

# **RENEWABLE ENERGY FOR RURAL ELECTRIFICATION IN ARGENTINA**

**Lic. Aldo FABRIS  
Advisor**

**Science and Technology Commission – National Congress  
Consultant for Renewable Energy Technology, Energy Efficiency and Rural Energy**

**ILZRO\_RAPS SEMINAR – Lima –PERU – February 11-13 - 2001**

# **CONTENT**



## **➤ PHOTOVOLTAICS**

- NATIONAL PROGRAM FOR ELECTRICITY SUPPLY TO DISPERSED RURAL POPULATION**
- EXPERIENCE OF ONE PRIVATE CONCESIONARIE SUPPLYING ELECTRICITY SERVICES TO RURAL DISPERSE POPULATION – EJEDSA IN JUJUY PROVINCE**
- EXPERIENCE OF ONE STATE OWNED ELECTRICITY SERVICES PROVIDER EPEN IN NEUQUEN PROVINCE**
- PERMER PROJECT WITH WORLD BANK FINANCING**

## **➤ WIND ENERGY**

- GRID CONNECTED WIND ENERGY POWER STATIONS**
  - TECHNICAL AND ECONOMIC EXPERIENCE**
  - LAW FOR THE PROMOTION OF WIND AND SOLAR ENERGY**
  - FORECASTING**

# THE PROBLEMS

- ✓ **92% people in Argentina have access to electricity services at home, but still we have around 2,5 millions without mainly due to dispersed population in rural areas.**
- ✓ **Also there are around 6000 public services in rural areas without electricity access (schools, first aid medical centers, water services and others)**
- ✓ **A non determined (more than 100) isolated diesel based systems with mini-grids with 15 to 500 KW maximum capacity with very high supply costs (0.5 US\$/KWh to 2.5 US\$/KWh). Most of them with 5 hours services and from poor to very poor quality of service**
- ✓ **Traditional supply by grids is not possible due to the high costs of grid extension in those areas. Present extension cost are in mean terms \$ 8000/user, with minimum values of \$5000/user and some cases with \$ 25000/user.**
- ✓ **The usual questions related with energy supply and consumption in rural areas (supply side issues emphasized, low concern and vision about the demand side issues that are particularly important in rural energy issues)**

# **ELECTRICITY SUPPLY PROGRAM FOR DISPERSED RURAL POPULATION - ESPECTED RESULTS**



- ❖ **PROVIDE ELECTRICITY SERVICES TO 1.4 MILLONS PEOPLE HAB (315.000 USERS) Y 6000 PUBLIC SERVICES WITH VARIOUS TECHNOLOGY ACCORDING TO COST. MOST OF THEM WILL USE RENEWABLES BECAUSE OF ECONOMIC REASONS.**
- ❖ **MINIMUM TARIFFS OF ABOUT \$15/MES.**
- ❖ **MINIMUM QUALITY 4 KWh/MONTH.**
- ❖ **JOBS WILL BE CREATED IN THE PRIVATE SECTOR (BY PRODUCT)**

# **PRESENT SITUATION/1**

- **TWO DISPERSED MARKETS HAVE PRIVATE CONCESIONARIES SINCE LATE 1996 AND THEY ARE DOING WELL. OF COURSE WITH SOME PROBLEMS THAT ARE UNDER CONTINUOS DISCUSSION WITH THE REGULATING AUTHORITIES OF EACH PROVINCE.**
- **PROYECTO DE ENERGIAS RENOVABLES EN MERCADOS RURALES (PERMER) WITH THE WORLD BANK.**
  - **FIRST PHASE FASE 7 PROVINCES**
  - **WB LOAN OF \$ 30 MILLONS.**
  - **SUBSIDIZATION FROM GEF OF U\$ 10 MILLIONS.**
- **IMPORTANT PROGRAM FOR TECHNICAL ASSISTANCE TO OVERCOME THE EXISTING BARRIERS FOR DISEMINATION OF RENEWABLES DE ASISTENCIA TECNICA PARA SUPERAR LAS BARRERAS A LA INTRODUCCION DE ENERGIAS RENOVABLES.**
- **LOAN CONTRACT SIGNED IN OCTOBER/99**

# **PRESENT SITUATION/2**



## **➤ SALTA PROVINCE**

- SALTA PROVINCE SET UP A PRIVATE CONCESIONAIRES WITH NO INITIAL USERS LA PROVINCIA DE SALTA PRIORITIZING THE ELECTRICITY SUPPLY TO PUBLIC SERVICES.**
- TODAY THE ACHIEVED WITH ELECTRICITY SERVICES AROUND 150 SCHOOLS, 40 FIRST AID MEDICAL CENTERS AND 60 PRIVATE USERS**

## **➤ JUJUY PROVINCE**

- JUJUY PROVINCE SET UP A PRIVATE CONCESIONAIRE WITH AROUND 1200 USERS RECEIVING SERVICES BY DIESELS, MICROHYDRO, HYBRIDS AND SHS.**
- NOW RECEIVING ASSISTANCE OF THE WORLD BANK FINANCED PROGRAM (PERMER)**

