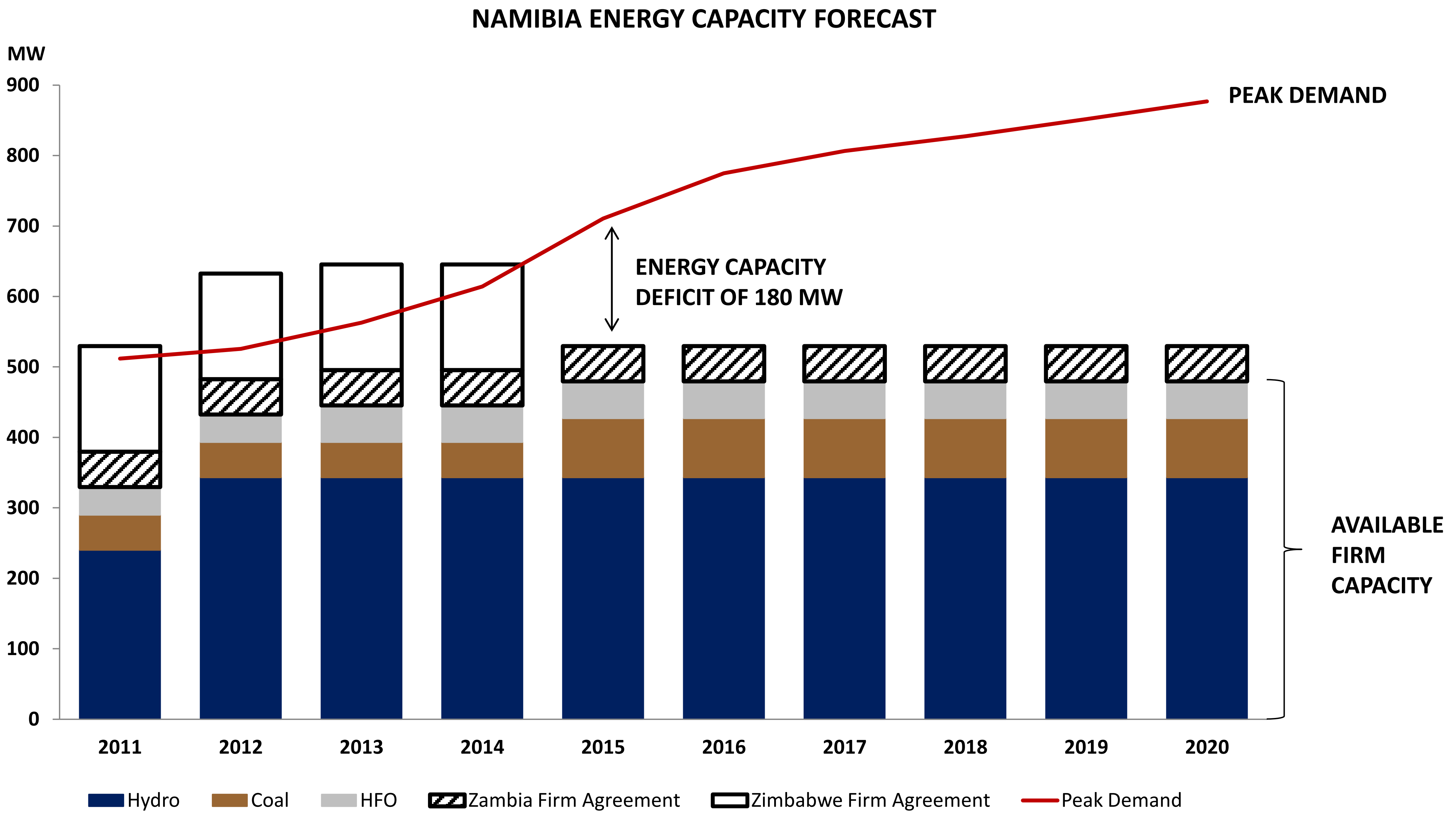
Ministry of Mines and Energy

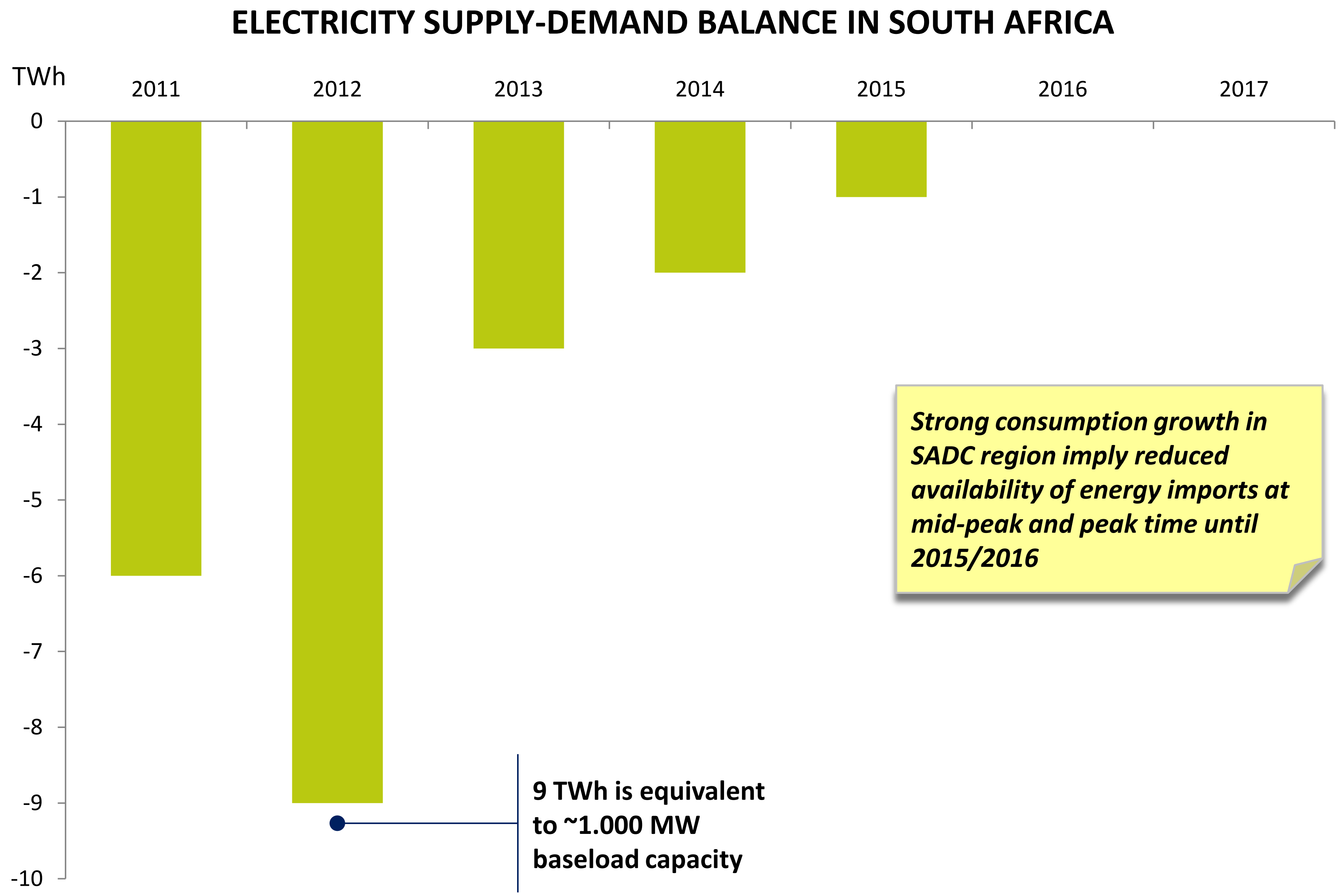
CSP DEVELOPMENT AND IMPLICATIONS FOR NAMIBIA

