Centre National pour la Recherche Scientifique et Technique (CNRST) – Maroc

Université de Nouakchott
Faculté des Sciences et Technologies – Mauritanie

Sahara Wind Energy Development Company

NATO 'Science for Peace'

SfP-982620

Sahara Trade Winds to Hydrogen: Applied Research for Sustainable Energy Systems

Driss Zejli - (Morocco)
Sidi Mohamed Ould Mustapha – (Mauritania)
Khalid Benhamou - PPD (Morocco)

NATO OTAN

This project is supported by: The NATO Science for Peace and Security Programme

Saharawind

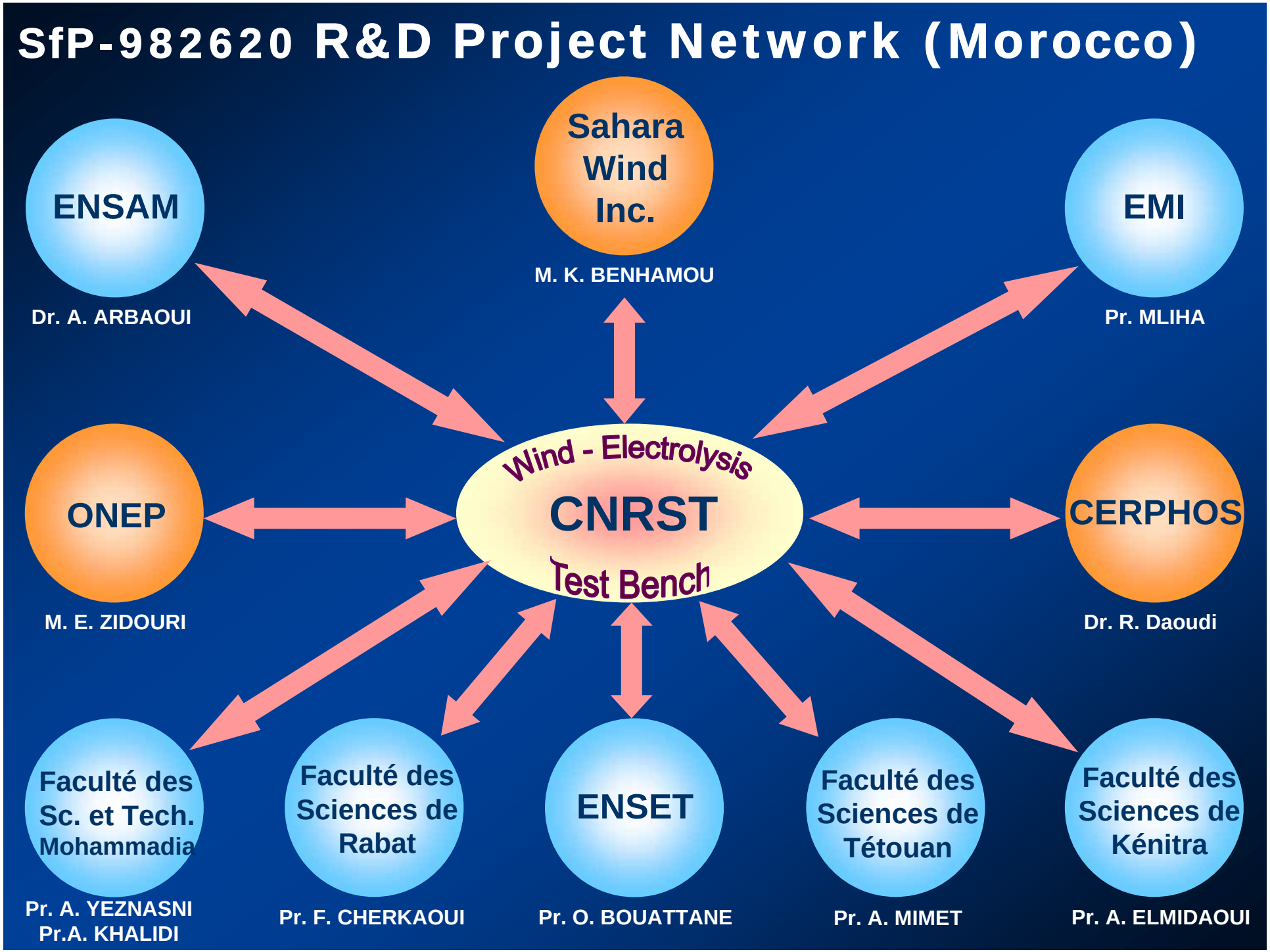
How will the science/research teams in Morocco and Mauritania work?