- OTHER PROVINCES NOW STARTING WITHIN PERMER PROGRAM. (RIO NEGRO, SAN LUIS, CORRIENTES AND OTHERS)**

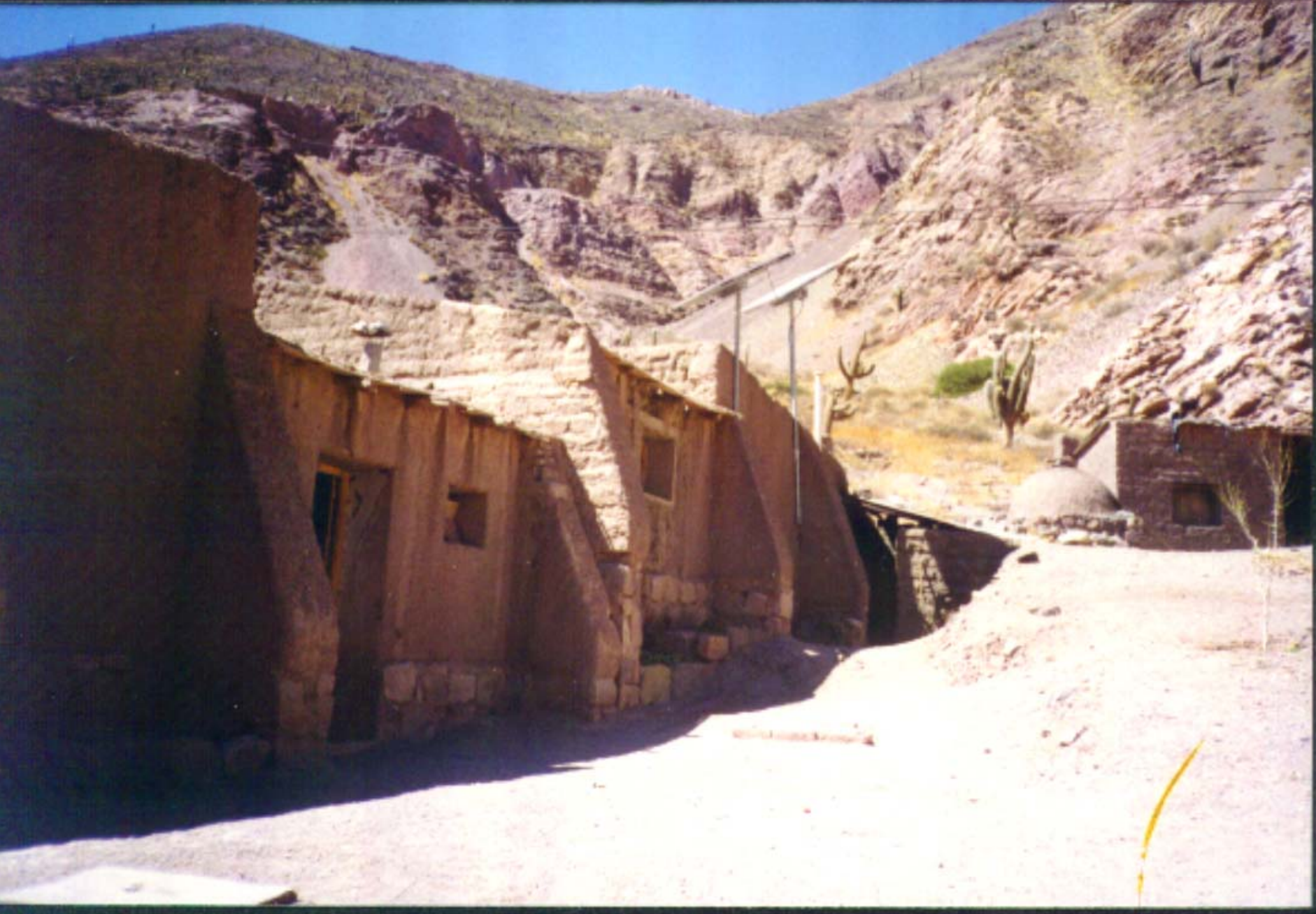


**EUSED SA**

**EMPRESA JUJEÑA DE SISTEMAS ENERGÉTICOS DISPERSOS S.A.**

# **EJSED S.A. – JUJUY PROVINCE ANNUAL MEMORY 2000**

		DEC 98		DEC 99		DEC 00	
		VILLAGES	USERS	VILLAGES	USERS	VILLAGES	USERS
<b>SMALL GRIDS</b>	<b>DIESEL</b>	<b>23</b>	<b>1131</b>	<b>24</b>	<b>1190</b>	<b>24</b>	<b>1137</b>
	<b>MINI HYDRO</b>	<b>5</b>	<b>497</b>	<b>5</b>	<b>523</b>	<b>5</b>	<b>531</b>
	<b>PV – WIND HYBRID</b>	<b>14</b>	<b>347</b>	<b>14</b>	<b>380</b>	<b>14</b>	<b>421</b>
<b>HOME SYSTEMS</b>	<b>SHS</b>	<b>58</b>	<b>70</b>	<b>193</b>	<b>945</b>	<b>?</b>	<b>1077</b>
<b>TOTAL</b>		<b>110</b>	<b>2045</b>	<b>236</b>	<b>3038</b>	<b>?</b>	<b>3166</b>



