ICAO ENVIRONMENT

ICAO Environmental Symposium 2019

DESTINATION GREEN: THE NEXT CHAPTER

Solar at Gate Project Implementation at Douala International Airport

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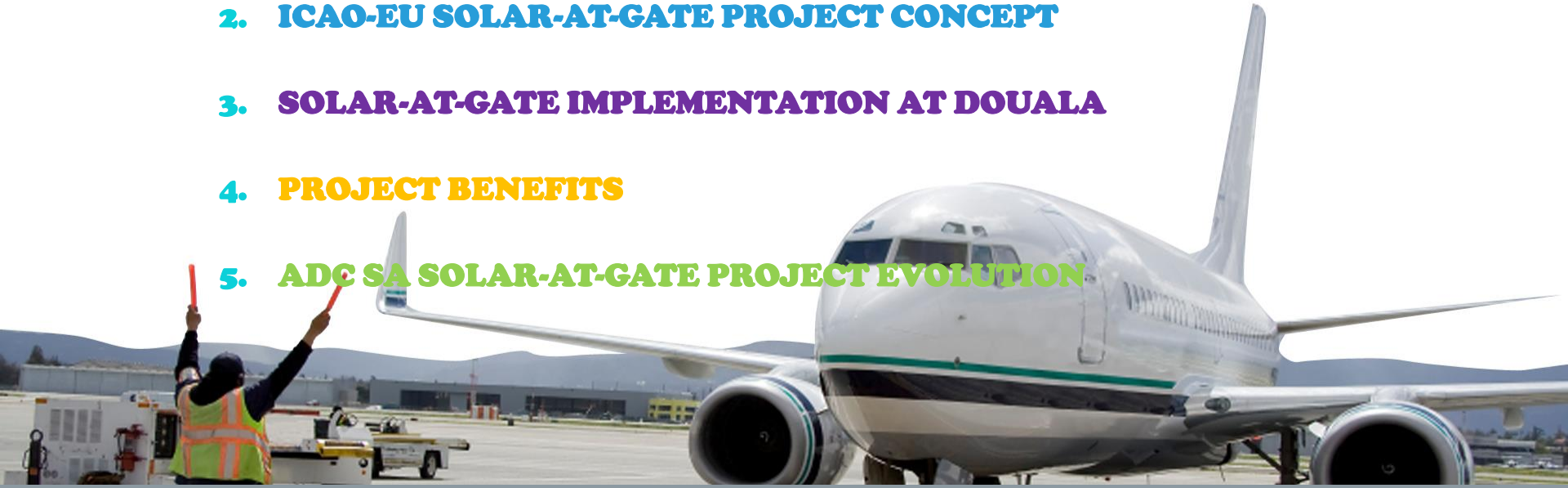
AGENDA OF THE PRESENTATION

1. PRESENTATION OF DOUALA INTERNATIONAL AIRPORT
2. ICAO-EU SOLAR-AT-GATE PROJECT CONCEPT
3. SOLAR-AT-GATE IMPLEMENTATION AT DOUALA
4. PROJECT BENEFITS
5. ADC SA SOLAR-AT-GATE PROJECT EVOLUTION