NAMIBIA FACES A CAPACITY DEFICIT FROM 2015 ONWARDS



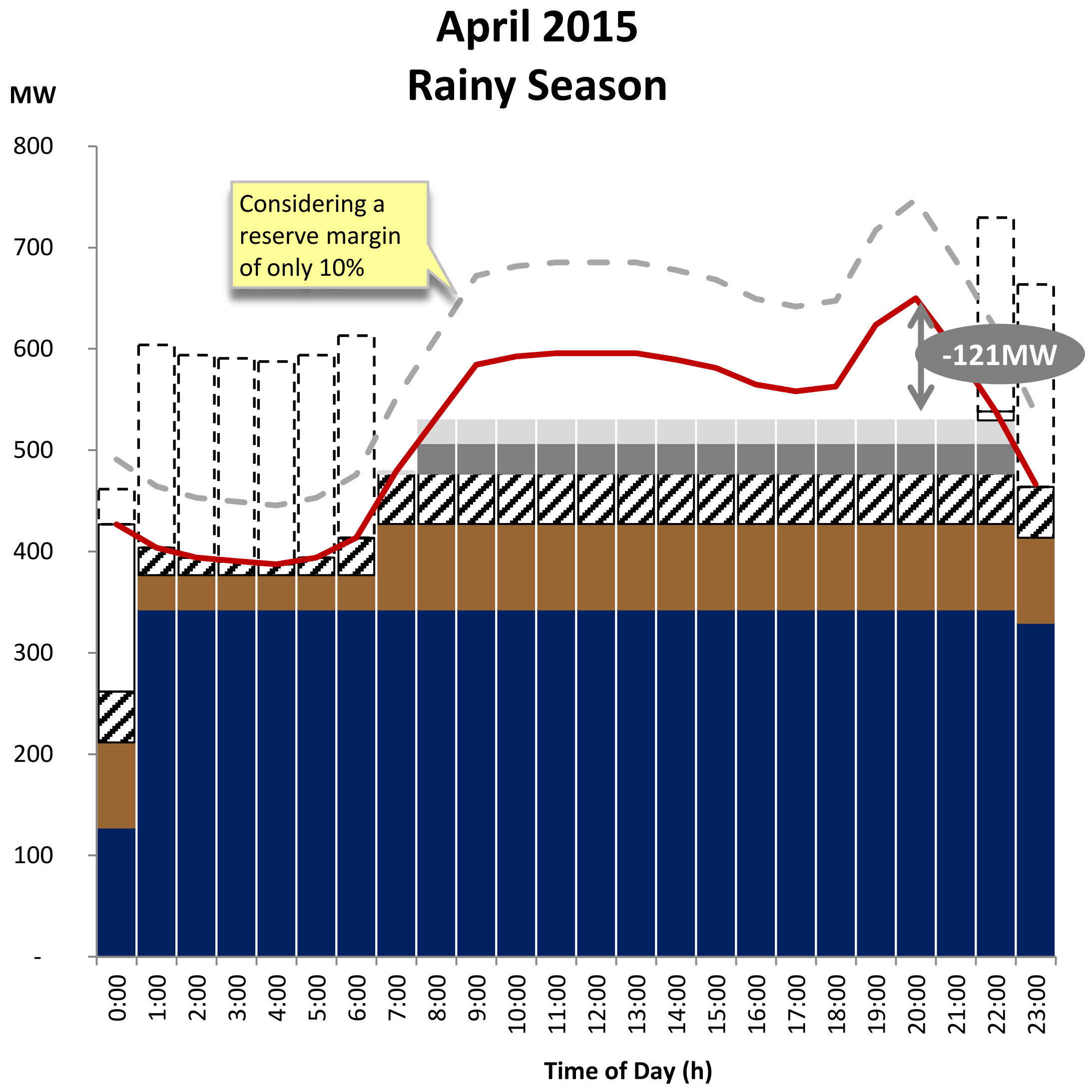
Source: *Hatch Planning Parameters and Generation Options Draft Report – April, 30 2012; Gesto Analysis*