# WHERE THEY GREW ?

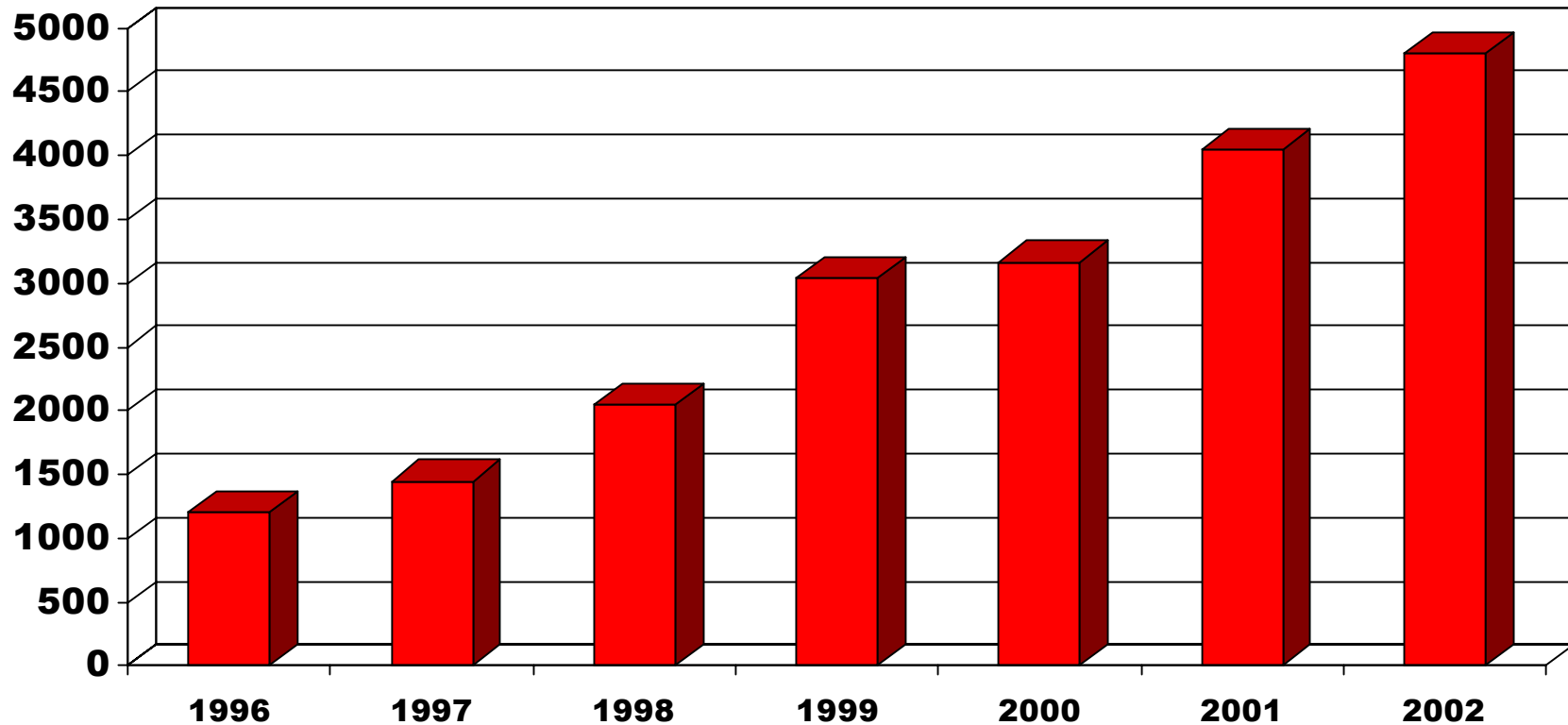
- DIESEL SYSTEMS: 2 NEW LOCATIONS (NEW PIRQUITAS AND LIVIARA).
- SOLAR HOME SYSTEMS: THEY ADD 875 NEW SERVICES FROM DIC 98 TO DEC 99.
- INSTALLED POWER :
  - ✓ Houses: 100Wp
  - ✓ Other Customers:
    - ✓ Schools - 300 a 450Wp
    - ✓ Comunitary Facilities - 150 a 300 Wp
    - ✓ Churches - 50 a 200Wp
    - ✓ First Aid Medicl Centers: 100 a 200W