PRESENTATION OF DOUALA INTERNATIONAL AIRPORT

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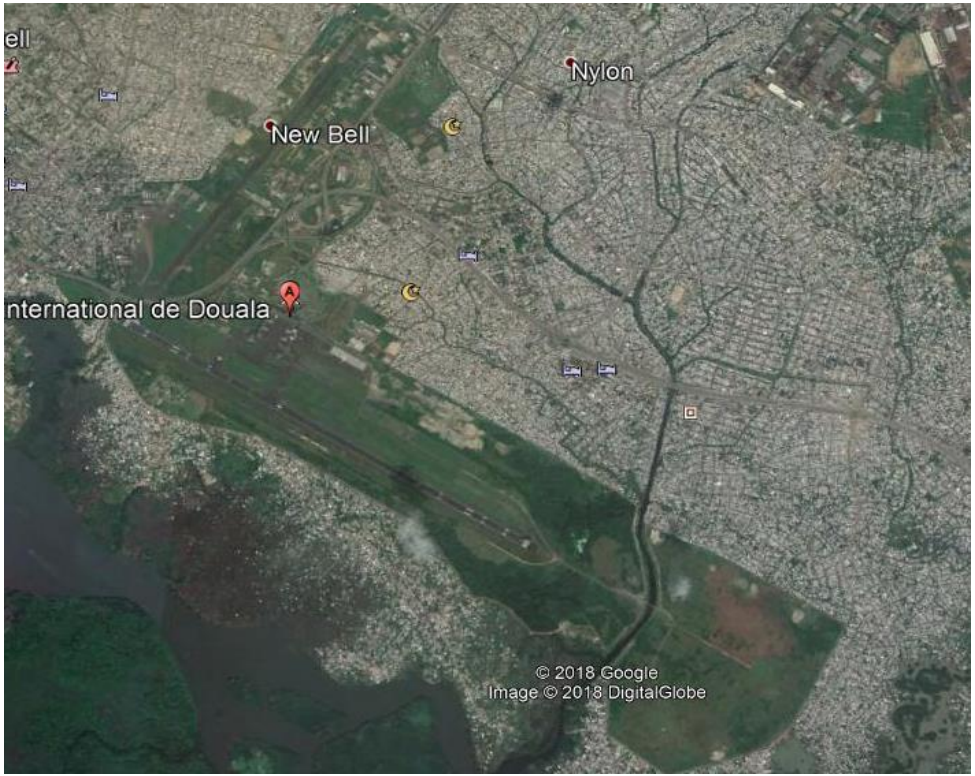


- Opened in June 27th, 1977
- Cameroon main airport

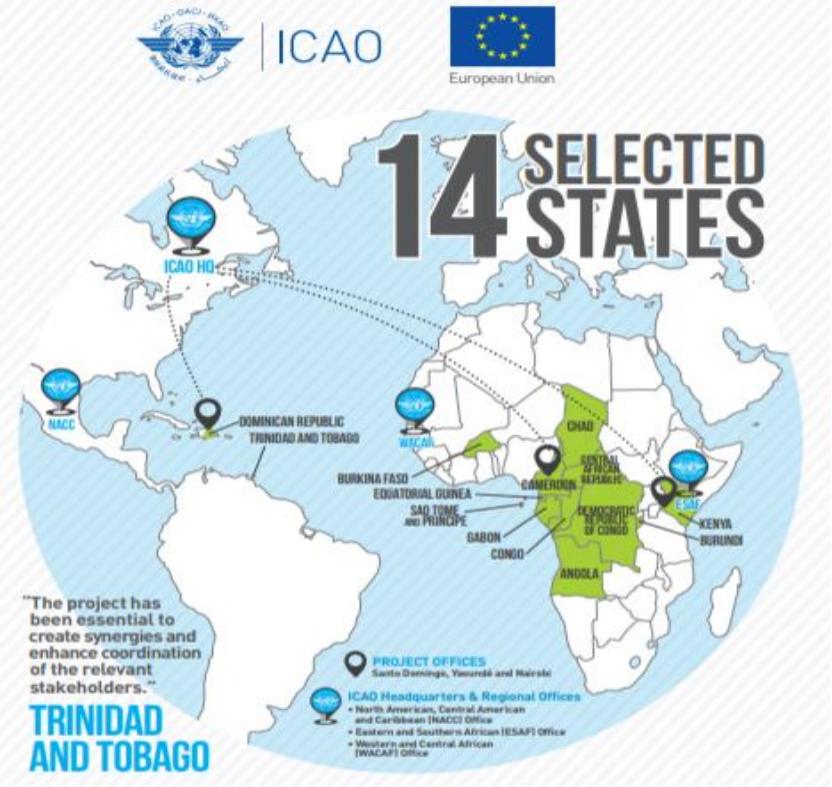
- Aerodrome Operator: ADC Aéroports Du Cameroun
- Ground Operator: ADC Aéroports Du Cameroun
- Runway 12/30: 2850 x 45 m

