



Stabilizing the temperature of the planet, while meeting growing energy demands, requires a shift toward low carbon, renewable sources of energy. Concentrated solar power (CSP) holds vast potential due to its ability to provide reliable, utility-scale power even when the sun is not shining. CSP is such a promising technology that the International Energy Agency estimates that up to 11 percent of the world's electricity generation in 2050 could come from CSP.¹ Current global CSP capacity, however, is just 4 gigawatts (GW), a tiny fraction of the world's power capacity. High technology costs and a limited number of CSP demonstration projects deter investors, especially in higher-risk emerging markets. To prove the economic and technological viability of CSP, trailblazing projects are needed across the world's most sun-drenched regions.

Established in 2008, the \$8.1 billion Climate Investment Funds (CIF) address these challenges by delivering investments at scale to empower climate-smart transformation.



\$945
MILLION
ALLOCATED TO
CONCENTRATED
SOLAR POWER

- ESTABLISH A TRACK RECORD OF PERFORMANCE
- LOWER PERCEIVED RISK
- REDUCE FUTURE PROJECT COSTS
- MOBILIZE PRIVATE SECTOR INVESTMENT



INVESTING IN CONCENTRATED SOLAR POWER

The CIF is a leader in driving global investments in CSP. A total of \$945 million from the CIF's Clean Technology Fund (CTF)—expected to attract an additional \$8.4 billion in co-financing—is supporting early public and private sector CSP projects in Chile, South Africa, and the Middle East and North Africa (MENA) region. Projected generation capacity is 1.2 GW, or more than one-fourth of the current global CSP capacity.

The CIF's CSP investments are intended to establish a record of performance for the technology, thereby lowering perceived risk and reducing future project costs for private sector CSP investors and developers.

- In South Africa, CTF \$250 million served as a catalyst in attracting other international financing institutions and in solidifying political backing for the 100 megawatt (MW) Eskom CSP project at Upington.
- In South Africa, CTF \$83 million is supporting some of the first independent power producers in the country to help expand the CSP market.
- In Morocco, low cost debt from the CTF totaling \$435 million has helped to reduce project costs and drive market competition, which translates into more affordable power tariffs.

CIF INVESTMENTS IN CSP

CHILE
\$67 million
for 110 MW

SOUTH AFRICA
\$333 million
for 350 MW

MENA REGION
\$545 million
for 710 MW

\$945
MILLION
CTF ALLOCATIONS

CONTRIBUTING TO
1.2 GW
concentrated
solar power
EXPECTED



OVER
1/4
CURRENT GLOBAL
INSTALLED CAPACITY
4 GW





CIF IN ACTION

CATALYZING INVESTOR CONFIDENCE & MARKET EXPANSION IN SOUTH AFRICA

In order to increase energy security and meet greenhouse gas emissions reduction targets, South Africa is working to add 20 GW of new, renewable power generation capacity by 2030, of which 3.3 GW is expected to come from CSP. South Africa has committed 66 percent of its \$500 million CTF investment plan to CSP to stimulate markets and give confidence to other lenders.

Of this, CTF \$250 million channeled through the African Development Bank (AfDB) and World Bank is considered a catalyst in revitalizing the 100 MW project in Upington, which was put on hold in 2009 during the global recession. **The CIF helped the project to proceed thanks to the volume, low cost, and long tenor of the CTF loan. As the first donor to come to the table in support of this fully publicly-funded project, the CIF attracted the interest of other international financing institutions and reassured national ministries to provide political backing.**²

Being developed by Eskom, South Africa's national state-owned electricity utility, the project is one of the most ambitious and technically challenging CSP power tower projects under development in the world. Stakeholders agree this project will deliver substantial global learning and benefits that could lead to replication and scaling up of CSP nationwide and beyond.

When completed, the Eskom project will provide 9 to 12 hours of thermal energy storage and will be able to dispatch power to meet peak load, which is critical in South Africa given persistent energy

shortages. In fact, the project will provide the most storage capacity with the highest volume of delivered energy of any CSP project currently under development in South Africa. It aims to produce 500 GWh of clean energy per year to supply up to 200,000 homes and offset 450,000 tons of CO₂.

Another \$83 million in CTF financing, channeled through the AfDB and International Finance Corporation (IFC), is **supporting some of the first independent power producers in the country**, including the 100 MW Xina Solar One project, the 100 MW KaXu Solar One project, and the 50 MW Khi Solar One project—all being developed by private sector partners. In addition to the clean power generation that will benefit South African households, **these projects will help bolster CSP's existing track record, particularly at larger scales (50 MW and above), to further develop South Africa's and other emerging markets.**

- Configured to meet the South African peak load demand, the 100 MW Xina Solar One project will use parabolic trough technology and a superheated steam cycle and will provide over five hours of storage capacity. The project is expected to save about 400,000 tons of CO₂ equivalent per year.
- The 100 MW KaXu Solar One project is a 310 hectare field of pivoting concave mirrors, or 'parabolic troughs,' which focus the sun's rays onto pipes that run along the center of the troughs and produce heat that is converted into steam used to generate electricity. The project will help mitigate 268,000 tons of CO₂ equivalent a year or roughly 2.7 million tons over 10 years.
- The 50 MW Khi Solar One project is a 600 hectare, circular field containing more than 4,500 mirrored 'heliostats' that focus the sun's rays onto a central receiver atop a 200-meter tower. It will help mitigate 174,000 tons of CO₂ equivalent a year or roughly 1.7 million tons over 10 years.