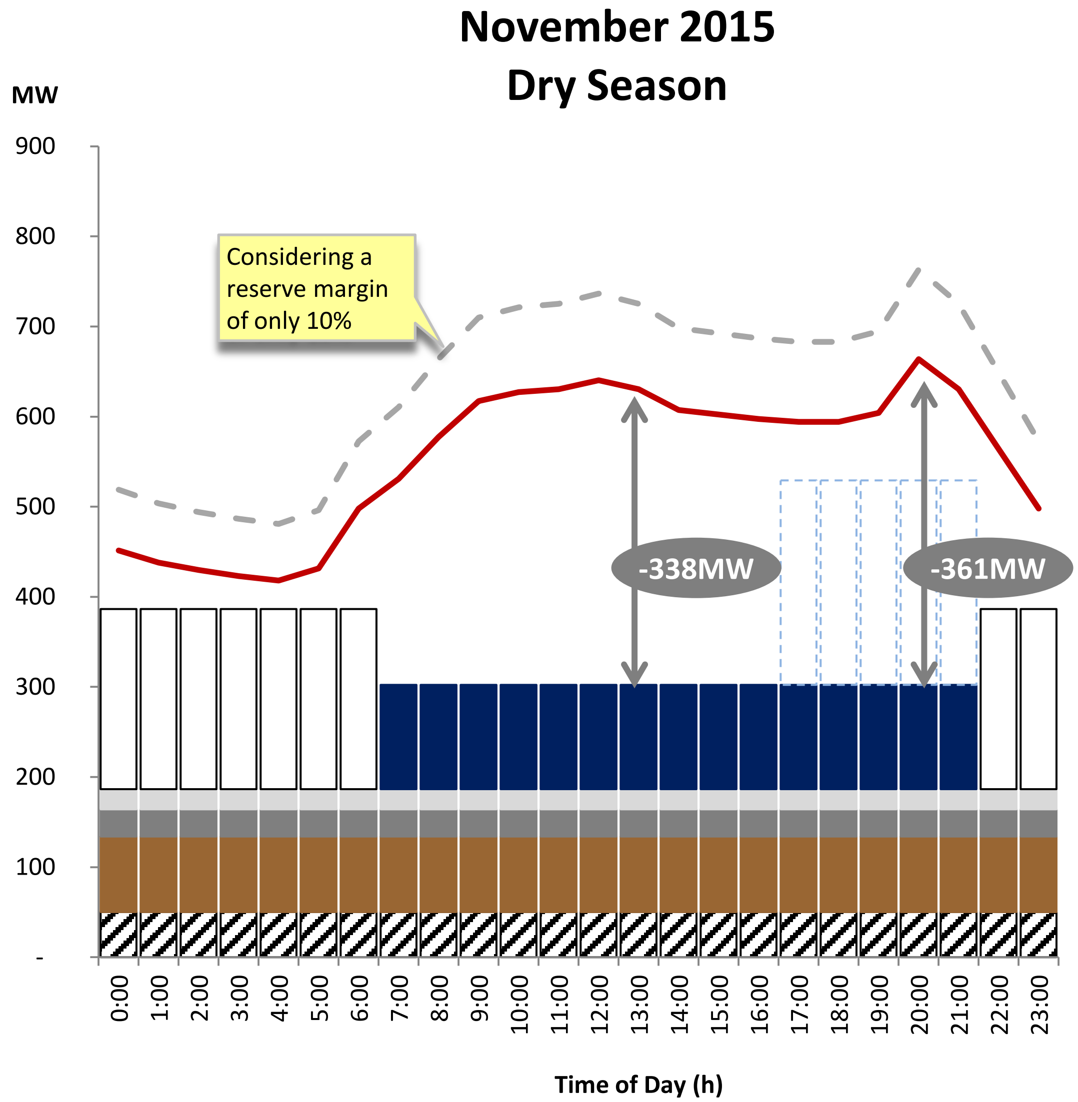
DUE TO SOUTH AFRICA'S ENERGY CRISIS, THE BILATERAL AND SUPPLEMENTAL CONTRACT MAY NOT BE AN OPTION FOR NAMIBIA'S ENERGY GAP



Source: *The outlook up to 2017 is based on the Integrated Resource Plan (IRP) "moderate demand" scenario*