PRESENTATION OF DOUALA INTERNATIONAL AIRPORT

- 01 passenger terminal
- 01 cargo terminal
- Traffic data (2018)
  - 19 airlines
  - 20 442 aircraft movements
  - 28 commercial flights per day
  - 1.1 millions passengers (transit excluded) handled
  - 16500t freight

ICAO-EU SOLAR-AT-GATE PROJECT CONCEPT

ICAO-EU SOLAR-AT-GATE PROJET CONCEPT



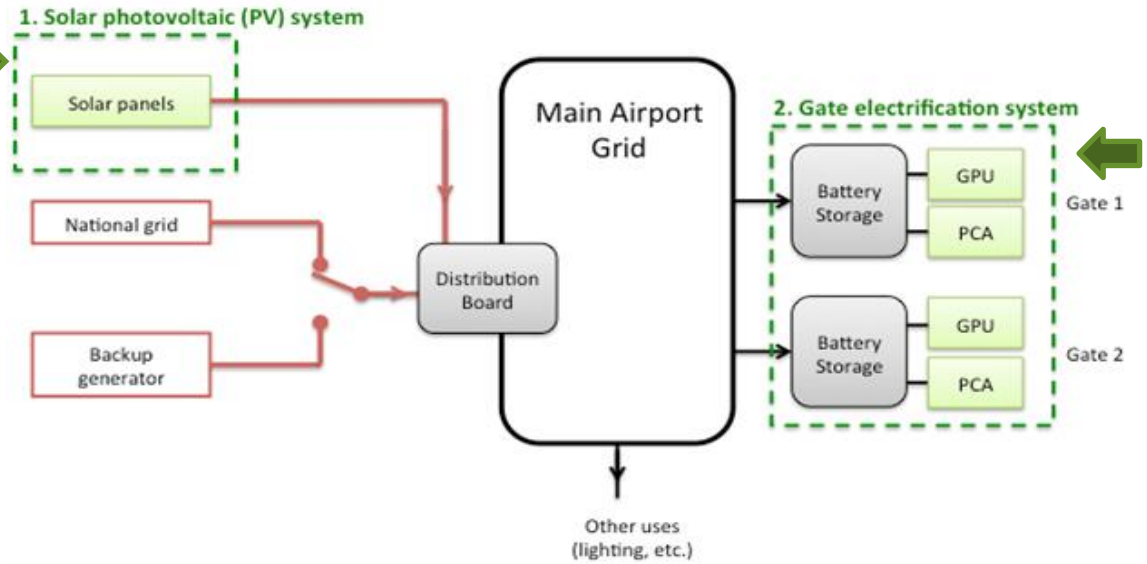
- Under **Objective n°3** of joint ICAO-EU Assistance Project Capacity building for CO_2 mitigation from international civil aviation

- To showcase concrete actions that may be replicated by other member States to contribute to the achievement of ICAO's aspirational goals for CO_2 emissions reduction from international civil aviation

ICAO-EU SOLAR-AT-GATE PROJET CONCEPT

Goal: To demonstrate CO_2 emissions mitigation through the use of solar (thus clean) energy to provide ground power (via electric GPU) and pre-conditionned air (via electric PCA) to aircraft serving international flights at the gate. Aircraft will therefore be able to switch off their Auxiliary Power Unit (APU), thus reducing CO_2 emissions from international civil aviation.

