**1 281** 15%
TOTAL	**3 438** 40%	**5 174** 60%	**1**	**8 613**

PEAK DEMAND

	DEC 2010	DEC 2011	G.R %
MW	4 579	4 961	8,34%
PERIOD	16/12/2010 19:30	14/12/2011 20:15	

II. Renewable Energy Framework

- D.L. N° 1002 (2008-05-02). Law to Promote Electricity Generation with Renewable Energy.
- D.S. N° 012-2011-EM (2011-03-23). Regulation of D.L. N° 1002
- Ley N° 26848 (1997-07-29). Geothermal Resources Law
- D.S. N° 019-2010-EM (2010-04-08). Regulation of Ley N° 26848
- D.L. N° 973 (2007-03-10). Law establishing the Special Scheme for Early Recovery Sales Tax.
- D.L. N° 1058 (2008-06-28). Law establishing the benefit of accelerated depreciation for hydropower and other renewable energy.

II. Renewable Energy Framework

TAX INCENTIVES

- Early Recovery Sales Tax: DL No. 973 (March 2007), investments in renewable energy are eligible for Early Recovery Scheme Sales Tax (Minimum investment of $ 5 million, minimum period pre-operative 02 years).

- Accelerated depreciation for purposes of payment of income tax: DL No. 1058 (June 2008) provides the benefit of accelerated depreciation, up to 20% per year for investment in hydropower and other renewable resources.

II. Renewable Energy Framework

MAIN CHARACTERISTICS

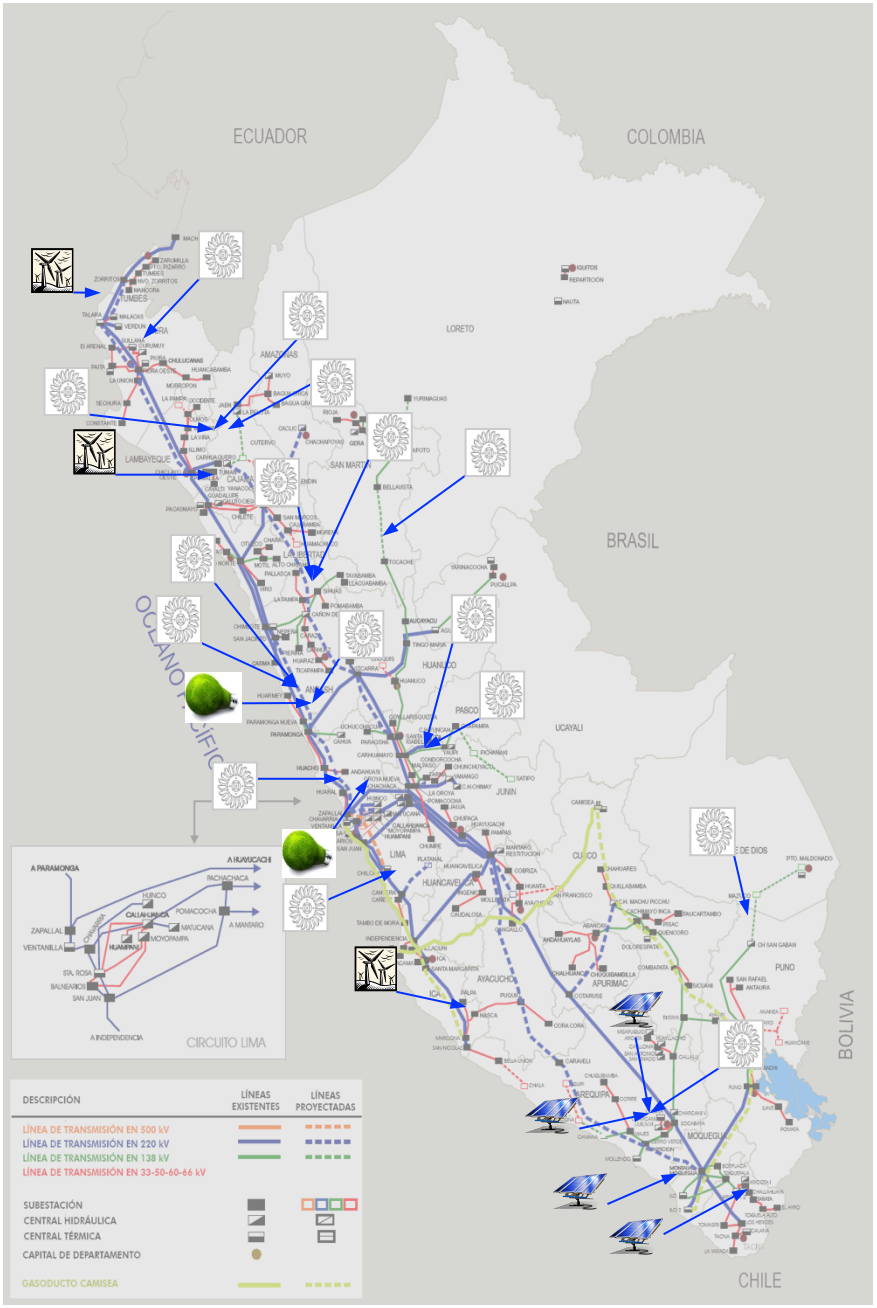
- Renewable Energy Resources (RER): Biomass, wind, solar, geothermal, tidal and hydropower up to 20 MW.
- Preferential Dispatch. (Variable cost of production is considered zero).
- Renewable energy requirement (RER), 5% of annual domestic production during the first five (5) years (excluding hydropower).
- The energy required is covered by Auctions.
- Bidders offered amount of energy and price.