LACK OF WATER AVAILABILITY DURING DRY SEASON INCREASES ENERGY DEFICIT

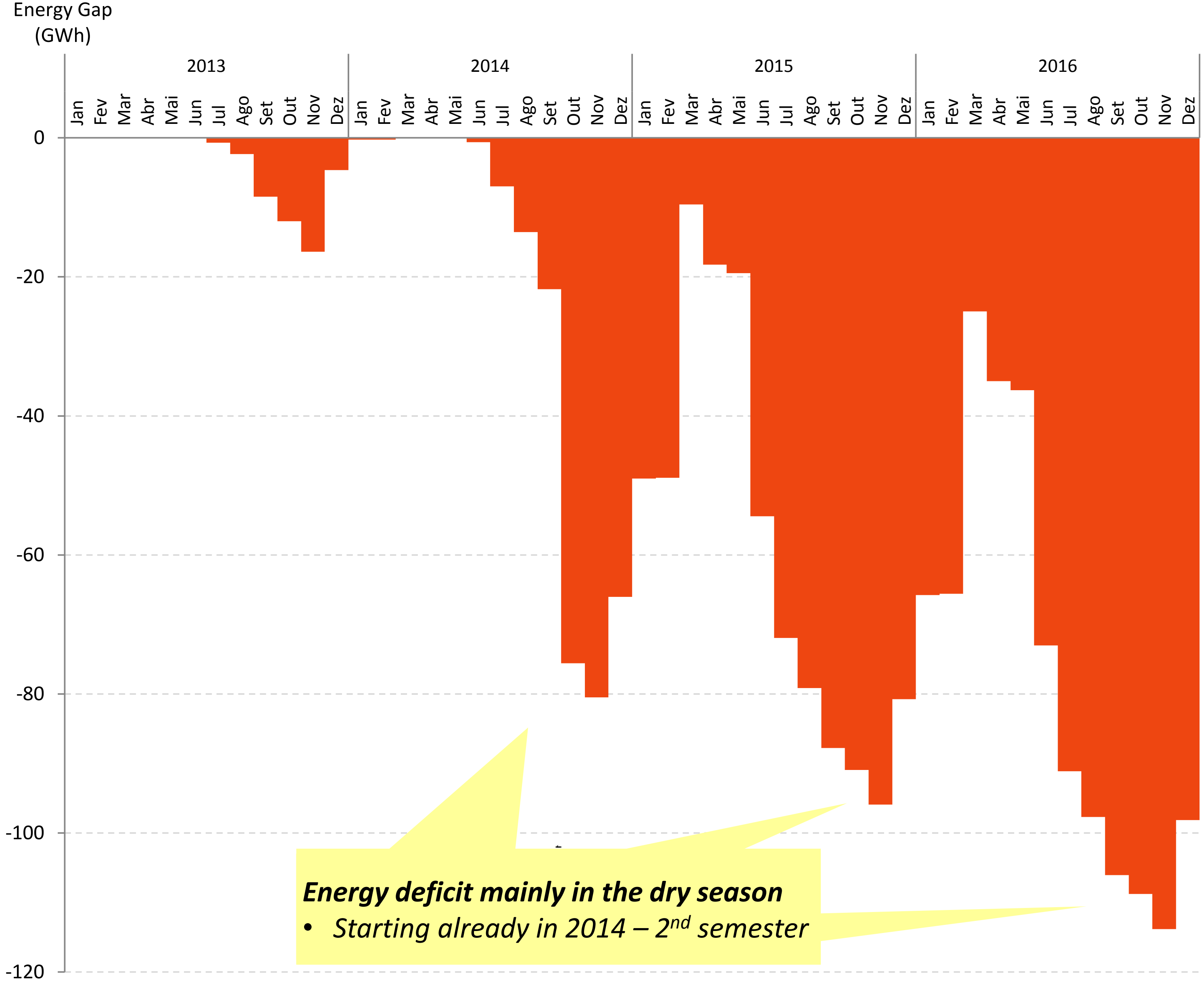




Source: *Hatch Planning Parameters and Generation Options Draft Report – April, 30 2012; Gesto Analysis*

WITHOUT SHORT TERM INVESTMENTS NAMIBIA MAY FACE A COST OF N$6.377M

ESTIMATED ENERGY GAP UNTIL 2016



Source: *Hatch Planning Parameters and Generation Options Draft Report – April, 30 2012; Gesto Analysis*

…may represent a +$6.377M cost for Namibia

Estimated total gap of 1,932 TWh between 2013 and 2016

- considering only peak and mid-peak periods

Without short term investments in power generation the gap will most probably be met with rental diesel

- Tanzania recently signed large contracts with Aggreko and Symbion
- Botswana had a 70 MW rental diesel unit operating until 2012

Tanesco estimated cost with Aggreko and Symbion rented diesel in 2012 amounts to $3.500M

- ~$3.300ND/MWh

If 75% of the Namibian energy gap is met using rental diesel this will represent a total cost for Namibia of N$ 6.377M

