

ENGINEERING MEETS THE HUMANITIES

Creating a New
Interdisciplinary University



MINERVA®

Over the last decade, South Korea imported around 93% of its energy needs, mostly in the form of fossil fuels. Like most developed economies, it needs to meet environmental objectives, which necessitates a transition to cleaner sources of energy.

The country developed a five-year strategic energy plan that addressed policy, technology, and capacity building, and included the creation of a higher education institution focused on energy management. The plan, which specifically created the Korea Institute of Energy Technology (KENTECH), was approved by parliament in 2020. It is jointly funded by the state-owned utility company, Korea Electric Power

Corporation (KEPCO), as well as the local city of Naju and the South Jeolla Province.

The vision for KENTECH was to create a selective university focused on energy engineering, energy technology, and energy markets, and which was differentiated from all existing research-focused science and technology institutes. The new university would nurture the leaders needed for the future that South Korea envisions, equipping them with the skills required to solve environmental and political challenges.

“Our vision was to educate energy leaders with a global citizenship mindset to improve the world,” said Dr. Kyung Kim, Director of the Center for Education Innovation (CEI) at KENTECH. “We wanted to empower our students to understand the real global issues they would face and to become active promoters of more sustainable societies. This is why field-initiated, problem-based, and student-centered learning was at the core of what we were trying to achieve.”

Dr. Kim, who holds a Ph.D. in Learning Science from Pennsylvania State University, had heard about Minerva Project and its learning methodology from his days in the United States, and immediately contacted its leadership. His early discussions with Minerva revolved around a shared vision for the future of higher education, the talent gaps, and the skills-building required to fill those gaps.



Architectural rendering of the full KENTECH campus.

In parallel, KENTECH President Euijoon Yoon, had received a report on new educational models written by global consultancy A.T. Kearney, which featured Minerva University as one of its case studies. He was intrigued by the interdisciplinary curriculum and the project-based models showcased, so when Dr. Kim recommended collaboration with Minerva, President Yoon agreed without hesitation.

In President Yoon's view, energy is a multidisciplinary field that includes artificial intelligence, material science, and engineering; however, for the new generation to lead and execute on the national energy transition plan, they have to be well-versed in social sciences, such as sociology,

economics, and politics. For President Yoon, Minerva's curriculum and learner-centered approach could deliver on KENTECH's vision. "If you focus on professors, you create departments," he said. "If you focus on students, you create interdisciplinary programs."

KENTECH agreed that Minerva would help design the undergraduate curriculum and implement its Fully Active Learning™ pedagogy. The Minerva-designed courses would be delivered virtually on Minerva's digital platform, Forum™. A partnership agreement between the two institutions was signed in August 2021, with an ambitious timeline, whereby classes would start seven months later, in March 2022.

"If you focus on professors, you create departments; If you focus on students, **you create interdisciplinary programs.**"



Ben Nelson (left), Minerva Project Founder & Chief Executive, with KENTECH President, Dr. Euijoon Yoon (right).

Designing a Humanities Program Within a Science Institution

KENTECH's leadership knew what they wanted the curriculum to look like. Before specializing in energy disciplines, KENTECH students were to have a strong foundation in mathematics, sciences, and the humanities. Their objective was to graduate students who could pursue diverse career paths as energy researchers, entrepreneurs, or public policymakers. Dr. Peter Jang, Assistant Professor of Energy Market Economics and Director of the International Office

said, "We were focused on what students should learn, not what professors could teach and, more importantly, what they can apply in the real world."

The program offers five tracks: Hydrogen Energy, Environment and Climate Energy, New Material Sources, Grid Modernization, and Energy and Artificial Intelligence. These tracks are supported by three underlying pillars:

A.

A strong foundation in math, physics, and chemistry, as well as full proficiency in English. The emphasis on English is true to the vision of the institution, which wants its graduates to have a global footprint.

B.

A humanities, arts, and social sciences curriculum, with the first two years designed by Minerva. The focus on humanities and social sciences is a departure from traditional Korean scientific universities.

C.

A residential college where the students live together, and staff and faculty participate in academic and community activities. It was important to build a community including all stakeholders and not to have students think of themselves as a separate group.

Minerva was tasked with designing, developing, and delivering the second pillar, with four of Minerva's general education courses to be taught to all incoming first- and second-year students: Strategic Learning and Leadership; Applied Creative and Critical Thinking; Systems and Society; and Interpretation, Communication, and Design. "It is important that students are well-rounded if they are to pursue careers in public policy. Engineers need to have a good understanding of politics and economics, because energy policy depends on that," said Dr. Sook-Kyoung Cho, Associate Professor of History of Science. The courses are designed to impart foundational

concepts that can transfer across disciplines. In other words, the learning outcomes in one course can be repeated in another, to ensure that students are able to apply concepts in new contexts.