III. Renewable Energy Auction Resoults

- First auction: hydropower (180 MW, 66 U.S. $ / MWh), wind power (142 MW, 80 U.S. $ / MWh), biomass (27 MW, 63 U.S. $ / MWh) and Solar (80 MW, 221 U.S. $ / MWh). It was committed an investment of US$ 813 million that would be done until 2013.

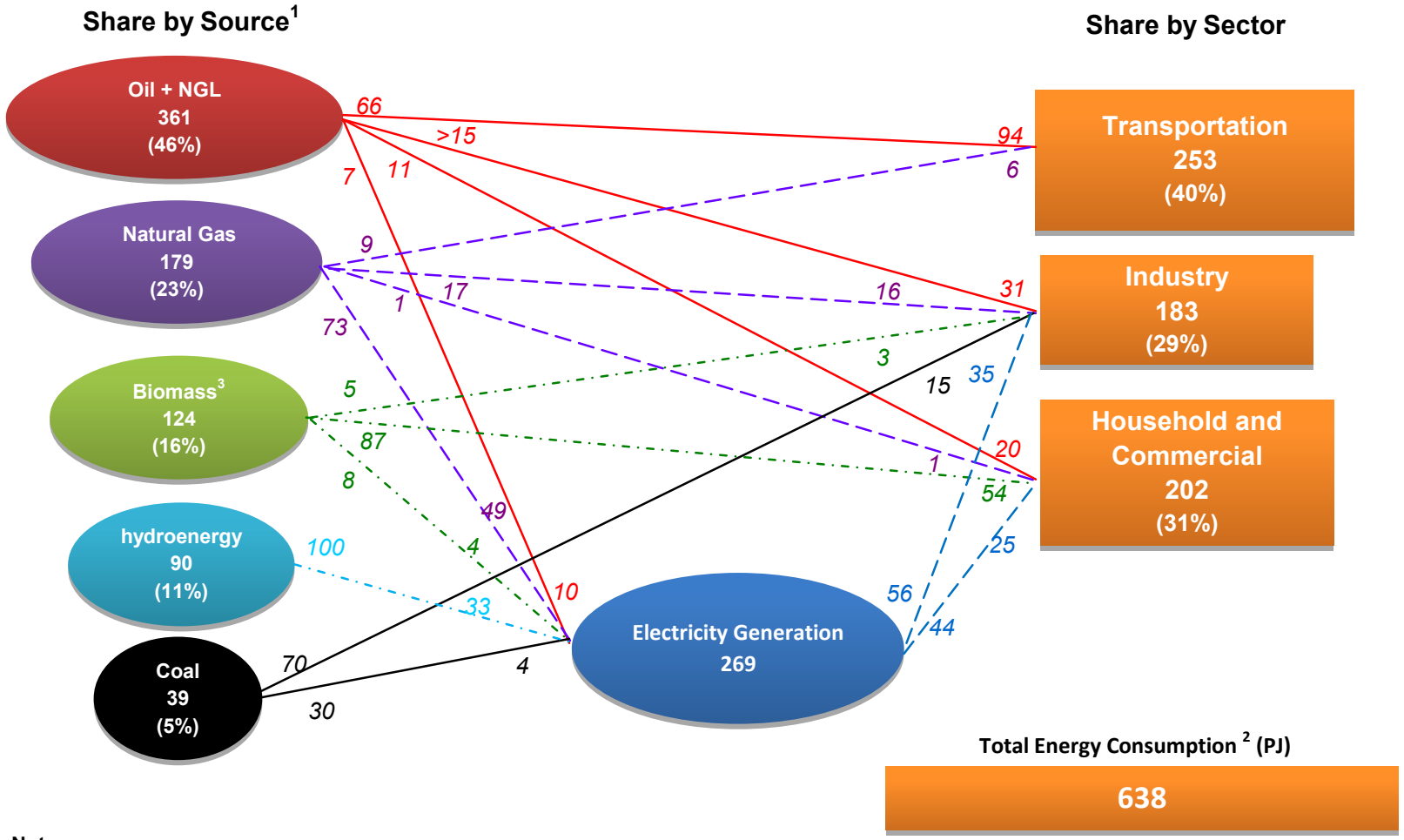
- Second auction resulted: hydropower (102 MW, 52 U.S. $ / MWh), wind power (90 MW, 69 U.S. $ / MWh), biomass (2 MW, 100 U.S. $ / MWh) and Solar (16 MW, 120 U.S. $ / MWh).