THREE SHORT TERM ALTERNATIVES TO RENTAL DIESEL

	1 HEAVY FUEL OIL	2 SOLAR CSP	3 SOLAR PV / WIND & BACKUP DIESEL	4 RENTAL DIESEL
Minimum Lead Time	**1,5 years**	**2 years**	**PV & Diesel – 1 year** **Existing wind – 1 year** **Other Wind – 2 years***	**6 months**
Investment ($N/MW)	**~$10M to $15M**	**~$40M**	~$16-18M (PV or Wind) ~$2-4M (Diesel) **Total: ~$20M**	**~0**
Operating Cost *(Fuel + O&M - $N/MWh)*	**~$1.200**	**~$250-$400**	**~$150 – 200 (PV) or** **~$100 – 150 (Wind) or** **~$2800 (Diesel)**	**~$3.300** *(based on Tanzania contracts with Aggreko and Symbion)*
Total Cost ($N/MWh)	**~$1.640 – 1.860** (@40% utilization)	**~$1.600** *(Devpt. Banks)* **~$1.900** *(IPP)*	**Solar PV & diesel: $1.780** (IPP) **Wind & diesel: $1.520-1.850**(IPP)**	**~$3.300**

- *Wind parks already with 1 year wind measurements and environmental impact assessment can be built in 1 year*
- *** Wind energy tariff calculated considering 40% of the energy will be sold at off-peak hours at $350/MWh throughout the priod for 2.500 and 3.000 hours net equivalent generation*

Notes: *a 5 year tax exemption was considered. Average project IRR of 15% and 11% in case of commercial and development financing, respectively.*
Source: *HFO: Hatch Planning Parameters and Generation Options Draft Report – April, 30 2012; CSP: SUNBD; Solar PV & Wind: South Africa Gesto Analysis*

ALL OTHER COST COMPETITIVE ALTERNATIVES BEING STUDIED IN THE NAMIBIAN IRP WILL NOT COME UP ON TIME

	1 NATURAL GAS	2 COAL	3 HYDRO BAYNES (600MW)	4 HYDRO ORANGE RIVER (100MW)
Minimum Lead Time	5 years (?)	5 years	9 years	6 years
Investment ($N/MW)	~$6M – 12M	~$21M	~$30,5M	~$28,6M
Operating Cost (Fuel + O&M - $N/MWh)	~$635 *(will depend on Kudu exploration agreement)*	~$559	~$50	~$50
Total Cost ($N/MWh)	~$850 - 1060 (@50% utilization)	~$1.080 (@70% utilization)	~$1.356 (@40% utilization)	~$1.275 (@40% utilization)

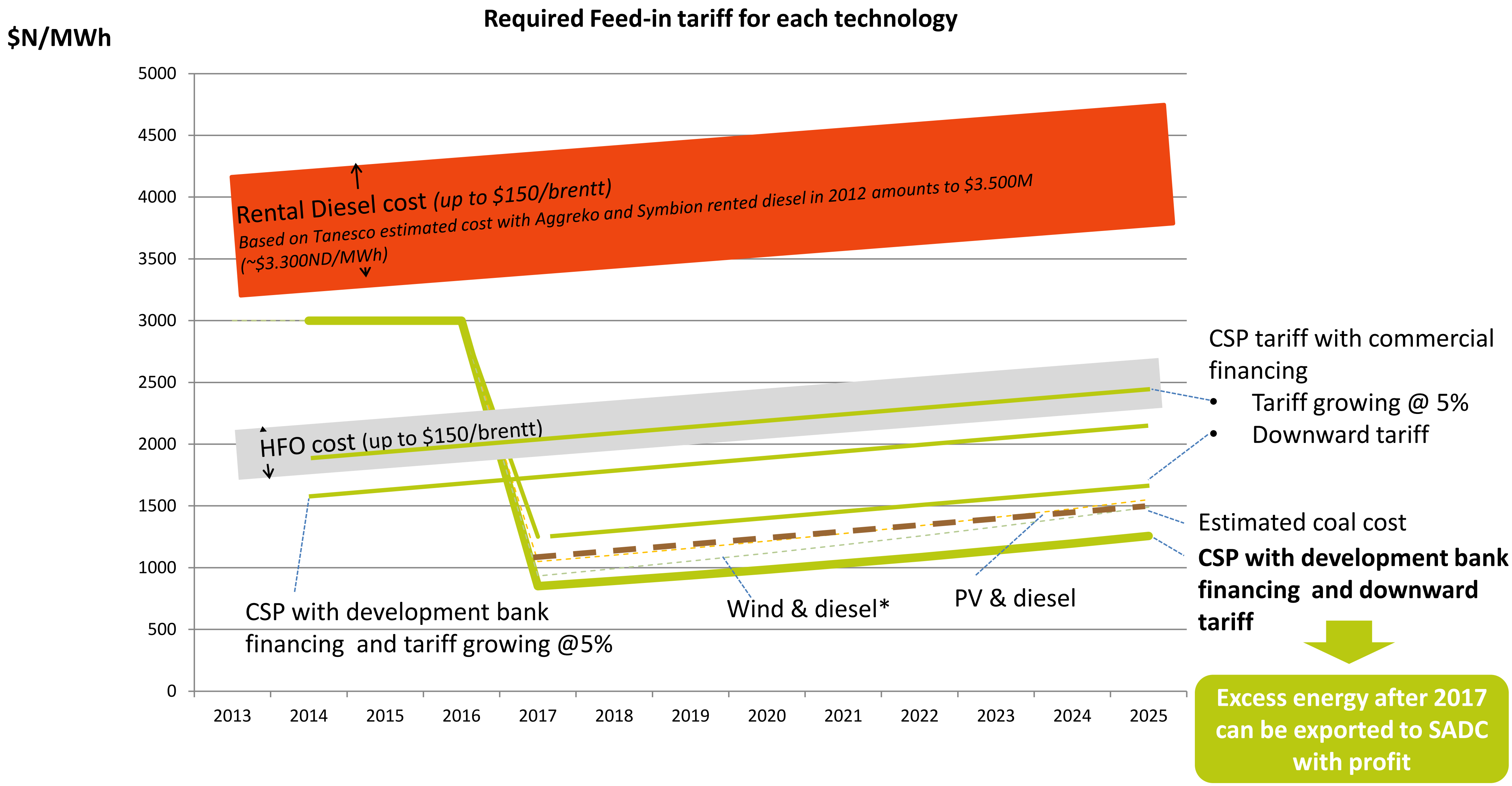
Coal seems to be the most reliable medium term alternative given Kudu timing uncertainty