# **EJSED S.A. – JUJUY PROVINCE ANNUAL MEMORY 2000 – NEW USERS**

		DEC 00		DEC 01		DEC 02	
		VILLAGES	USERS	VILLAGES	USERS	VILLAGES	USERS
<b>SMALL GRIDS</b>	<b>DIESEL</b>	<b>24</b>	<b>1137</b>	<b>24</b>	<b>1137</b>	<b>24</b>	<b>1137</b>
	<b>MINI HYDRO</b>	<b>5</b>	<b>531</b>	<b>5</b>	<b>531</b>	<b>5</b>	<b>531</b>
	<b>PV – WIND HYBRID</b>	<b>14</b>	<b>421</b>	<b>14</b>	<b>421</b>	<b>14</b>	<b>421</b>
<b>HOME SYSTEMS</b>	<b>SHS</b>	<b>?</b>	<b>1077</b>	<b>?</b>	<b>1961</b>	<b>?</b>	<b>2711</b>
<b>TOTAL</b>		<b>?</b>	<b>3166</b>	<b>?</b>	<b>4050</b>	<b>?</b>	<b>4800</b>

# CUSTOMERS OVER TIME







# PUBLIC HEARING

20 DE MAYO DE 1.999

# ***REVIEWED ISSUES IN THE PUBLIC AUDIENCE***



➤ ***TARIFFS***

➤ ***TARIFF STRUCTURE AND CUSTOMERS REGIME***

➤ ***SUPPLY CODE***

➤ ***SERVICE QUALITY***

# SMALL GRIDS LOCATIONS/1



- **METERED ENERGY SERVICE PAYMENT.**
- **MINIMUM DAILY HOURS OF SERVICE    AVAILABILITY:**
  - **THERMAL: 8 hs/day.**
  - **SMALL HYDRO: 18 hs/day.**
  - **HYBRIDS (SOLAR-WIND): 8 Hs/día.SUSQUES: 24 hs/day.**
- **TECHNICAL PRODUCT:**
  - **VOLTAGE: 220V+/- 10%.**
  - **FREQUENCY: 50Hz +/- 2,5Hz.**

# **S M A L L   G R I D S   L O C A T I O N S / 2**



## **➤ TECHNICAL SERVICE:**

**➤ BLACK OUTS: 12 in six months maximum**

**➤ TOTAL TIME: 25 Hs in six months maximum**

## **➤ COMERCIAL SERVICE:**

**➤ NEW CUSTOMERS WITHOUT CHANGES OF THE DISTRO LINES: 15 DAYS AFTER SERVICE REQUEST.**

**➤ NEW CUSTOMERS WITH CHANGES IN DISTRO LINES: 30 DAYS AFTER SERVICE REQUEST.**

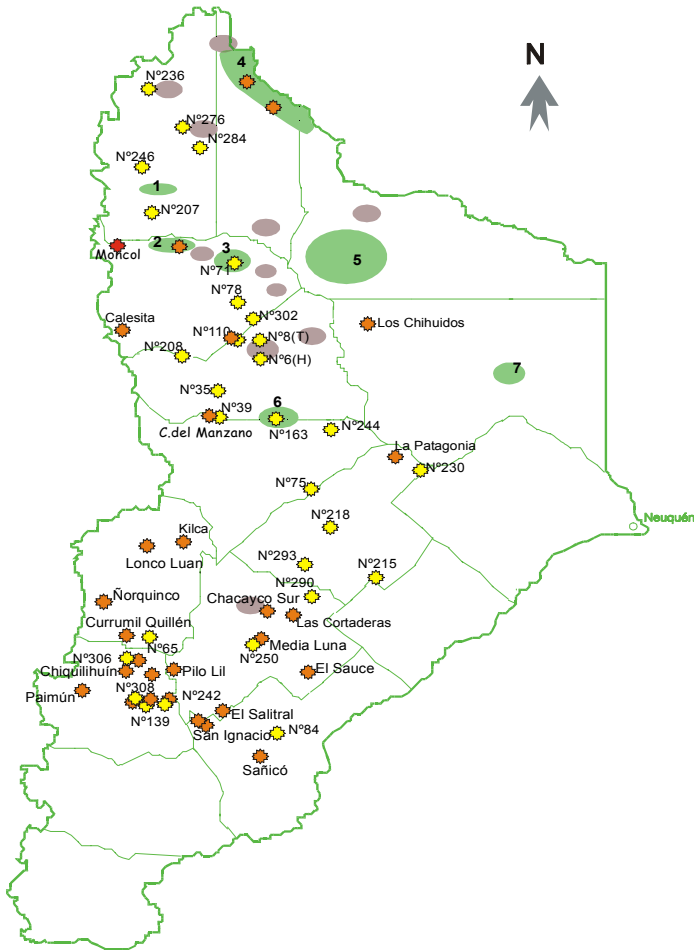
**➤ CONNECTION AFTER DISCONNECTION: 2 DAYS.**






# SOLAR HOME SYSTEMS MARKET

- **BILLING BY ENERGY AVAILABILITY**
- **SERVICE AVAILABILITY 24 HS.**
- **TECHNICAL PRODUCT:**
  - 12Vcc (-10% a +20%)
  - HIGH FREQUENCY NOISE
- **TECHNICAL SERVICE:**
  - MINIMUM OF 1 REVIEW/YEAR
- **CUSTOMERS SERVICE:**
  - 5 days for places that can be reached by road.
  - 9 days for other customers.
- **COMMERCIAL SERVICE:**
  - 30 days for new services request.
  - 15 days for equipment relocation or service connection after disconnection.