1. Solar PV system
Provides clean power to the airport grid

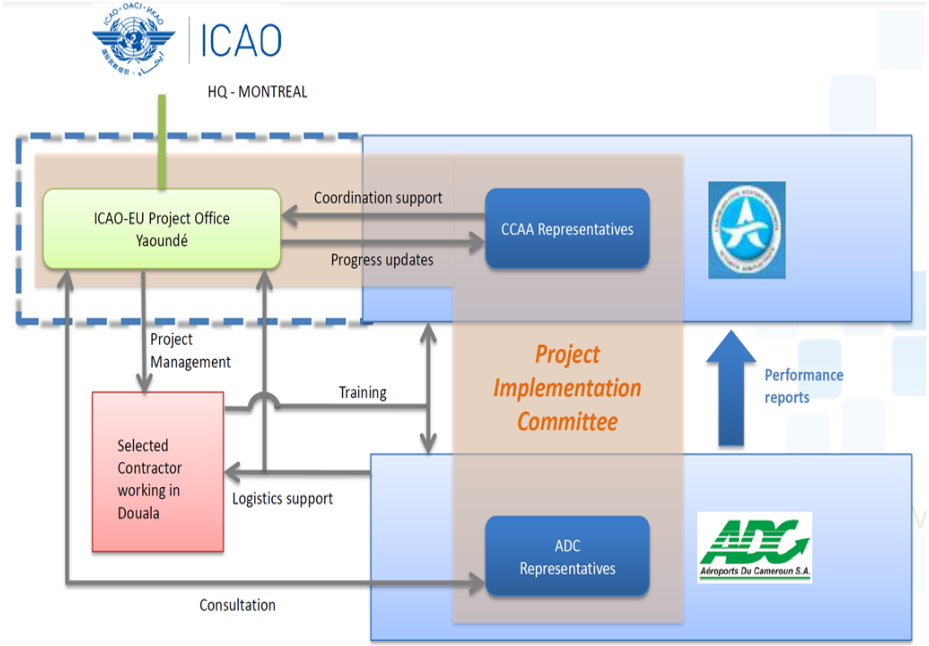


2. Gate Electrification system
Provides ground power and pre-conditioned air to the aircraft at the gate

SOLAR-AT-GATE IMPLEMENTATION AT DOUALA

SOLAR-AT-GATE IMPLEMENTATION AT DOUALA

Project Organization



- **Cost**: 1,432,340 USD
- **Stakeholders**: ICAO, CCAA and ADC SA
- **Project Implementation Committee** set up
- **Project Kick-off meeting**: 16 November 2016