Natural gas is the most adequate alternative in terms of investment, cost and fit with hydro.
However uncertainty on Kudu timeline undermines this option

Note that: *Taxes were not considered. Capex was annualized using a 15% weighted average cost of capital with equal payments (no inflation)*

CSP WITH DEVELOPMENT BANK FINANCING IS THE PREFERRED OPTION

A 2 STEP DOWNWARD TARIFF ALLOWS RENEWABLES TO BE EXPORTED AFTER COAL IS INSTALLED



* Tariff for wind calculated considering 40% of the energy will be sold at off-peak hours at $350/MWh throughout the period

Source: Hatch Planning Parameters and Generation Options Draft Report – April, 30 2012; Gesto Analysis

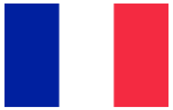
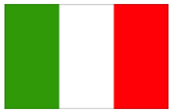
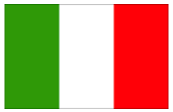
FOUR MAIN ALTERNATIVE BUSINESS MODELS STUDIED FOR NAMIBIA

		Development banks	Downward negotiated tariff (IPP)	Refit with auction	Market price + Fixed Premium
Description		• CSP project developed by Nampower or Strategic private partner + Government institution (ex. REEEI) • Government support for low cost debt from development institutions	• Negotiated IPP and PPA contract with private investors • Recommended for PV and Wind projects	• Pre-established maximum Renewable feed in tariffs • Tariff auction (downward from maximum tariff) • Similar to South Africa Refit program	• Recommended only in the medium term given higher risk for investment • Multi-buyer bilateral agreement + fixed premium • Bilateral agreements with mines for market price
Incentive system		• Negotiated Fixed tariff • Debt incentives • Tax exemptions	• Negotiated Fixed tariff • Tax exemptions	• Auction based Fixed tariff • Tax exemptions	• Market price + premium • Tax exemptions
Tariff design	**Currency**	• US Dollars (preferred)	• Most likely Namibian dollars • US Dollars (preferred)	• Namibian dollars	• US Dollars (energy) • Namibian dollars (premium)
	Duration	• 20 years	• 20 years	• 20 years	• 20 years
	Time structure	• Downward (preferred) • Growing with inflation (alternative)	• Downward (2 step approach) • 2nd step growing at fixed rate	• Growing with inflation or at a fixed rate	• Downward premium
	Counter-part	• Nampower as buyer with state guarantee	• Nampower as buyer with state guarantee	• Nampower as buyer with state guarantee	• Multi buyer • ECB paying the premium

Recommended alternatives for Namibia in the short term

DIFFERENT INCENTIVE SYSTEMS FOR RENEWABLES

BACKUP

	Fixed Tariff			Variable tariff			
	Negotiated fixed tariff (for each project)	**Fixed tariff**	**Auction based fixed tariff**	**Market price + Premium (fixed, negotiated or auction)**	**Green certificates and/or obligations**	**Financing incentives**	**Investment or Tax incentives**
Description	• Power purchase agreement directly negotiated with promoters for the pre-established duration • Current system in Namibia under the Independent power producer regime	• Typically applied through the establishment of a priori defined tariff • The most applied incentive model in Europe	A quantitative target for renewables is realized by auction where investors are invited to apply a bid for a renewable contract: • Successful bidders will receive a fixed price in accordance with their bid	Renewable power generators receive two types of revenues: • The market price of energy (variable) • A premium which may be either fixed, negotiated or auctioned	A minimum share of power coming from renewables is required for utilities: • Eligible technologies are defined • Targets are set • Green certificates for each MWh of renewable energy are awarded to producers • If a utility is lacking certificates must pay penalty	Various types of debt arrangements with lower cost accessible for middle income countries: • State guarantee • World bank IDA or IBRD partial risk guarantee (PRG) • DFI financing • AFDB financing	Applied in several countries, that provide incentive systems, as a complementary incentive: • Tax exemptions • Subsidies
Examples	• Current sytem in Namibia (IPP regime)  • Botswana 	• France  • Portugal (initial regime - 2001) 	• South African Refit System  • New Italy regime (2012)  • Portugal (wind bid)	• Spain 	• U.K.  • Italy (old regime) 	• Cape Verde financed 7,5 MW solar with concessionary loan • Also a 25 MW wind project was financed with World Bank support 	• United States uses a tax credit mechanism 