"The CIF's early support was the catalyst that inspired both sponsor and other investor confidence and provided the much-needed impetus to commence project development."

Penny Herbst
Corporate Renewables Specialist, Eskom

“CIF funds have been able to mobilize a bigger pool of liquidity and, thus, make available larger amounts of funds permitting a higher leverage for a longer tenor and at a lower risk premium. The proof of the value created can be seen in the tariff we have been able to deliver.”

Paddy Padmanathan
Chairman and CEO, ACWA Power

DECREASING COSTS AND INCREASING COMPETITION IN MOROCCO

In Morocco, \$435 million in CTF concessional funding channeled through the AfDB and World Bank is supporting the three phase construction of the 500 MW Noor CSP complex. It is Morocco's first utility scale solar energy complex and a critical step of the Moroccan Solar Energy Program, which aims to install 2 GW of solar power by 2020. When completed, the Noor CSP complex expects to achieve over 500 MW installed capacity, reduce carbon emissions by 760,000 tons per year, and supply power to 1.1 million Moroccans by 2018.

Structured by the Moroccan Agency for Solar Energy (MASEN) as a public-private partnership, **the first phase of the project (Noor I) benefitted from low-cost debt provided by the CTF (\$197 million) and other international financial institutions, which reduced project costs by about 25 percent** compared to financing available from commercial banks in the market.³ This **enabled strong market competition** during the bidding cycle resulting in a winning bid from ACWA Power of \$0.18 per kilowatt-hour (kWh) that was 25 percent lower than initial cost projections. This is helping to **reduce strain on public finances** by lowering the yearly subsidy that the Moroccan government contributes from \$60 million to \$20 million.

Noor I construction began in 2013, and the first 160 MW solar power station is scheduled to come into operation by the end of 2015. MASEN took the lessons learned during the complicated and lengthy tendering process of this first phase to replicate and refine the Noor I financing model for the second and third phases of the project. The CTF's contribution of \$238 million for the 350 MW Noor II and III has since helped to generate further cost reductions. In 2015, ACWA Power won the competitive bid to construct the two new CSP plants offering an average power tariff of about \$0.16/kWh, roughly 10 percent below Noor I.⁴

RISKS AND REWARDS OF CSP



- High development costs, particularly upfront investment
- Perception of high policy risk by investors due to reliance of projects' profitability on public resources
- Technology risks, especially in countries with limited CSP experience or where solar resources may be lower than predicted
- Regulatory risks in emerging and developing economies, which can increase the financing costs
- Additional financing risks in countries where financial markets are not fully developed and interest rates on debt may be high and debt maturities short



- Taps the abundant, low carbon solar resources of the world's sun belt
- Can be combined with cost-effective energy storage solutions to produce utility-scale power when the sun is not shining
- Ability to overcome intermittency concerns of solar photovoltaic and wind power
- Potential to displace fossil fuel-based generation
- Positioned to play an important role in maintaining a steady power supply in future low-carbon energy systems

PUBLIC FINANCE NEEDED TO SCALE UP CSP

CSP development in South Africa and Morocco show that public support is still required to deliver on the global expectations of CSP. With the technology still at an early stage, investors face many uncertainties and challenges. Proof of technical design and related system performance will help to establish the real value of the technology, in particular large volumes of storage, and incentivize replication and scale up. It will help to reduce risk perception among project developers, host governments, and possible future lenders.

A year-long study⁵ carried out by the Climate Policy Initiative (CPI) on behalf of the CIF in 2014 explored how public financing can be used most effectively to scale up CSP deployment and reduce its cost. It found that international public finance can best be used:

- In countries committed to harnessing their solar resources that are unable to bear the full cost due to weak capital markets and no CSP experience
- For early stage CSP technologies with high investment risks but great potential for cost reductions or energy system benefits to mitigate those risks the private sector is unwilling to bear
- To provide knowledge on policy tools and technology to local policymakers

Research concluded that if international financing institutions and committed national governments joined forces to deploy 5 to 15 GW of CSP, it could reduce its electricity production costs by around 14 to 44 percent and make CSP competitive in countries like Morocco and South Africa.

RECOMMENDATIONS FOR CLOSING THE CSP VIABILITY GAP

For national governments

- Design policy to ensure that the cost of support falls to reflect decreasing costs over time
- Ensure that support can be sustained over time, to avoid boom and bust cycles
- Align public and private actors' financial interests to reduce the perception of policy risk and the cost of renewable energy support
- Remunerate flexible power supply from CSP to reflect its benefit to the energy system

For international financing institutions

- Consider adjusting loan requirements according to the technology maturity
- Harmonize loan and regulatory requirements among lenders
- Reduce foreign exchange hedging costs of loans by international financing institutions to developers



Notes

- 1 See http://www.iea.org/publications/freepublications/publication/csp_roadmap...
- 2 See <http://climatepolicyinitiative.org/wp-content/uploads/2014/06/SGG-Case-Study-The-Role-of-Public-Finance-in-CSP-Eskom-CSP-South-Africa.pdf>
- 3 See <http://climatepolicyinitiative.org/publication/san-giorgio-group-case-study-ouarzazate-i-csp/>
- 4 See <http://www.csp-world.com/news/20150110/001639/acwa-beats-abengoa-and-wins-2-b-deal-noor-ii-iii-csp-plants-morocco>
- 5 All CPI/CIF analytical work on public financing for CSP, including case studies, dialogues, and reports, is available at <http://www.climateinvestmentfunds.org/cif/node/13991>.

Photos: World Bank Group

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