- **Inauguration**: 10 January 2019

- **Project acceptance**: 13 February 2019

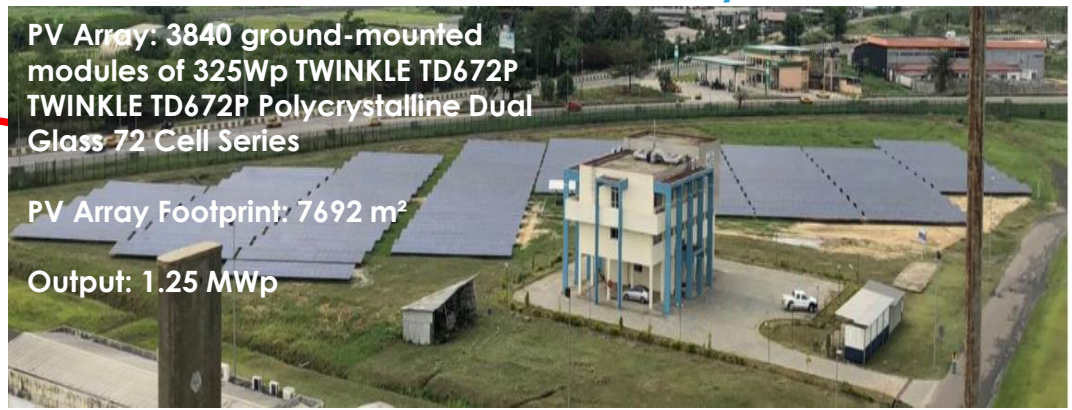
SOLAR-AT-GATE IMPLEMENTATION AT DOUALA

Technical Description

- 3840 x **PV modules** 325Wp / Global power = 1,25 MWp
- 20x **Combiner boxes** DC
- 20x **Inverters** SMA STP 60 kW
- 1x High Voltage Transformer Station (**MVS**) 400V/15kV
- 1x **High voltage cell** to connect to airport main distribution board at 15KV
- 2x **Educational kiosks**
- 1x **Monitoring and data acquisition system**
- **Gate Equipment: 01 electric GPU** and **01 electric ACU** procured and commissionned by the airport
- **No battery storage system**
- **Training to ADC SA Staff**
- **Preventive and corrective maintenance contracted for 2 years**

SOLAR-AT-GATE IMPLEMENTATION AT DOUALA

Solar PV Array



- PV Array: 3840 ground-mounted modules of 325Wp TWINKLE TD672P TWINKLE TD672P Polycrystalline Dual Glass 72 Cell Series
- PV Array Footprint: 7692 m²
- Output: 1.25 MWp