DIFFERENT INCENTIVE SYSTEMS FOR RENEWABLES

BACKUP

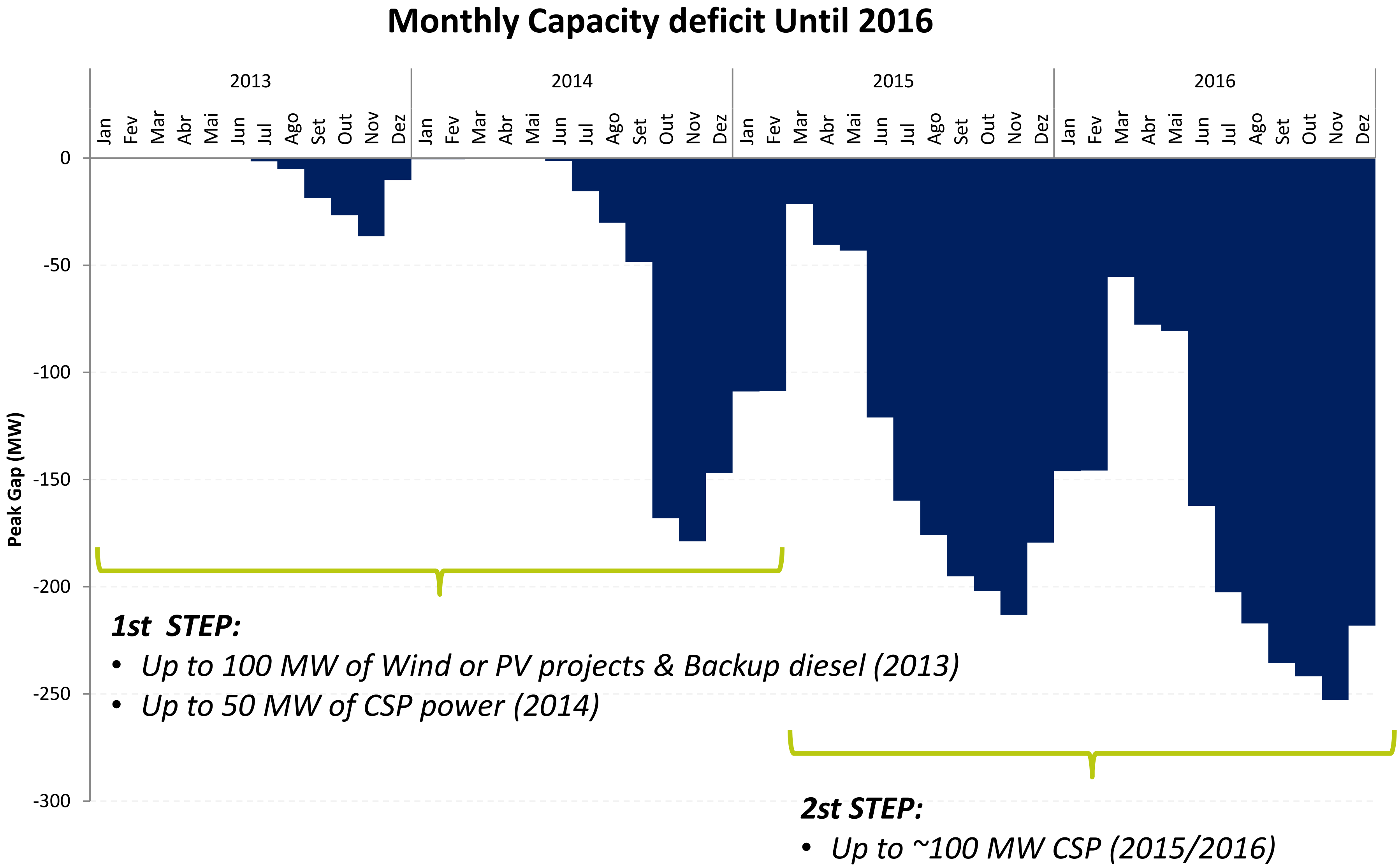
	Fixed Tariff			Variable tariff			
	Negotiated fixed tariff (for each project)	**Fixed tariff**	**Auction based fixed tariff**	**Market price + Premium (fixed, negotiated or auction)**	**Green certificates and/or obligations**	**Financing incentives**	**Investment or Tax incentives**
Advantages	• Fast to deploy given existing IPP system • Stable for investors • Easy to control capacity awarded	• Stable for investors • Easy to establish • Less dependent on incumbent	• Efficient model if there is sufficient players or bidders • Stable for investors • Easy to control capacity awarded • Less dependent on incumbent	• Compatible with multi-buyer approach intended by ECB • Possibility to make bilateral agreements with mines (using hard currency) • Variability of price (peak vs. off-peak & rainy vs. Dry)	• Gives incentive only to the most cost competitive type of renewables	• Reduces cost of debt for investors • Complementarity with other types of incentives	• Limited cost for the Government (without investment there would be no tax) • Complementarity with other types of incentives
Disadvantages	• Risk of having "opportunistic" developers interested in selling rights instead of building (requires careful negotiation) • Very dependent on incumbent	• Difficult to control capacity award • First come first served too risky relative to implementation capacity • Risk of setting the tariff too high and overpaying	• Takes time to design and launch • Risk of raiders who want to sell licenses and that lower too much the price (making the projects not financeable)	• Higher risk for investors • Requires involvement of mines • Risk of overpaying in case market prices grow significantly	• Increases risk for investor (as future value is unknown) • Risk of too high incumbent power depending on buying obligations • Complex system to implement and monitor	• Access may be limited given Namibia's middle income status • Requires public leadership and involvement	• Reduces short term Government budget revenue
	Faster model to deploy and can be efficient considering South Africa bid results	Very popular in many European countries but not recommendable given high risk of overpaying	**Efficient mechanism, however requires relevant investment and time**	• **Not recommendable in the short term given higher risk** • **Good for medium term with mines**	Not recommendable given high risk. It is being abandoned in many countries (ex. Italy)	**Very relevant as Namibia can have access to development banks or concessionary loans with low cost debt**	**Recommendable additional measure. Reduces tariff cost**