# ENTE PROVINCIAL DE ENERGIA DE NEUQUEN

## PV CUSTOMERS



Ente Provincial de Energía del Neuquén	
	Parajes con Energía Fotovoltaica
	Parajes a ejecutar
	Escuela con Energía Fotovoltaica
	Puesto Sanitario con Energía Fotovoltaica
	Puesto Gendarmería Nacional

- 1 Pailaleche
- 2 Reñileuvú  
Chochoy Mallín  
Trocomán
- 3 Tres Chorros  
Rahueco
- 4 Cochico  
Coyuco
- 5 Curaco  
Huantraico  
Cortaderas
- 6 Pilmatué
- 7 Aguada San Roque

# ENTE PROVINCIAL DE ENERGIA DE NEUQUEN

## PV in RURAL AREAS

The Ente Provincial de Energía de la Provincia del Neuquén (EPEN) supply 58 public services (schools and first aid medical centers) and 217 customers (Nov.99). Now expanding to 250 more.

<i>Use</i>	<i>Number</i>	<i>Installed Power</i>
Houses	217	26,38 k Wp
Schools	27	3,42 k Wp
Medical Centers	30	6,77 k Wp
Border Police	1	1,63 k Wp
<b><i>Total</i></b>	<b>275</b>	<b>48,30 kWp</b>

# **OTHER PROVINCES INITIATIVES**



## **➤ CHUBUT PROVINCE**

- THEY INSTALL AROUND 8 VILLAGE POWER HYBRID UNITS (WIND-DIESEL) MAINLY IN LOCATIONS WITH SCHOOLS.**

## **➤ SANTA CRUZ**

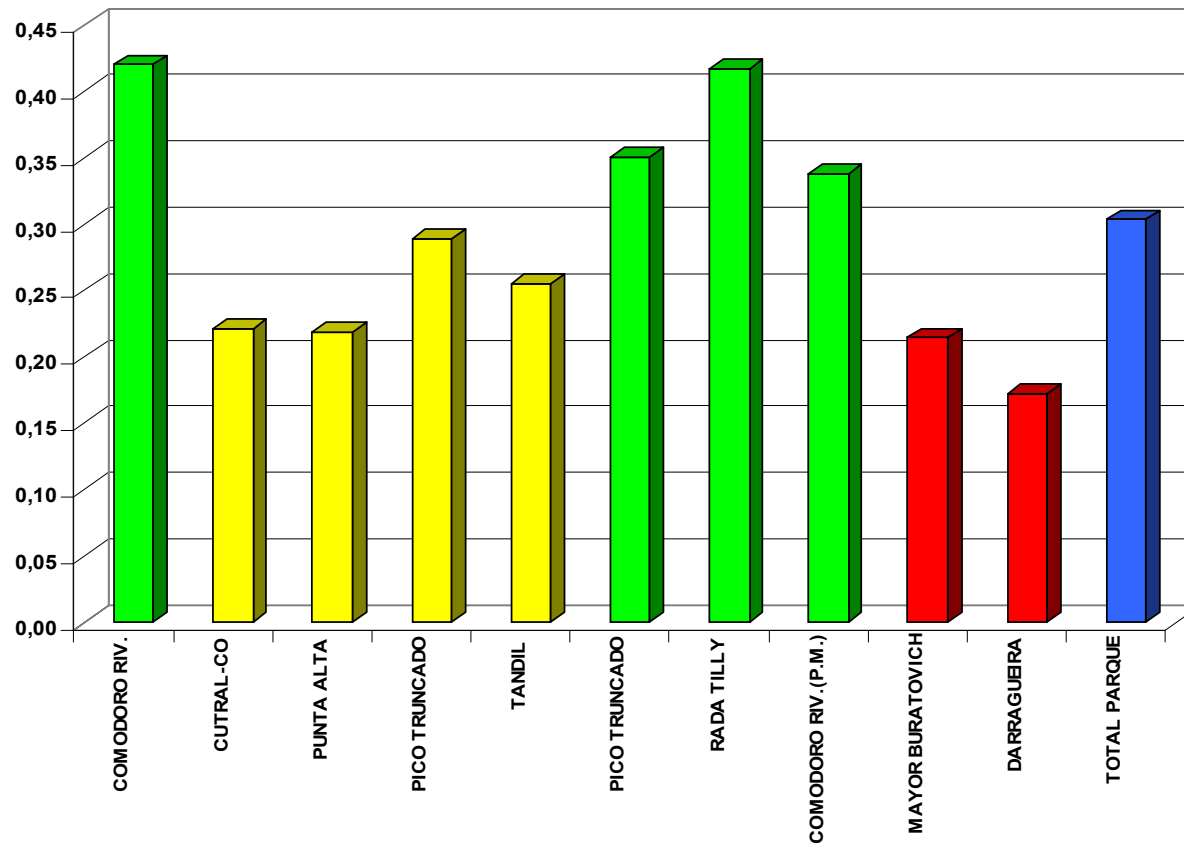
- FINAL STEPS FOR INSTALLING A VILLAGE POWER HYBRID SYSTEMS (WIND-DIESEL) WITH A 60 KW WIND GENERATOR IN TRES LAGOS SITE. COOPERATION WITH NREL/NRECA. SWITCH ON FORESEE FOR APRIL/2001.**
- THEY HAVE 8 SITES WITH SIMILAR PROBLEMS.**