One of the consequences of this approach was demonstrated in the faculty recruitment process. "The interdisciplinary curriculum meant that we could deliver the educational objectives without inflating the number of professors," said President Yoon. "We did not need an expert in each of the social sciences, but rather professors who could embrace this philosophy and teach across disciplines."

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Training Faculty in a New Way of Teaching

The Fully Active Learning pedagogy for which Minerva is known was a crucial element in setting up the Humanities, Arts, and Social Sciences part of the curriculum. This was a radical departure from the lecturing that KENTECH faculty were used to. It entailed changing their roles from information provider to discussion facilitator. It also required that students acquire basic knowledge independently, prior to each class.

To prepare the KENTECH faculty for this new pedagogy, Minerva assigned two of its academic directors to build capacity. Over eight weeks, KENTECH faculty participated in classes that covered Minerva's approach to education, including the science of learning, active learning, and the flipped classroom. KENTECH faculty

also learned how to bring lesson plans to life, while teaching on Minerva's Forum platform, as well as how to assess students' work using rubrics. They then applied everything they learned to actual course delivery, through two practice sessions. Each faculty member took turns teaching Minerva University students in front of their colleagues, who provided feedback on their overall performance.

Following the faculty training, Dr. Philippa Kim, Minerva's Academic Program Manager, held weekly course meetings with KENTECH's academic team. The purpose of these meetings was to discuss lesson plans before the faculty taught them, and to provide feedback on their facilitation abilities. KENTECH faculty would generate questions about the lesson plans prior to the meeting and resolve them during the meeting. They also took turns leading class run-throughs, practicing lesson delivery and facilitation, considering pedagogical techniques, and providing peer-to-peer feedback. These practice sessions were followed by collaborative revision of the lesson plans, where needed.



Workshop with the founding faculty members Dr. Jang, Dr. Yoon, Dr. Cho, and Dr. Park, Spring 2022.

“The collaboration between KENTECH and Minerva faculty was intensive,” said Dr. Philippa Kim. “KENTECH professors have a strong will to succeed, despite the challenges, such as introducing active learning into an education system that relies on lectures and tests.”

KENTECH faculty also held workshops among themselves before the semester began, in order to coordinate course instruction and review lesson plans. Minerva academic leaders made themselves available for one-on-one coaching and advice. “Our faculty invested a great deal of time in learning the Minerva pedagogy and its application through Forum,” said Dr. Jang.

Dr. Chulmin Yoon, a philosophy professor, admitted to struggling with the Minerva pedagogy in the first weeks. “Not slipping into lecturing mode or explaining concepts takes practice,” he said. However, the multiple practice classes with Minerva University students, and the one-on-one coaching and feedback sessions with Minerva’s Dr. Kim, helped him master the new teaching methodology.

The commitment from both KENTECH and Minerva was well spent. “Korean students are more used to listening than speaking. Minerva classes are the only place where they can contribute verbally or in writing to topics that are relevant to them in class,” said Dr. Yoon.

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Recruiting Students Selectively for a Brand New Institution

While the curriculum was being developed, and the faculty being trained, KENTECH started the student recruitment process. However, KENTECH was a new institution with no track record or brand recognition. Minerva University, which was the flagship institution that Minerva Project launched, had been in an identical situation a decade ago. Since then, it has graduated four classes and ranked as the most innovative university in the world. The Minerva Project team shared its expertise on how to position the new institution to attract students. A key pillar for both institutions' positioning was a program distinguished by exceptional quality, selectivity, and unconventional admissions criteria.

KENTECH admissions officers visited almost 300 selective high schools, all over South Korea, in the months before recruitment began. Some of their admission criteria were traditional, such as evidence of achievement, especially in subjects like the sciences, math, and English. Unlike other Korean universities, they did not attribute much attention to standardized tests, such as the CSAT. Instead, they focused on ensuring that

the motivation of students was high and they had a strong commitment to pursue energy studies in a small town, away from the big metropolitan centers.

In exchange, KENTECH's promise was that of a highly differentiated higher education institution. It offered full scholarships and a stipend for each admitted student, as well as the opportunity to study abroad. However, as attractive as the financial incentive was, the academic opportunity was the main draw. KENTECH offered research assistantships for students from the first year, as well as three advisers for each student, covering both the academic and residential components of the program.