- The government has not yet defined the date for the third auction.



IV. Energy Matrix

PERUVIAN ENERGY MATRIX 2010



Nota:

[1]: After going through the transformation centers and / or discounted losses, except for power generation

[2]: Not considered final consumption of Non-Energy.

[3]: Biomass integrates wood, dung & Yareta and bagasse.

1/ The share of solar energy is minimal.

2/ PJ = 10^{12} Joule

IV. Energy Matrix

CHALLENGE FOR 2040

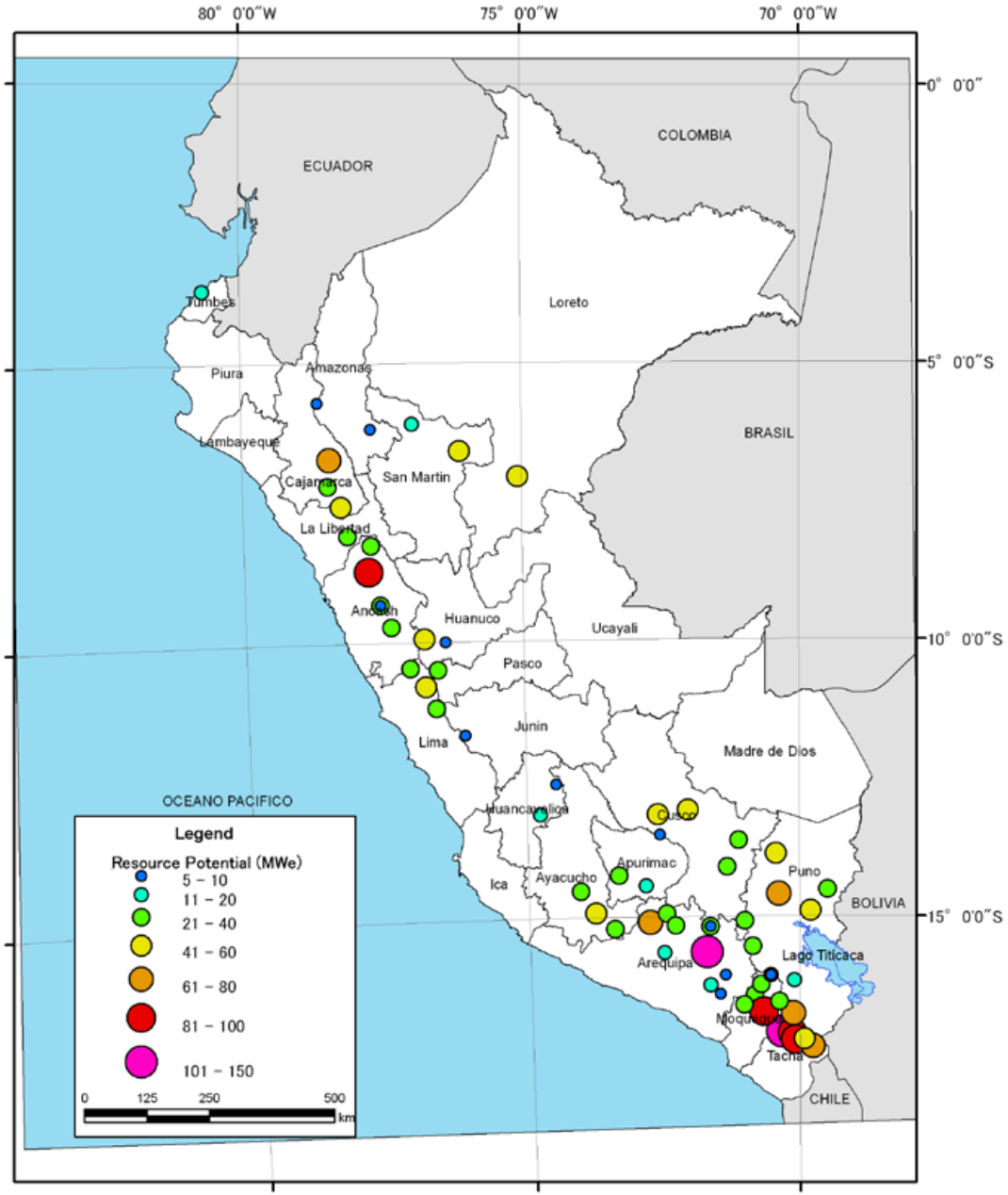
OPTION	BASE PLAN	NUMES PLAN
Share for generation of electricity	Hydroenergy 70%, Natural Gas 25%, RER 5%	Hydroenergy 40%, Natural Gas 40%, RER 20%
Petrochemical	Ica, South	Base
NG transportation	South and North	Base
Oil an NG exportation	Current contracts	Base GN; regional exp. of EE
Heavy oil development	No	Yes
Biofuels	5% biodiesel, 7.8% etanol	5% biodiesel, 10% etanol
Natural gas coverage	14% al 2040	18% al 2040, max coverage
Up stream NG	3 a 4 TCF quinquennium additional	Base
Energy Efficiency	Current situation (PRUEE 2009-18)	15% of savings

Source: Sustainable Energy Matrix and strategic environmental assessment – IDB, Ministry of Energy and Mines PERU, 2012.

V. Geothermal Energy

- Law 26 848, Organic Law of Geothermal Resources, July 21, 1997.
- Regulation of Law 26848, April 8, 2010.
  - Recognition – Free
  - Exploration – Authorization
  - Exploitation - Concession
- 20 authorization for geothermal exploitation.
- INGEMMET - Geological, Mining and Metallurgical Institute.

V. Geothermal Energy



MASTER PLAN

- Master Plan of Geothermal Energy, JICA.
- The total geothermal potential in Peru is estimated to be 2860 MW in 61 geothermal fields.

V. Geothermal Energy

BARRIERS

- The government has set a target of 5% of the energy demand to be supplied by renewable energies, BUT the proportion of the contribution of each energy source has not been formulated neither it is concrete plans for development.
- The risk of resource finding ant the elevated initial cost, peculiar to geothermal development, might possibly prevent the progress of development by private sector. Thus it is necessary to consider options such as the improvement of the current electricity legal frame work, or to proceed to governmental participation in geothermal power generation projects.