# GRID CONNECTED WIND POWER GENERATION IN ARGENTINA

LUGAR	PROVINCIA	PUESTA EN MARCHA	POTENCIA ACUMULADA (KW)	POTENCIA TOTAL (KW)	POTENCIA UNITARIA (KW)	NUMERO MAQUINAS	FACTOR UTILIZACION (1)	ENERGIA ANUAL ESTIMADA (GWh)	OBSERVACIONES
COMODORO RV.	CHUBUT	Ene-94	500	500	250	2	0,42	1,8	
CUTRAL-CO	NEUQUEN	Oct-94	900	400	400	1	0,22	0,8	
PUNTA ALTA	BUENOS AIRES	Feb-95	1300	400	400	1	0,22	0,8	
PICO TRUNCADO	SANTA CRUZ	May-95	1600	300	100	3	0,29	0,8	FUERA DE SERVICIO
TANDIL	BUENOS AIRES	May-95	2400	800	400	2	0,25	1,8	
PICO TRUNCADO	SANTA CRUZ	Ene-96	3100	700	100	7	0,35	2,1	FUERA DE SERVICIO
RADA TILLY	CHUBUT	Mar-96	3500	400	400	1	0,42	1,5	
COMODORO RV.	CHUBUT	Sep-97	9500	6000	750	8	0,34	17,7	
MAYOR BURATOVICH	BUENOS AIRES	Oct-97	10700	1200	600	2	0,21	2,3	
DARRA GUEIRA	BUENOS AIRES	Oct-97	11450	750	750	1	0,17	1,1	
PUNTA ALTA	BUENOS AIRES	Dic-98	13250	1800	600	3	0,25	3,9	
CLAROMECO	BUENOS AIRES	Ene-99	14000	750	750	1	0,20	1,3	
<b>POTENCIA TOTAL INSTALADA</b>		<b>14</b>	<b>MW</b>	<b>ENERGIA ANUAL ESTIMADA</b>			<b>35,9</b>	<b>GWh</b>	
(1) ESTIMADO		(2) MEDIDO DURANTE EL PERIODO DE FUNCIONAMIENTO							

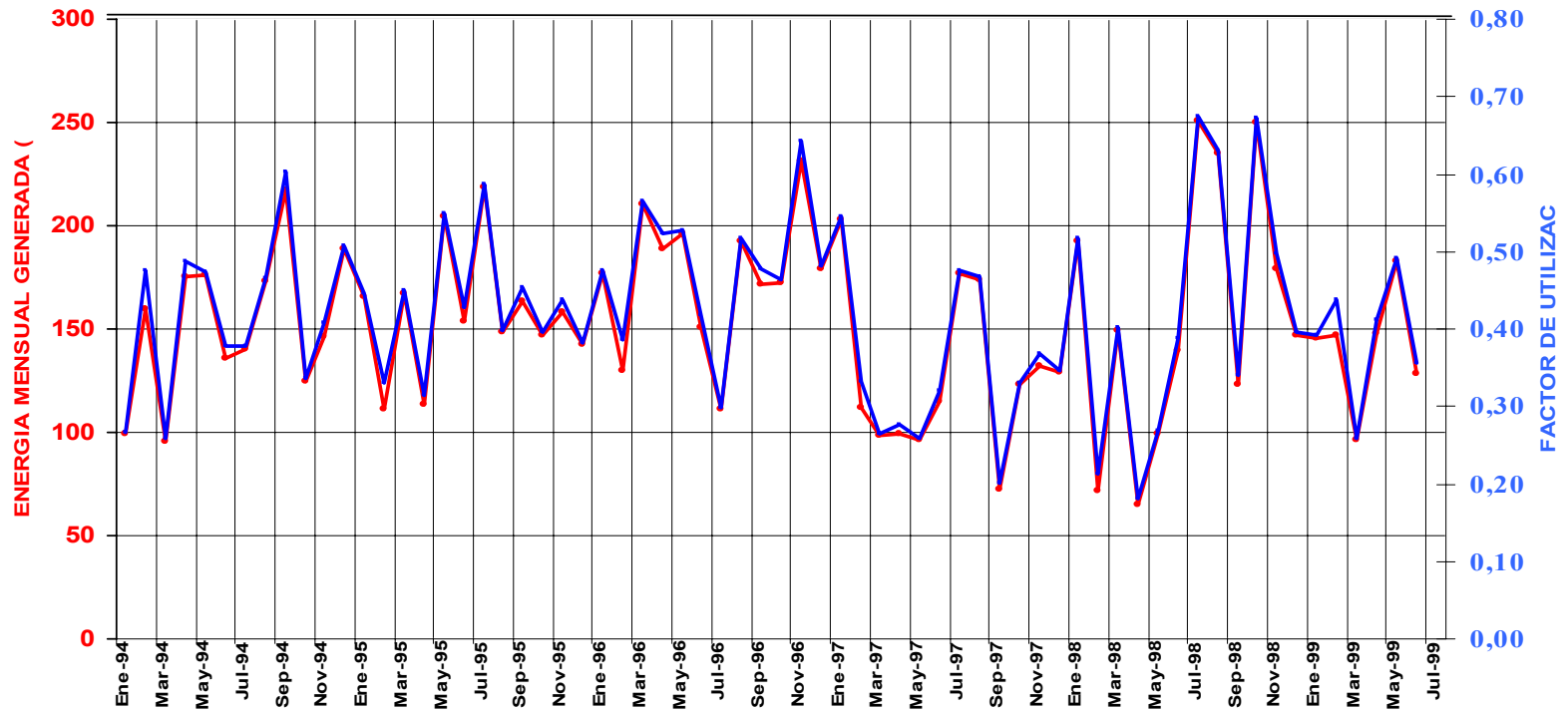
# UTILIZATION FACTOR OF WIND POWER STATIONS IN ARGENTINA

