Impact of Collaboration with World-Class Universities: The KFUPM Story

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Outline

- KFUPM Philosophy
- Levels of Collaboration
- Map and Timeline
- Requirements for success
- KFUPM Model
- Overall Impact
- Challenges
VISION
To be a preeminent institution known for its globally competitive graduates, cutting edge research, and leadership in energy fields.

MISSION
To make a difference within the kingdom of Saudi Arabia and beyond in the fields of sciences, engineering and business; we are committed to graduating leaders who are knowledgeable, skillful, and productive members of society creating new knowledge that makes a scholarly impact, provides innovative solutions, and contributes to the national economy engaging our society, alumni, and partners in valuable endeavors.

KFUPM AT A GLANCE  As of September 2016

THE ACADEMIC SECTOR

- 8824 Students are enrolled at the University
- 15:1 Students to faculty ratio
- 1.6 Ratio of undergraduate students to graduate students
- 1,484 Graduates
- 30,658 Total number of alumni since inception of the University
- 1,230 Faculty
- 648 Professorial-rank faculty
- 581 Teaching Staff
- 33 Bachelor's degree programs
- 37 Master's degree programs
- 13 Ph.D. programs
- 8 Academic Colleges
- 27 Academic Departments
- 650 Scheduled courses offered in a semester
- 2,500 Sections offered in a semester
- 95% Courses with material on (Blackboard)
- 132 Companies participated in the annual Career Day event
- 8 Centers of research excellence
- 716 Research papers published in ISI Journals
- 321 Patents registered for the University
- 758 Patents filed
- 16 Companies have signed a partnership to build their research labs in Dhahran Techno Valley
- 269 Total externally funded research projects

ADMINISTRATIVE SECTOR

- 1900 Employees
- 380 Smart Classrooms
- 20 Educational laboratories
- 2.0 Billions S.R. construction projects
- 1.38 Billions S.R. annual budget
- 1.68 Billions S.R. Endowment Value
- 3 Billions S.R. expected endowment fund

LIBRARY HOLDINGS

- 212,746 Titles held
- 264,487 Volumes held

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KFUPM Philosophy

- Aligning with
  - The National AAFAQ Plan
  - Plans of other governmental agencies
  - Strategic Goals of the Institution
- Selective and Patient
- Clear Articulation of the Need
- Clear Value Proposition for all Parties
- Clear ownership within KFUPM
- Strategic and Focused
- Peer-to-Peer and Bottom-up
- Engagement of Multiple Departments/Centers
Type of Collaboration

- Both:
  - Bilateral Collaboration: KFUPM + International University or Research Center
  - Trilateral Collaboration: KFUPM + Industry + International University or Research Center
Collaboration Map

It goes from East to west: different mentalities and cultures require different approaches
Institutional Collaboration Timeline

- **2007**: Sept 2007
- **2008**: Aug 2008
- **2009**:
- **2010**: Sept 2010
- **2011**:
  - Jan. 2011
  - Apr. 2011
  - Mar. 2011
- **2012**:
- **2013**:
  - Aug 2013
  - Sept 2013
- **2014**:
  - Apr. 2014
- **2015**:
  - Apr. 2015
- **2016**:

Institutions:
- MIT
- Universidad Zaragoza
- National University of Singapore
- Stanford University
- Georgia Tech
- Caltech
- University of Cambridge
<table>
<thead>
<tr>
<th>University/Institution</th>
<th>Research Area</th>
<th>Host Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIT</td>
<td>Clean Water and Clean Energy</td>
<td>Mechanical Engg Dept</td>
</tr>
<tr>
<td>Stanford</td>
<td>Oil, Gas and Geosciences</td>
<td>Center for Petroleum &amp; Minerals, ES and PETE</td>
</tr>
<tr>
<td>California Institute of Technology</td>
<td>Catalysis, Polymers, Refining and Petrochemicals</td>
<td>Center for Refining and Petrochemicals</td>
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<tr>
<td>Technical University of Munich</td>
<td>Refining and Petrochemicals</td>
<td>Center for Refining and Petrochemicals</td>
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<tr>
<td>Cambridge University</td>
<td>Refining and Petrochemicals</td>
<td>Center for Refining and Petrochemicals</td>
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<tr>
<td>University of California, Berkeley</td>
<td>Solar Refining</td>
<td>Center for Nanotechnology</td>
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<td>Georgia Tech</td>
<td>Geo-signal Processing</td>
<td>Electrical Engg Dept</td>
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<td>KAUST</td>
<td>Engineering and Sciences</td>
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<tr>
<td>NUS Singapore</td>
<td>Chemistry</td>
<td>Chemistry Dept</td>
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<tr>
<td>University of Zaragoza, Spain</td>
<td>CO2 Reaction and Homogenous Catalysis</td>
<td>Center for Refining and Petrochemicals</td>
</tr>
</tbody>
</table>
Requirements For Success

