Industrial Consortium to Foster Applied Research and Technological Development in Mexico
1. Monterrey is a large industrial city, near the U.S. border, with two large and prestigious universities, UANL and Tecnológico de Monterrey.

2. Companies have to compete with the U.S. to retain talents in Mexico.
3. Companies need to strongly compete to have a position in the global market (China and India).

4. The opportunity of creating new products that incorporate innovation and technology, helps the roots/foundations of the companies to grow in Mexico.

5. The technical engineers in the industrial plants have limited time and non-updated knowledge, to think and analyze innovative solutions.
Why the Consortium?

- After several months visiting the companies related to the energy sector, the idea of creating a consortium that links them with universities was reinforced, to create a working environment which attracts highly qualified students who wish to engage in solving challenging industrial problems with innovating ideas, and seriously consider joining the sponsoring companies after concluding their studies.

- Some of the details of the negotiation between the university and the sponsor companies included:
  - Linking with the company
  - Intellectual property
  - Student workload
  - Scholarships for students
  - Health insurance
  - Expenses for conducting experimental thesis
  - Travels to international conferences, etc.
Consortium Knowledge Areas

- **Power electronics**: static converters for reactive power and flicker control in electric arc furnaces for steel industry, electronic control for electric motors and flexible systems of power transmission.

- **Design of electrical equipment**: electromagnetic fields studies, electric arcs, dynamic mechanical components for electric switches, simulation of phenomena related to the operation of electrical switches.

- **Heat transfer**: Design of boilers and heat exchangers, design of transformers cooling systems. Heat sinks for use in power electronic systems.

- **Optimal dispatch of energy**: in interconnected power systems powered with thermal generation and renewables like solar and wind.

- **Modeling and simulation of industrial processes**: focusing the electric arc furnace by optimizing the use of energy and control systems.

- **Combustion systems**: applied in furnaces and boilers.
The Company

- Are forced to develop technologies that can compete globally.

- Cannot keep all its engineers updated with technological advances.

- Usually do not have computer platforms, advanced design tools and/or qualified personnel to use them.

- Finds it hard to attract design engineers to join their staff.

- Finds it very convenient to be linked with universities.
1. Graduate programs attract highly qualified candidates, seeking to acquire advanced knowledge.

2. The university can focus these candidates to implement and design new products, which promote economic growth for the businesses.

3. Teachers and students are encouraged to think about industrial problems, and networks are established to exploit the synergy between theoretical knowledge and industrial experience.
The Students

1. Use their scholarships to devote exclusively their time to study and develop new solutions and products.

2. Have the certainty that their work contributes to the economic development of the country.

3. Secure work as "Design Engineer" after graduation (or earlier).

4. Pursue their studies in an environment that recreates the conditions of work of a Design Center, under the supervision of engineers from companies and faculty.
Main Differences with Traditional Graduate Studies

- Thanks to the scholarship, students are dedicated exclusively to study, research and technology development.

- The courses, and its contents, are aimed to the needs of the companies and a few of them are taught with the assistance of experienced professionals in team teaching with the professors of the university.

- There is permanent monitoring of student progress, performed by the school and the sponsoring company.

- Every week students participate in seminars where they present the progress of their research work. Additionally, they are trained to improve their communication skills.
Main Differences with Traditional Graduate Studies

- The students regularly prepares a presentation and speaks, in the above mentioned seminars, to develop communication skills and teamwork with peers from other disciplines.

- The student has funds to attend international conferences, specialized courses in the use of any software, etc. when it is justified to the progress of their thesis, and in that way establish ties with world leaders in the specialty that they are working on.

- Visits to the labs and design centers of companies in the consortium during the summer period.
Key points

- Full tuition scholarship (6500 USD/semester), and paid living expenses (850 USD/month).
- Defined career plan immediately after admission to the program.
- Opportunity to connect with the best specialists in their area by attending international conferences.
- Certainty that with their dedication they contribute to the competitive development of the country.
- The challenge of joining a group of excellence and becoming a competent engineer to design equipment for international markets, in 18/24 months.
Some Projects

Power Control Optimization of AC Electric Arc Furnaces
Fernando Martell
Some Projects

Heat Transfer Simulation of Windings in Power Transformers for Estimation of Hot Spots
Oscar Ruiz Martínez
Some Projects

Compliant Mechanisms in Miniature Circuit Breakers
Juan Ignacio Melecio Ramírez
Some Projects

Process Simulation in Electric Arc Furnaces
Eder Trejo
Proposal of an Electric Arc Furnace Coverage Index by means of Harmonic Analysis and Sequential Components
Alejandro Deschamps
Admission Requirements

- Being a top performing student from a career related to the focus areas of the program.

- Having sound knowledge in basic science such as physics, mathematics and computing, and in their area of expertise (mechanical, electrical, chemical, etc.).

- Write an essay defining their areas of interest and attaching their professional background.

- Pass Tecnológico de Monterrey’s admission exam (PAEP) with a score to qualify for excellence scholarships.

- Being selected for any of the participating companies.
Admission Requirements

- Advanced English proficiency for reading books and scientific papers written in that language.

- Have excellent communication skills both oral and written in English and Spanish.

- Have industrial vocation to work in the area of equipment and systems design.

- Adhere to the rules of the consortium, especially with regard to intellectual property rights, and be determined to work hard to complete the master's thesis and in 18/24 months.

- Respect all the agreements that each student agrees upon with the member of the consortium that sponsors the studies.
First Cohort
(Graduated on December 2009)

- 5 companies participated: Schneider Electric (3 students), Ternium (2 students), AMI-GE (2 students), Cerrey (2 students), Prolec-GE (2 students).
- The first generation of 11 students successfully completed their program.
- After 30 months of finishing their masters, the first graduates have enjoyed a strong growth in the businesses. Participating companies are still in the consortium and are our best allies to spread the benefits of the program.
A total of 7 companies were involved. The 5 founding companies and 2 more that later joined them: Nutec Bickley and the Instituto Costarricense de Electricidad.

To deepen research activities at the Ph.D. level the Energy Research Chair Roberto Rocca was founded, under the sponsorship of Ternium and Tenaris-Tamsa.
Established Networks

This Consortium brought together recognized specialists from other research institutes:

- Dr. Robert Lorenz, University of Wisconsin, founder of WEMPEC.
- Dr. Klaus Krüger, Hamburg, Germany.
- Dr. Lidong Teng, KTH, Stocolm.
- Dr. Marco Ramirez, UNAM, Mexico
- Dr. Manuel Castro, CINVESTAV, Saltillo, Mexico.
- Dr. Gordon Iron, McGill, Canada.
In the consortium the companies and the university contribute with their best assets:

- The industrial experience of plant engineers.
- The eagerness to acquire knowledge is found in the best students enrolled in program, and their availability of time to think about innovative solutions to industrial problems.
- State of the art knowledge of teachers and company mentors.
- University and sponsor company laboratories.
Proposes a merging force, between the companies and the university, for the promotion of added value activities:

- New products
- Patents
- Energy savings
- Active industrial presence in the learning process.

This ensures the sustainability of the program.
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Thank you!

http://www.mty.itesm.mx/dia/consorcio/

[Logos of various companies]