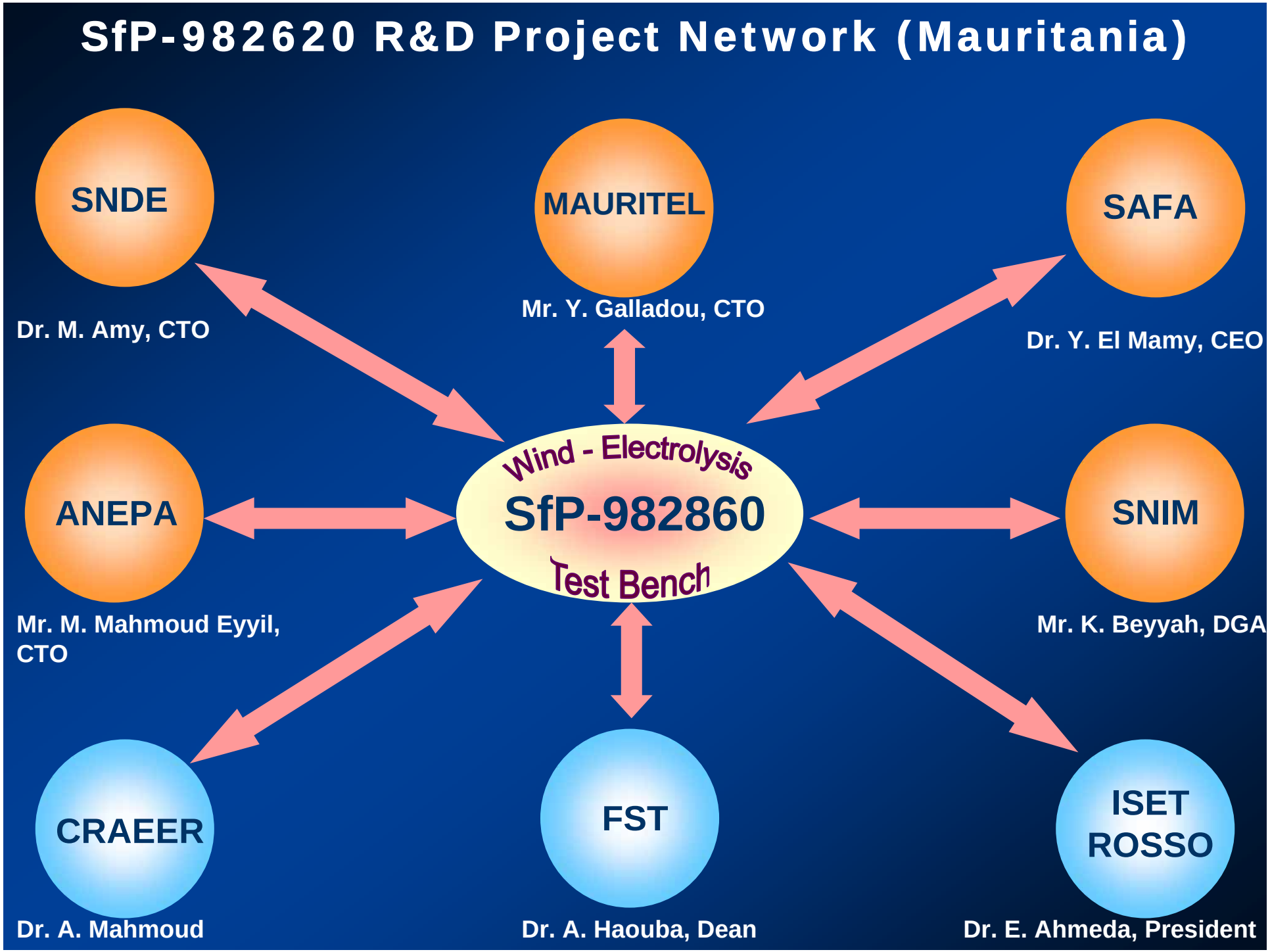
- **Students Exchange / Expertise with institutions in Morocco and Mauritania**
- **Joint selection of research topics, teams with joint publication of findings**
- **Morocco & Mauritania End User collaboration OCP/ONEP/MAROC TELECOM with SNIM/SNDE/MAURITEL through academia/SfP-982620 project.**
- **Academia & End User Cross fertilization experiences and Joint Co-development work on Electrolyzer prototypes, Hydrogen, Oxygen, and other electrolysis by-products storage, handling, integration/utilizations.**
- **By research themes:**
  - *Morocco more focused on synergies industrial/chemical integration*
  - *Mauritania more focused on energy access, remote decentralized applications*
  - *Cross fertilization and synergies between group's competence*
- **By leveraging resources, research frameworks/programs and facilities**
- **Coordination with NATO SfP-982620 Co-Directors**