FOUR IMPORTANT DIMENSIONS FOR TARIFF DESIGN

BACKUP

	1. Currency	2. Duration	3. Time Structure: Inter annual	3. Time Structure: Intra annual (Daily , weekly or seasonal)	4. Counterpart
Description	• Tariffs may be paid in local currency or a "hard" currency such as US Dollars or Euros • Reduces exchange rate risk in case of external financing	• Tariff incentives typically have durations between 10 and 25 years • In case of hydro projects the period is normally higher (up to 50 years)	• Tariffs may be stable, vary downward or upward • Many incentives grow the tariff with inflation • However, downward systems facilitate market convergence and reduce the total interest cost	• Energy tariffs vary according to time • May vary between off-peak, mid-peak and peak time • May vary between months or seasons	• Payment risk will depend on the reliability of the counterpart • Normally local utility as counterpart, however in some cases a public institution may guarantee the payments
Alternatives	• **Namibian dollars** • **US dollars** • **Euros**	• **10 years** • **20 years (as in South Africa)** • **25 years – economic life**	• **Stable** • **Growing with inflation or at a fixed rate** • **Downward**	• **Fixed tariff** • **Peak/Off-peak tariff** • **Seasonal tariff**	• **PPA with Nampower** • **Payment by ECB** • **PPA with Nampower and State guarantee** • **Multibuyer (eg. Mines)**
Recommendations for Namibia	• Given that Namibia economy exports mainly in US Dollars • And high investments in energy : • **We recommend the tariffs to be set in US Dollars or to create a compensation mechanism for exchange fluctuations**	• **We recommend the tariffs to have a duration of 20 years as value of money after 20 years becomes too high** • 10 years are only sufficient to recover investment and may imply higher short term tariffs	• Given that Namibia short term energy gap would be met with rental diesel and a coal power plant will be commissioned in 2017 • **We recommend a 2 step downward system to reflect the cost of rental diesel and coal in the short and medium term, respectively**	• Given high dependence on hydro and available low cost off-peak energy in the region • **We recommend the tariffs to change between peak and off-peak and to be reduced during the rainy season (to be in line with marginal value)**	• Given Namibia's current single buyer model • **In the short term, we recommend the counterpart to be NamPower with state guarantee**

GIVEN TECHNOLOGY LEAD TIMES WE PROPOSE A 2 STEP APPROACH



Note that: *based on Namibia's Energy Policy, a 75% coverage of peak demand with internal resources was considered. The capacity of Ruacana was equally distributed between mid-peak and peak hours according to average water availability*

Source: *Hatch Planning Parameters and Generation Options Draft Report – April, 30 2012; Gesto Analysis*

THIS APPROACH CAN SOLVE NAMIBIA'S ENERGY SHORTFALL WITH THE LEAST COST

2012 – 2nd Semester | 2013 – 1st Semester | 2013 – 2nd Semester | 2014 – 1st Semester | 2014 – 2nd Semester | 2015 – 1st Semester | 2015 – 2nd Semester | 2016 – 1st Semester

1st STEP

Up to 100 MW of Wind or PV & Backup diesel
+
Up to 50 MW of CSP

- Negotiate PPA under IPP regime

  All renewable promoters required to install and transfer(?) to Nampower diesel backup engines
- Delivery and installation of Diesel backup engines
- Operation startup (up to 100 MW)
- Installation of wind and solar PV projects
  (only wind projects with measurements can provide energy in the required time frame)
- Operation startup reducing diesel oil consumption
- Feasibility study

  Environmental screening

  Negotiation with Development institutions

  Selection of implementing agency
- EPC procurement

  Financial closing

  Environmenta l clearance
- Installation of CSP project (50 MW)
- Operation startup of the first 50 MW CSP project

2nd Step

Up to 100 MW of CSP

- Installation of the second phase (100 MW)
- Operat ion startup

CSP SOLAR PROJECTS HAVE SIGNIFICANT ADVANTAGES FOR NAMIBIA

Namibia has one of the best solar resources for CSP in the world enabling a competitive source of energy

- If there is an initial period of 3 years with higher PPA tariffs (taking into account that rental diesel is the existing short term alternative), CSP can become a competitive source of energy (relative to coal) with export potential

CSP in Namibia can have access to development funding for renewable energies in Africa

- Increasing access to available financing (important given strong investment requirements until 2017)
- Significantly decreasing the cost of debt and increasing the required tenors, which results in lower tariffs

CSP is a renewable source of energy with zero CO2 emissions contributing to climate change and improving Namibia's international image and visibility

CSP is a reliable technology with more than 1 GW of projects already deployed

- Spain with +750 MW installed and the USA with +440 MW installed
- Energy storage already tested and deployed in many projects around the world

CSP can guarantee dispatchable peak power even for the night peak time

- With storage or hybrid with biomass

CSP does not need to produce at off-peak periods when the value of energy in the region is very low

A CSP technology transfer program will enhance the renewable competences of Namibian research and education institutions

CSP has a strong potential for local job creation

- Which may significantly be increased in case of biomass hybridization