Due diligence needs to be done before any collaboration agreement is initiated:

- Chemistry between faculty/researchers
- Shared Enthusiasm
- Getting things ready: channel resources, legal, team preparation ... etc
- Reasonable and timely expectations
- Proper Follow up and Feedback
KFUPM Model

Successful Collaboration

Host
Dept./Center
At KFUPM

Host
International
Dept./Center

Other KFUPM
Dept./Center
Management of Collaboration

**Steering Committee**

*Lead and Oversee the Collaboration, Chaired by the Vice Rector for Research*

**Executive Committee**

*Follow up the progress of the joint projects*

**Coordinators**

**Joint Projects**
Impact

- More global visibility
- Capacity building
- Shared Experiences
- Focus & Depth
- New topics
- Establishing trust
- Culture
Some KPIs --- Articles Indexed in ISI

- 1995: 337
- 1996: 327
- 1997: 350
- 1998: 369
- 1999: 346
- 2000: 290
- 2001: 277
- 2002: 337
- 2003: 324
- 2004: 323
- 2005: 298
- 2006: 310
- 2007: 334
- 2008: 341
- 2009: 417
- 2010: 502
- 2011: 600
- 2012: 616
- 2013: 692
- 2014: 713
- 2015: 900
Progression of Patents Filed/Issued

- 2006: 20
- 2007: 8
- 2008: 4
- 2009: 9
- 2010: 14
- 2011: 91
- 2012: 28
- 2013: 172
- 2014: 200+
- 2015: 200+
Intellectual Property and Commercialization

- Companies
  - GRADIANT CORPORATION and GRADIANT ARABIA (CGE™ Hybrid Treatment Plant in Texas)
  - GRoWater

- Technologies
  - Humidification Dehumidification (HDH + Carrier Gas Extraction) Technology
  - Water Treatment Technology
Gradiant Corporation

- Licensee Agreement Completed in 2013
- Revenues started in 2014
- Excellent Progress
- Commercial site productivity expanding, and
- Other projects in development
Technology Development Timeline

- **Concept**
  - MIT Sep '09

- **Lab system**
  - MIT, Dec '11

- **10 bpd ZLD demo**
  - Gradiant, Apr '13

- **50 bpd pilot**
  - Gradiant, Aug '13

- **500 bpd ZLD field unit**
  - Gradiant’s site in Texas, Dec ‘13
Gradiant Corporation

CGE™ hybrid treatment plant in Midland, TX

1Q – 2Q 2014

- 12,000 bpd 100% liquid recycling facility
- Fresh water, “clean brine,” and 10 lb. brine
- Uses site/ pipeline gas as fuel

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Developed a next-generation water purification membrane with the potential to significantly improve performance & decrease costs

Current Status

- Nanofiltration demonstrated in centimeter-sized graphene membrane with sub-nanometer pores
- Seeking Funds to establish laboratory
- Likely to be located in Boston
- Discussion with DTV on investment, support and transition of technology into KSA

IP Status

- Patents filed on key aspects of graphene membrane technology including:
  - Design of graphene membranes with appropriate choice of support substrates
  - Methods to generate sub-nanometer pores in graphene
  - Methods to plug leakages, enabling use of graphene with currently available quality
- IP jointly owned by KFUPM & MIT
Objective: Joint collaboration with Japanese partners (JX Nippon) and Saudi Aramco to develop a chemical-oriented refining process (HS-FCC) for converting heavy oil to value-added products.

Initiated pilot plant testing at University.

3,000 barrel per day HS-FCC in Mizushima Refinery, Japan

Comparison between conventional and new process (HS-FCC)
Development of Refining Process

Collaboration Stages for Technology Development:
From KFUPM Laboratory to Refinery in South Korea

Technology Owners:
KFUPM; Saudi Aramco; JX Nippon

Technology Licensors:
Axens, Technip

Successful scale-up

1996 - 2001
0.1 BPSD
Pilot at KFUPM
Saudi Arabia

2001 - 2004
30 BPSD
Demonstration plant
in Ras Tanura, KSA

2011 - 2013
3,000 BPSD
Semi-commercial Plant
in Mizushima, Japan

Commercial Unit
77,000 BPSD
S-Oil Onsan, S. Korea
Thank You