FACTORES DE UTILIZACION DE PLANTAS EOLICAS DE GENERACION ELECTRICA



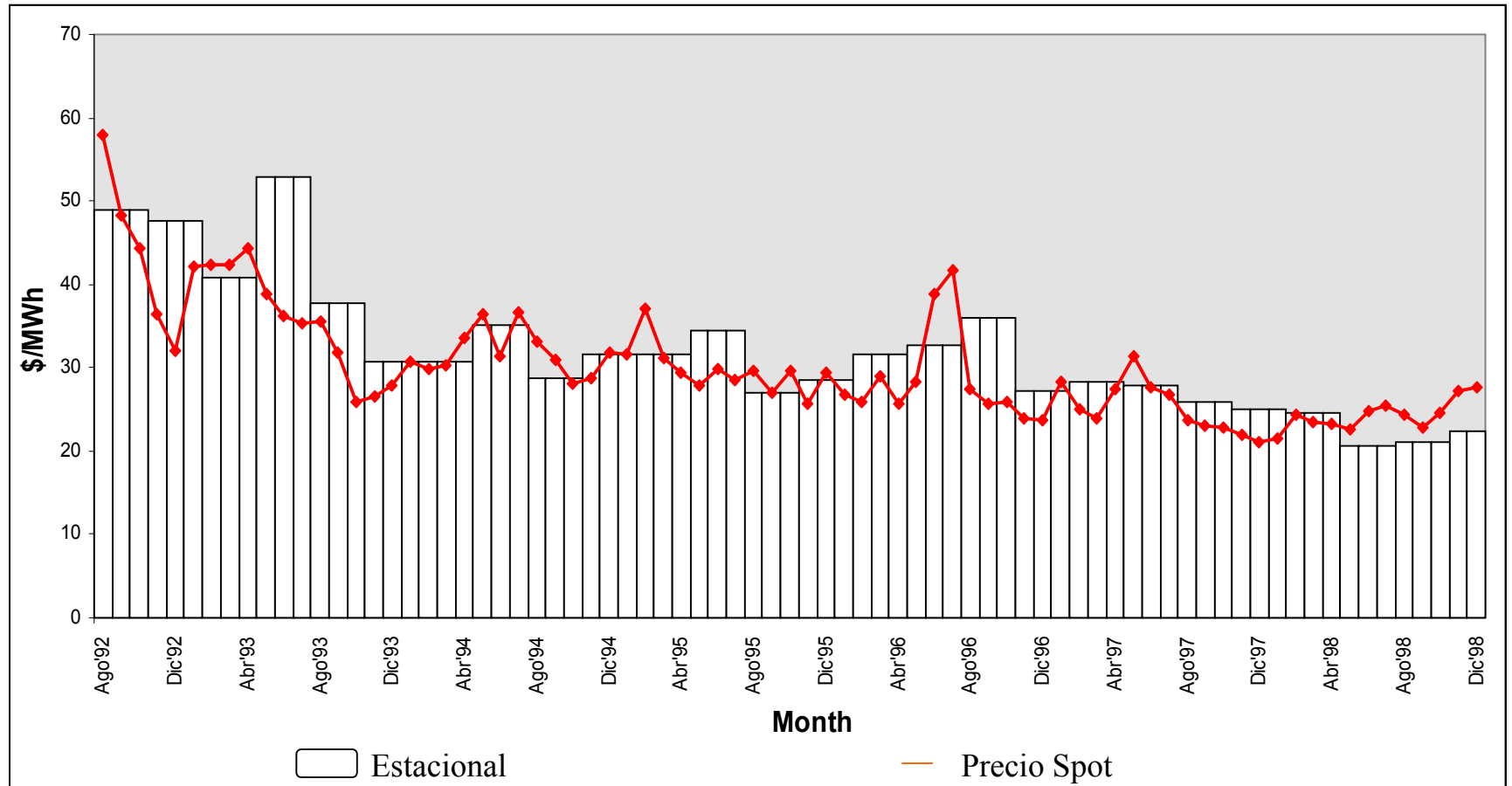
# MONTHLY ENERGY OF COMODORO RIVADAVIA (2X250 KW) WIND POWER STATION - FOR GUINNESS BOOK OF RECORDS