V. Geothermal Energy

BARRIERS

- The only existing incentive for promoting geothermal power generation projects is currently the Feed in Tariff scheme for the renewable energy resources generators collect at least a monomic fixed price for the energy supplied to the grid and contracted through tenders for renewable energy.
- There is not a strong base of human resources in Peru with capacity to develop geothermal energy for power generation and for the multiple use of geothermal heat.

V. Geothermal Energy

RECOMENDATIONS

- Target of Geothermal Power Development.
- Legal and Organization Framework for Geothermal Power Development.
- Assistance and incentives for promotion of geothermal development.
- Multi-purpose Use of Geothermal Energy.
- Action Plan, short and long term.

V. Geothermal Energy

ACTION PLAN

	Short-term Target		Long-term Target							
	2012	2013	2014	2015	2016	2017	2018	2019	2020-	Note
Revision of targeted RE participation			▼					▼		present status: 5% of total energy demand
Tender for RE projects		▼		▼		▼		▼		every two years
Legal Framework										
- Enactment of policy	■									National Plan for RE etc.
- Revision of Geothermal Law (as necessary)	■	■	■	■	▶					Management of development by private sector, etc.
- Revision of RE Law (as necessary)	■	■	■	■	▶					
- Guideline for natural and social environmental considerations	■	■								
System/Organization										
- Capacity building to develop. management	■	■	■	■	▶					DGE・INGEMMET
- Network for promoting geothermal	■	■								MEM Geothermal Committee
- Database updating system	■	■								
- Organization in state-owned utilities		■	■	■						Electroperú, etc.
- Capacity building of the public sector for their participation in geothermal			■	■	■	■	■	■	▶	
Support from the Government										
- Development finance system (TSL, etc.)	■	■								COFIDE etc.
- Establishment of PPP scheme	■	■								Financing at low interest, etc.
- Exploration by the public sector	■	■	■	■	■					
- Upgrade knowledge of geo-potential	■	■	■	■	■	■	■	■	▶	INGEMMET
Multi-purpose Heat Use										
- Management of hot water resources	■	■								
- Legal framework for multi-purpose use	■	■								
- Establishment of subsidy system	■	■	■	■	▶					
- Public demonstration project		■	■	■	■	■	▶			

V. Geothermal Energy

GEOTHERMAL DEVELOPMENT PLAN

Rank for Priority	Description	Geothermal Field	Possible Power Output (MW)	Total Possible Power Output (MW)
Rank A	Earliest development is expected. (The development would be done even without any support from the government)	Tutupaca	105	340
		Crucero	70	
		Calacoa-Putina	100	
		Pinaya	35	
		Puquio	30	
Rank B	Followin the Rank A (The authorization for exploration is to be waited for.)	Chivay-Pinchollo	150	300
		Ancocollo	90	
		Ccollo/Titire	35	
		Ulucan	25	
Rank C	Relatively early development is expected, but the resource potential is to be confirmed.	Cailloma	5	(60)
		Huancarhuas	(30)	
		Paila del Diablo	(15)	
		Pararca	(10)	
Rank D-1	The resource potential is to be confirmed. (Based on the existing data, high potential resource can be expected.)	17 fields (including Chancos and Jesus Maria)	–	Unknown
Rank D-2	The resource potential is to be confirmed. (Based on the existing data, the existence of high potential resource cannot be expected.)	24 fields	–	Unknown
Others	Environmental impact of possible geothermal project should be evaluated. If the impact can be avoided or mitigated sufficiently, the development should be permitted.	7 fields (including Borateras, Calientes and Chungara-Kallapuma)	–	>225

V. Conclutions

- Peru is one of the Latin American countries with higher economic growth, the country aims to encourage sustainable development.
- The Peruvian government is promoting electricity generation with renewable energy through Auctions.
- The electricity generation structure for 2040: 40% hydro, 40% natural gas and 20% renewable energy.
- The total geothermal potential in Peru is estimated to be 2860 MW in 61 geothermal fields.
- From the priority evaluation it can be expected that 640 MW power generation would be achieved from the fields categorized in relatively high priorities.

Thanks

Ernesto Rimari

Ministry of Energy and Mines - PERU

erimari@minem.gob.pe

Telf: 51-1- 411-1100 ext. 1800