266632 Bi-National Laboratory on Smart Sustainable Energy Management and Technology Training

“Open Innovation: Energy Sustainability training through MOOCs Subproject”

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May 2019
“Open Innovation.
Outstanding innovation that brings a new approach to open education. Ideas or solutions that present innovative applications of OER to create new opportunities or address existing challenges in open education.”
Open Innovation: Energy Sustainability training through MOOCs Subproject

In the project we worked with new approaches to open education, integrating training solutions and applying OER through 12 MOOCs with innovative strategies, where we created new entrepreneurship opportunities to face the challenge of energy sustainability.

We linked the open innovation of the quad helix:
- Industry: Federal Electricity Commission,
- Government: National Council of Science and Technology and Secretary of Energy of Mexico,
- Academy: Mexican institutions: Tecnologico de Monterrey, Tecnologico Nacional de Mexico, National Institute of Electricity and Clean Energies and international institutions: Arizona State University, and University of California at Berkeley, as well as networks: research groups of strategic change approach Climate Change and Educational Innovation Research, Openergy Network and UNESCO Chairs / ICDE Open Educational Movement for Latin America, and
- Civil Society: more than 200,000 participants from more than 50 countries.
Global Project

The Bi-National Laboratory on Smart Sustainable Energy Management and Technology Training is an initiative of the Ministry of Energy, the National Council of Science and Technology and the Tecnologico de Monterrey in collaboration with various institutions of higher education, public and private, national and international, which consists of a generation of technology and knowledge platform around energy with which we seek to place Mexico at the height of the most advanced countries in the sector by benefiting it in training, research and infrastructure.

https://energialab.tec.mx/
MOOC’s Project goal

To support the formation of human resources specialized in energy sustainability, and to develop human talent with the necessary capabilities to respond to the technological conditions prevailing in the energy value chain (Power sector), through graduate programs, massive open online courses that will be available nationwide, and will be validated through competencies certification processes.
Project Products

12 MOOC’s on Energy sustainability:
1. Energy: past, present and future
2. Clean, conventional energy and their technology
3. Mexico’s energy reform and its opportunities
4. Energy markets: business opportunities
5. Carbon markets: a way to mitigate climate change
6. Mexico’s new electric power industry
7. Introduction to electric energy
8. Energy saving
9. Electric power transmission
10. Distribution of electric power
11. Smart grid: electricity networks of the future
12. Smart grid: technical foundations
# MOOCs Team

<table>
<thead>
<tr>
<th>Energy Sustainability experts</th>
<th>Educational Innovation experts</th>
<th>Teaching and eLearning experts</th>
</tr>
</thead>
</table>
| ● Research Group on Energy and Climate Change  
● School of Engineering and Sciences  
● Business School  
● Expert Guests | ● School of Humanities and Education  
● Graduate Education students | ● eLearning team  
● Teaching team |

| 23 | 14 | 22 |
Suggested sequence for taking the courses

1. Energy: past, present and future
2. Mexico’s energy reform and its opportunities
3. Clean, conventional energies and their technology
4. Energy markets: business opportunities
   - Carbon markets
5. Mexico’s new electricity industry
6. Introduction to electric energy
   - Energy saving
   - Transmission
   - Distribution
7. Smart Grid
Learners’ profile

+ 17 years old

Minimum High school studies

Wants to learn about energy sustainability

Chooses xMOOC as a training program to achieve learning goals

CFE or industry related employees

Colaboran:
Instructional Model

http://hdl.handle.net/11285/632891
Learning path in a MOOC

Página descriptiva

Mensaje de bienvenida
Encuesta de inicio
Forma de trabajo
Autodiagnóstico inicial
Temas del 1 al 5
Examen final
Autodiagnóstico Final
Conclusión

Colaboran:
Incorporation of Educational Innovation

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Gamification

Remote Lab

Augmented and Virtual Reality resources

Biometrics

Colaboran:

- SENER
- SEP
- CONACYT
- FONDO DE SUSTENTABILIDAD ENERGÉTICA
- ASU
- Berkeley
Incorporation of Educational Innovation

Gamification

- In-house development where a question is presented to learners about the content they have studied.
- Badges are assigned to learners that solve the question based on how many opportunities and how long it took them to finish the exercise.