ENERGIA MENSUAL GENERADA Y FACTOR DE UTILIZACION DEL PARQUE EOLICO COMODORO RIVADAVIA - PROVINCIA DE CHUBUT - (2X250KW)



# ARGENTINA WHOLESALE MARKET ELECTRICITY PRICES

## Agosto 1992 - Diciembre 1998



# **ARGENTINAS LEGISLATION ON PROMOTION OF WIND AND SOLAR**



- **NATIONAL LAW BENEFITS (APPROVED)**
  - **IMPORTS V.A.T. (21 %) FINANCING FOR 15 YEARS (Art. 3°)**
  - **ADDITIONAL PAYMENT OF 1 CENT/kWh FOR WIND ELECTRICITY (Art. 5°)**
  - **TAX ESTABILITY(Art. 7°)**
- **CHUBUT PROVINCE LAW (APPROVED)**
  - **ADDITIONAL PAYMENT OF 0.5 CENT/kWh FOR WIND POWER**
  - **LOCAL PARTS INTEGRATION REQUIRED PROGRESIVELY**
- **BUENOS AIRES PROVINCE LAW (APPROVED)**
  - **ADDITIONAL PAYMENT OF 1 CENT/kWh FOR WIND POWER**

# FORECASTING OF WIND POWER IN ARGENTINA

## ➤ **ADDITIONAL INSTALLED CAPACITY (?)**

➤ **2001            50-70    MW**

➤ **2002            30        MW**

➤ **2003            30        MW**

➤ **2004            30        MW**

➤ **UP TO 2002/2003 LIMITATIONS DUE TO  
TRANSPORTATION CAPACITY**

➤ **CARBON FUND (GEF) CAN BE A BIG HELP**

# Sistema Electrico Argentino



<b>Capacidad Instalada</b>	<b>20.930 MW</b>
<b>Generacion</b>	<b>68.100 GWh</b>
<b>500 kV</b>	<b>7.920 km</b>
<b>330 kV</b>	<b>1.111 km</b>
<b>220 kV</b>	<b>1.232 km</b>
<b>132 kV</b>	<b>6.484 km</b>
<b>MEM</b>	
<b>Capacidad Instalada</b>	<b>18.900 MW</b>
<b>Demanda</b>	<b>65.666 GWh</b>
<b>Max. Capacidad</b>	
<b>Generada</b>	<b>12.269 MW</b>
<b>MEMSP</b>	
<b>Capacidad Instalada</b>	<b>840 MW</b>
<b>Demanda</b>	<b>3.420 GWh</b>
<b>Max. Generacion</b>	<b>534 MW</b>

# CONCLUSIONS



- **NEW RENEWABLES ENERGY TECHNOLOGIES CAN HELP TO ALLEVIATE PEOPLE'S PROBLEM**
- **THERE EXIST SEVERAL MECHANISM BY WHICH THESE TECHNOLOGIES CAN BE PROMOTED IN NEARLY ECONOMIC COMPETITIVE TERMS WITH OTHER OPTIONS**
- **THE BIGGEST CHALLENGE IS TO PROMOTE SOLUTIONS THAT CAN BE SUSTAINABLE IN ALL THE DIFFERENT ASPECTS THIS MEAN WITH A CLEAR VISSION OF WHAT CAN BE DONE BY:**
  - **THE GOVERNEMENT (NATIONAL AND PROVINCIAL)**
  - **THE PRIVATE SECTOR**
  - **THE PEOPLE**

# El Gran Obstáculo



....No hay cosa más difícil de tratar ni más dudosa de conseguir, ni más peligrosa de conducir, que hacerse promotor de la implantación de nuevas instituciones. La causa de tanta dificultad reside en que el promotor tiene por enemigos a todos aquellos que sacaban provecho del viejo orden y encuentra unos defensores tímidos en todos los que se verían beneficiados por el nuevo. ....

Fragmento de: “El Príncipe” (Maquiavelo)



**THANK YOU VERY MUCH**

**ALDO FABRIS**  
**aldofabris@ciudad.com.ar**