جامعة انواكشوط
UNIVERSITE DE NOUAKCHOTT

NATO OTAN

This project is supported by: The NATO Science for Peace and Security Programme


SfP-982620 R&D Project Network (Morocco)
Sahara Wind Inc.
M. K. BENHAMOU
ENSAM
Dr. A. ARBAOUI
EMI
Pr. MLIHA
Wind - Electrolysis
CNRST
Test Bench
ONEP
M. E. ZIDOURI
CERPHOS
Dr. R. Daoudi
Faculté des Sc. et Tech. Mohammadia
Pr. A. YEZNASNI
Pr.A. KHALIDI
Faculté des Sciences de Rabat
Pr. F. CHERKAOUI
ENSET
Pr. O. BOUATTANE
Faculté des Sciences de Tétouan
Pr. A. MIMET
Faculté des Sciences de Kénitra
Pr. A. ELMIDAOUI


SfP-982620 R&D Project Network (Mauritania)
SNDE
Dr. M. Amy, CTO
MAURITEL
Mr. Y. Galladou, CTO
SAFA
Dr. Y. El Mamy, CEO
ANEPA
Mr. M. Mahmoud Eyyil, CTO
Wind - Electrolysis
SfP-982860
Test Bench
SNIM
Mr. K. Beyyah, DGA
CRAEER
Dr. A. Mahmoud
FST
Dr. A. Haouba, Dean
ISET ROSSO
Dr. E. Ahmeda, President

Equipment Selection Issues

Electrolyzer technologies:

- **Atmospheric Electrolyzer**

H_2 & O_2 outputs needs pressurization (high costs, low overall energy efficiency)

- **Alkaline Electrolyzer**

Low costs, lower purity of H_2 & O_2, low pressure outputs (unless large ones)

- **Aqueous Alkali (Membrane) Electrolyzer**

Produces H2, Chlorine and Caustic, pressurized output (hard to downscale)

- **PEM (Membrane) Electrolyzer**

Produces H_2 & O_2 High purity, pressurized output
Drawbacks: Very High costs, no by-products handling, 'black box' concept

Co-development framework with equipment manufacturer sought to access prototypes/ technology under IPR transfer agreement.

جامعة انواكشوط
UNIVERSITE DE NOUAKCHOTT

NATO OTAN
This project is supported by: The NATO Science for Peace and Security Programme

Storage Technical Issues

Storage H_2 & O_2 :

- High pressure: H_2 & O_2 needs boosting (high equipment costs + energy)
- Low pressure: H_2 & O_2 storage needs large container volumes
- New Prototypes have median pressure of 30 bars (ideal for streamlined processes)

Filtration H_2 & O_2 (Safe Storage & Fuel Cell):

- Membrane processes (integrated to research team)
- Other processes

جامعة انواكشوط
UNIVERSITE DE NOUAKCHOTT

NATO OTAN
This project is supported by: The NATO Science for Peace and Security Programme

Saharawind

NATO SfP-982620 PROJECT REPORTING

Reporting on scientific progress and on administrative and financial matters of the Project is required by the SfP Programme Office twice per year in the form of a Progress Report.

Further payments through NATO funds will depend on the timely submission of a satisfactory report. Such six-monthly Progress Reports give the Project Co-Directors also the opportunity to evaluate the status of his/her contribution to the Project and to evaluate progress of the Project as a whole.

Reports are also essential for effective communication with all groups and individuals who have an interest in the Project.
After the Project has been completed, the Project Co-Directors will prepare a detailed Final Report on the accomplishments.

جامعة انواكشوط
UNIVERSITE DE NOUAKCHOTT

NATO OTAN
This project is supported by: The NATO Science for Peace and Security Programme

Sahara wind

NATO SfP-982620 PROJECT REPORTING

Progress Report received by the SfP Programme Office no later than 20 October and 20 April.

These dates coincide with NATO's allocation of funds for the next semester.

A Progress Report is made up of five chapters:

a) Technical Progress;
b) Financial Status;
c) Equipment Inventory;
d) Criteria for Success Table;
e) Summary Report.

The preparation of a complete Progress Report requires careful logistical planning. It is assumed that each Project Co-Director will prepare sufficiently in time his/her contribution to each of the above mentioned chapters.

It will be the responsibility of the PPD and the NPD to merge these contributions and send a complete and coherent Progress Report to the SfP Programme Office by the due date.

UNIVERSITE DE NOUAKCHOTT

NATO SfP-982620 PROJECT REPORTING

The six-monthly Progress Report is both a management report and a technical report. It is not a detailed elaboration of the technical and scientific findings. The report should thus focus on actual tasks and activities that have been carried out, rather than on scientific details.

The Progress Report should be written so that it can be read as a free-standing self-explanatory documents, and should not contain references to previous reports unless a summary of the subject, to which reference was made, is given.

جامعة انواكشوط
UNIVERSITE DE NOUAKCHOTT

NATO OTAN

This project is supported by: The NATO Science for Peace and Security Programme