<table>
<thead>
<tr>
<th>Usuario</th>
<th>Tiempo en contestar</th>
<th>Número de intento</th>
<th>Insignia</th>
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<td>Usuario_3</td>
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<td>3</td>
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</table>
Incorporation of Educational Innovation

**Virtual reality**

- The use of these resources allows learners to interact with concepts and promotes active learning.
- The resources are selected on how they best support the learning experience.

https://sketchfab.com/itesm_mooc
Incorporation of Educational Innovation

Augmented reality

• The use of these resources allows learners to interact with concepts and promotes active learning.
• The resources are selected on how they best support the learning experience.

https://sketchfab.com/itesm_mooc
Incorporation of Educational Innovation

Remote lab

• Learners access the remote lab based at Tecnologico de Monterrey and complete several exercises to practice the concepts they have reviewed in the MOOC.

• There is a limited number or seats, so students have to make a reservation beforehand.
Incorporation of Educational Innovation

Biometrics

• MOOCs were delivered on MexicoX Platform, which is provided by the Mexican government.
• The platform didn’t offer the use of biometrics, so this functionality was tested using an external provider and an in-house development.
MOOC Enrollment

MOOC’s were offered on MéxicoX platform (2017-18) and edX (2018-2019)

<table>
<thead>
<tr>
<th>MOOC</th>
<th>Enrolled</th>
<th>Certificates</th>
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<tbody>
<tr>
<td>Energy saving</td>
<td>14,004</td>
<td>2,001</td>
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<tr>
<td>Distribution of electric power</td>
<td>8,262</td>
<td>946</td>
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<tr>
<td>Introduction to electric energy</td>
<td>17,889</td>
<td>1,776</td>
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<tr>
<td>Energy: past, present and future</td>
<td>13,847</td>
<td>2,047</td>
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<tr>
<td>Clean, conventional energy and their technology</td>
<td>20,238</td>
<td>2,721</td>
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<tr>
<td>Mexico’s new electric power industry</td>
<td>9,304</td>
<td>1,196</td>
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<td>Mexico’s energy reform and its opportunities</td>
<td>13,203</td>
<td>1,914</td>
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<td>Carbon Markets: a way to mitigate climate change</td>
<td>9,213</td>
<td>1,187</td>
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<td>Energy Markets: business opportunities</td>
<td>14,376</td>
<td>1,318</td>
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<td>Smart grid: technical foundations</td>
<td>6,729</td>
<td>720</td>
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<td>Smart grid: electric networks of the future</td>
<td>9,217</td>
<td>812</td>
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<tr>
<td>Electric power transmission</td>
<td>7,132</td>
<td>1,088</td>
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<td><strong>Total</strong></td>
<td><strong>143,414</strong></td>
<td><strong>17,726</strong></td>
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I would like to thank Dr. Luis Sierra, the teaching staff, MéxicoX platform, and Tecnologico de Monterrey for the present course, certainly is a valuable tool for understanding and learning how to apply the energy reform. Excellent course! Thank you.

I want to congratulate Dr. Luis Alberto Serra Barragán and each and every one of the collaborators by the brilliant integration of content, methodology, and presentation of this course, as well as the Tecnológico de Monterrey for his participation in this educational platform. Congratulations.

I have taken many MOOC across platforms…and few courses I have completed among them this course. When I compare it I find that this course has high quality content, resources are well made and the proposed activities are not only quizzes but more motivating such as networking and the gamification challenge, which help me to apply my knowledge and share it with others.

Learners’ experience

MOOC Energy: past, present and future

MOOC The Mexican Energy Reform and its opportunities
## Incorporation of OER

<table>
<thead>
<tr>
<th>MOOC</th>
<th>OER Anthology</th>
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<td>Distribution of electric power</td>
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Publication of MOOC resources as OER on open repository RITEC

https://tinyurl.com/repositorio-itesm-mx
Energía: Pasado, presente y futuro

23 videos • 1,488 vistas • Se actualizó por última vez el 26 Jun. 2017

A través de un recorrido histórico, los videos explican la manera en la cual ha evolucionado la obtención de energía, y permite entender la relación entre la disponibilidad del recurso energético y su aprovechamiento.

http://mx.mexicox.gob.mx/courses/cour...
Open Innovation project

Results

- Initiative
  - Goals
  - Ideas
  - People
  - Research centers

- New approach to Open Innovation
  - Development of entrepreneurial talent
  - Contributions to the knowledge of open educational innovation

- Selection
  - New opportunities to open education
    - Educational innovations for environments with open technologies
    - Services and strategies for open innovation,

- Selection
  - Transference knowledge
    - Government
    - Companies
    - Institutions
    - NGOs
    - Civil Society.

- Training models with technologies
- New services for open innovation,
- New instruments for measuring open innovations
- Training services: workshops, diplomas, certificates and consultancies.

Colaboran:
Thanks!

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