20 combiner box DC

- Inside the PV array

SOLAR-AT-GATE IMPLEMENTATION AT DOUALA

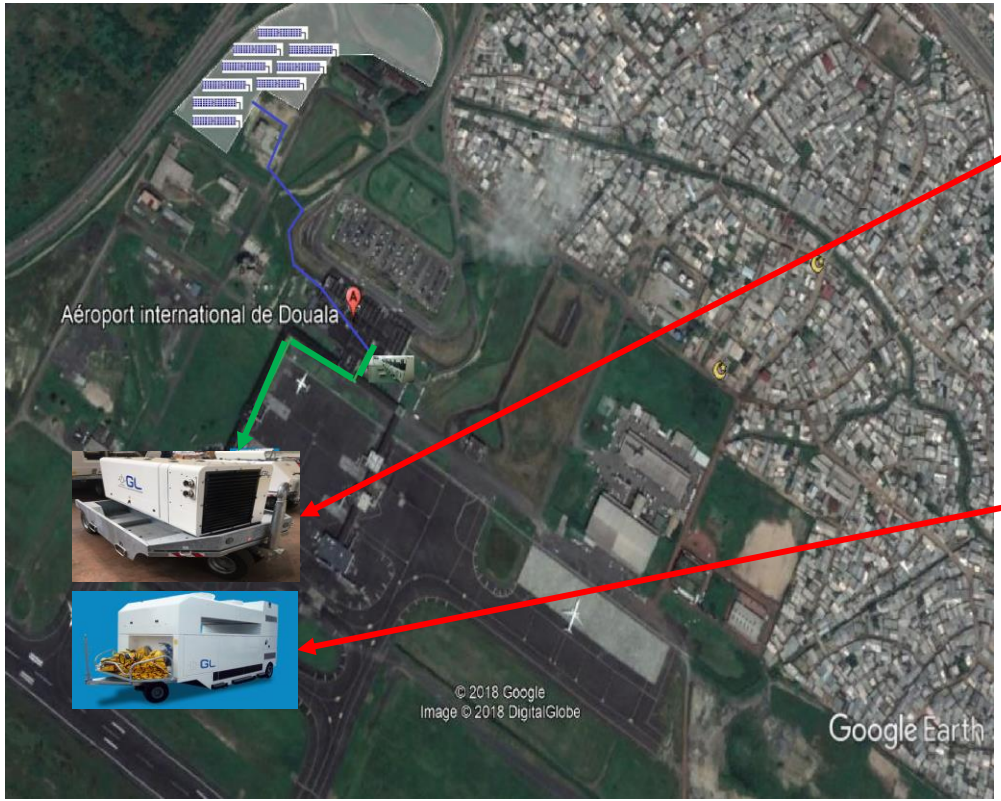
Inverters and MVS

20 Inverters SMA STP 60 kW
- 5 in one column below
- 4 columns
- 3 cables: DC, AC, Monitoring

01 High Voltage Transformer Station (MVS)
- 400V/15kV

SOLAR-AT-GATE IMPLEMENTATION AT DOUALA

Electric GPU and PCA



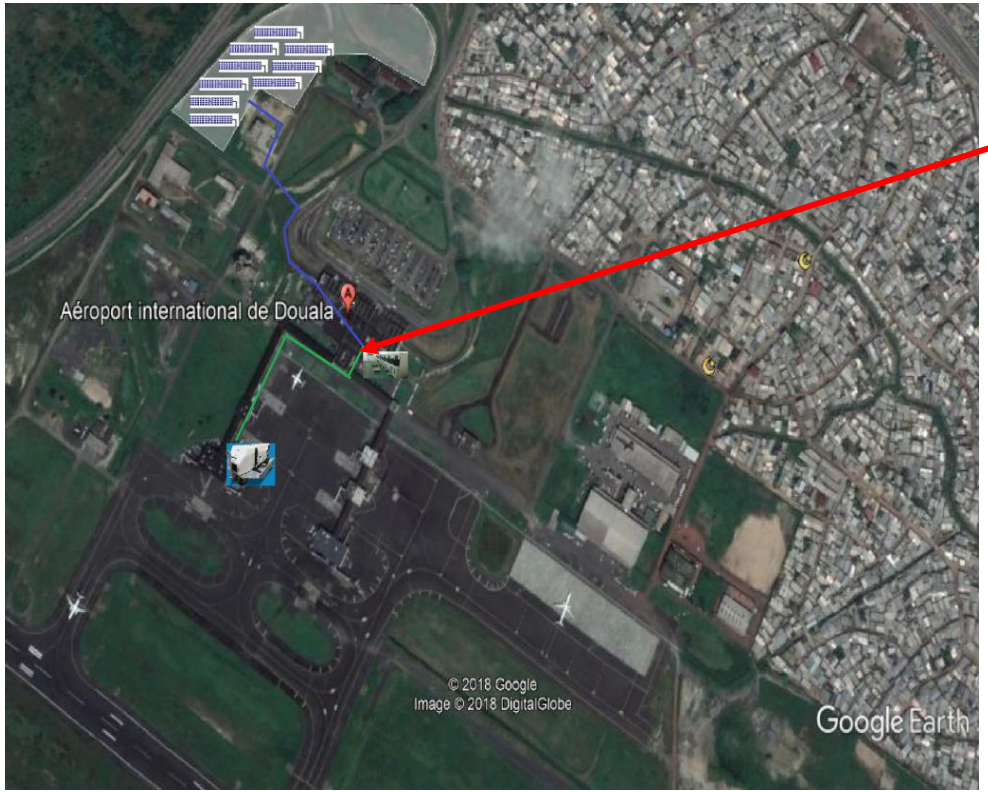
GPU: Guinault SA 180

- 50/60Hz: 400V – 3 phases – 250A
- 400 Hz 115/200V: power rating 180kW

ACU: Guinault CF 30

- Nominal air flow rate: 3.0 kg/s
- Cold air outlet temperature: -5/+5 °C

SOLAR-AT-GATE IMPLEMENTATION AT DOUALA



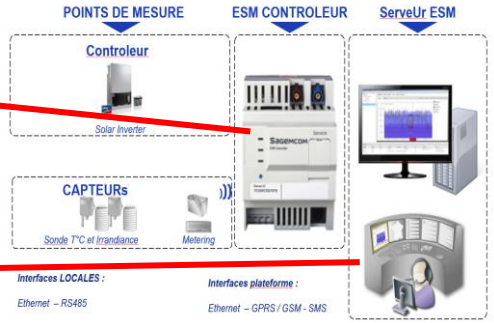
SwitchGear

SCHNEIDER

- 50/60Hz: 400V – 3 phases – 250A
- 400 Hz 115/200V: power rating 180kW

SOLAR-AT-GATE IMPLEMENTATION AT DOUALA

Monitoring and Data Acquisition System

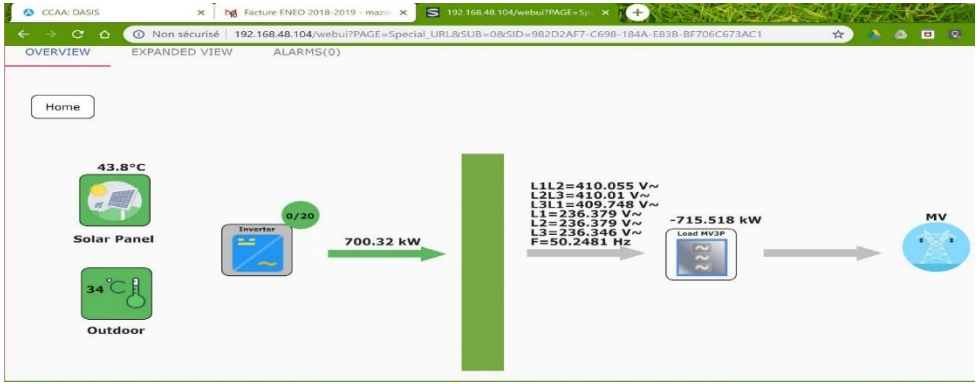


ESM Vision components:

- Sensors everywhere to measure (e.g. on PV modules)
- SMA Controller for solar inverters
- ESM Controller collect data from sensors and SMA controller
- Server at the airport server room

ESM Vision function:

- Measure points
- Alarms
- Report and KPIs



SOLAR-AT-GATE IMPLEMENTATION AT DOUALA

Educational Kiosks

02 Educational Kiosks: Screens with dimensions (2.0x1.5)m, inside pax terminal (1 departure, 1 arrival)

SOLAR-AT-GATE IMPLEMENTATION AT DOUALA

Training

- To ensure durability of the project, training on the solar PV plant and its maintenance was provided to ADC electrical staff

SOLAR-AT-GATE IMPLEMENTATION AT DOUALA

Spare Parts and Maintenance

- The contractor also provided solar PV plant spare parts that are now stored in its warehouse for the 2 next years

- The contractor is required to provide corrective and preventive maintenance of the solar PV plant for 2 years

- An MoU is about to be signed between ADC SA and the contractor to define the outlines the maintenance to be carried out under ICAO contract

PROTOCOLE D'ENTENTE

ENTRE AEROPORTS DU CAMEROUN (ADC) S.A ET SAGEMCOM CAMEROUN SARL PORTANT SUR L'EXPLOITATION ET LA MAINTENANCE DE LA CENTRALE PHOTOVOLTAIQUE DE L'AEROPORT INTERNATIONAL DE DOUALA

PROJECT BENEFITS

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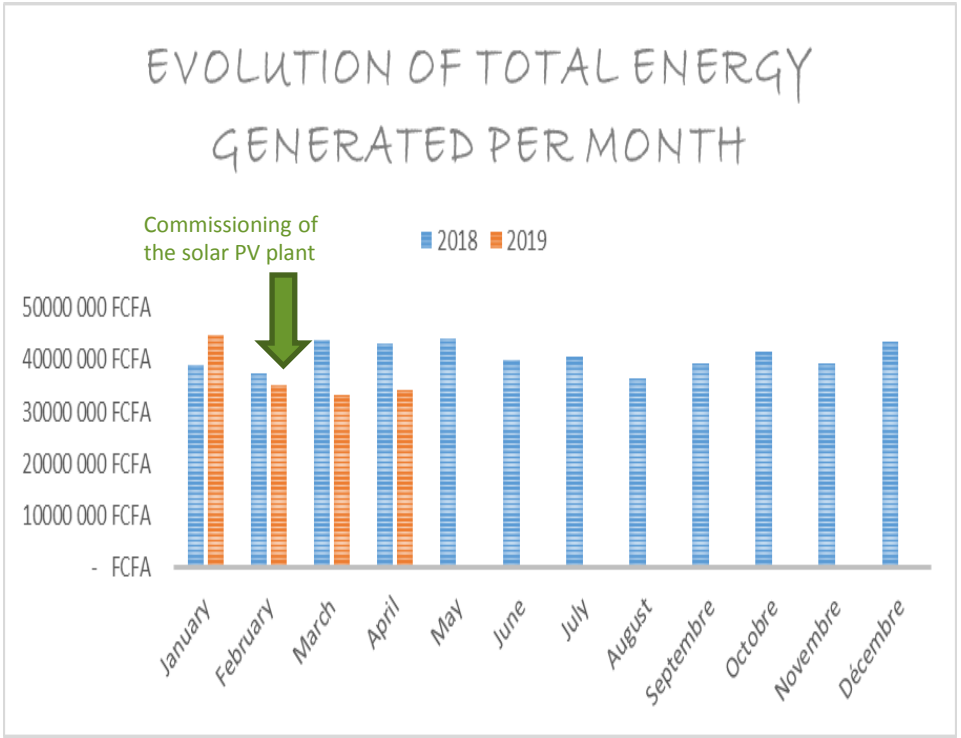

- Since commissioning in February 2019
  - 360MWh generated
  - 25 % of energy demand is now satisfied by solar !!!
  - 250 tons of CO_2 saved (equivalent to planting 2500 trees)
  - 17000 USD per month saved on electricity bill

PROJECT BENEFITS

- Reduction in CO_2 emissions from the solar PV plant of about 1200 tons/year
  - Provide power from renewable energy
  - By the end of the year, the solar-at-gate project will save globally around 1200 tons.
- Reduction in CO_2 emissions from international civil aviation
  - Eliminate aviation fuel burn at gate
  - The use of the GPU and PCA will save globally around 2600 tons/year of CO_2, emissions from international civil aviation (assuming 10 flights per day using the GPU), which is globally equivalent to planting 26000 trees, thus showing the contribution of ADC SA to reduce environmental degradation.
- Co-benefit: reduces NOx (a greenhouse gas) improving local air quality
- Cost savings:
  - 204 000 USD per year
  - after 7-8 years, the total cost of the projet is covered
- Enhanced network with industry, especially Solar PV system industry
- Enhanced teamwork

ADC SA
SOLAR-AT-GATE PROJECT EVOLUTION

ADC SA SOLAR-AT-GATE PROJECT EVOLUTION

- In short term, expand the solar PV plant from 1.25MWp to 2MWp using the available remaining space on the site
- Procure additionnal electric GPUs and PCAs
  - Reduce as much as possible CO_2 emissions from national and international civil aviation
- In medium term, add a Battery Storage System to the Solar PV System
  - As an alternative to fuel generators
    - No CO_2 emissions
    - Significant cost saving (TCO less then fuel generators)
    - Geater independance from rising fuel or energy prices
  - To be able to power critical parts of the airport with clean energy at night (serves as a UPS)
  - To be totaly independant from the utility grid (ENEO): in case of a power outage from utlity grid, batteries provide backup power to tighten the output of the PV system and ensure a continuous power supply
- Replicate Solar-at-gate projects to other international airports: Yaoundé-Nsimalen and Garoua starting in 2020

SPECIAL THANKS

- European Union for having funded the Project
- ICAO Council
- ICAO Environment Team for very strong commitment, availability and full support to meet the project obje
  - Mrs. Jane **HUPE**,
  - M. Eduardo **CALDERA-PETIT**
  - M. Didier **MOUKALAN**
  - Mrs. Christelle **BRAUN**
  - Mrs. Christelle **DAMAR**
  - Others in Backoffice

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THANK YOU