KENTECH targeted 100 high-achieving students for its inaugural class. In March 2022, it admitted 107 students without compromising on selectivity. In its early-admission round, it had admitted 4% of students, with that number dropping to around 1% in regular decisions. "Other selective science institutions had an admission rate of 10%–15%, so we did not expect those numbers at all, especially since we were not going to compromise on quality," said Dr. Jang. Moreover, 50%

of the students came from science schools or schools for the gifted.

Minseo Park was a non-traditional student who applied to KENTECH. She had already enrolled in an undergraduate degree program to study education at Seoul National University. After completing a year there, she realized she wanted to pursue studies that did not lead to a narrow career path, and recognized that KENTECH would support a

student like her. “My parents expressed some concern that KENTECH did not have an alumni network, an important community in opening career opportunities,” she said. “However, unlike other engineering schools who pushed you towards corporate careers, KENTECH offered a wide range of possibilities from research to entrepreneurship, which matched my aspirations and my personality better.”



A conference room at the KENTECH campus.

Overcoming Challenges

While the curriculum design, pedagogical training, and even student recruitment occurred on time and according to the initial vision, the launch of KENTECH was not without its challenges. Most of these revolved around the shifting mindsets of the stakeholders.

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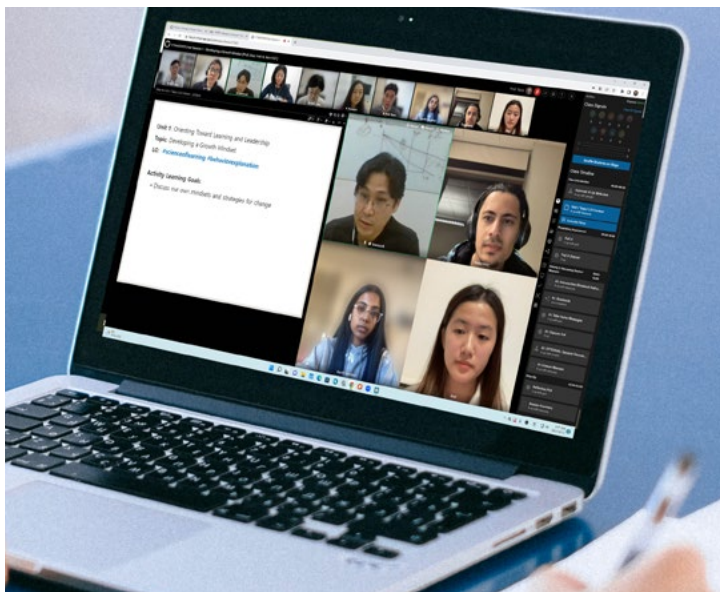
Embracing a New Pedagogical Approach

Dr. Cho had a background in the history of science and spent 20 years in government, connecting science to society and policymakers. KENTECH's mission to introduce humanities to an engineering degree was precisely what attracted her to KENTECH, which she joined in November 2021.

When she was introduced to the Minerva methodology, Dr. Cho was wary of teaching using a fully active learning pedagogy over an online platform, especially in the period following the pandemic where “typical” online learning experiences had earned a bad reputation. “Korean students are not used to speaking, even in a physical classroom, let alone in a digital environment,” she said. Dr. Cho's approach was to be candid with the students, sharing that this was also a new environment for her. By facing this common challenge and embracing the new environment together, the students mirrored the effort their professor was making.

It did not take Dr. Cho long, though, to change her mind about what was possible through Forum. “Forum was a great platform, where I could have eye contact with all my students all the time—something I could not do in a physical classroom,” she said.

“It was quite difficult at the beginning,” student Minseo Park agreed. “Having to speak in English in front of everyone did not come naturally, and it was even difficult to follow the professors, so we students ended up collaborating even more to fill each of our individual gaps.”



A KENTECH faculty training on Minerva's Forum platform.

2

Introducing an Innovative Curriculum in a Traditional Environment

While KENTECH's leadership was convinced of the importance of an interdisciplinary curriculum in a science and technology university, the feeling was not always shared by students or their parents.

When the engineering students complained about the humanities curriculum, Dr. Cho responded, "Leaders should know about society as a whole. This interdisciplinarity — combining behavioral psychology with logic and economics — is crucial for your future readiness and success."

Parents, on the other hand, were more resistant at first. They did not understand why their children would be spending so much time on humanities and social sciences, when they were clearly pursuing a scientific degree. They were also worried that the English requirements would push the students' averages down. Moreover, coming out

of the pandemic, they were less than enthusiastic about the online nature of the classes, particularly given that KENTECH has a physical campus.

The KENTECH leadership listened to the concerns of the parents, and addressed their apprehension about grades by making English and humanities classes pass/fail courses, thus not affecting students' overall averages. However, after the first semester, the students asked for grades to be reinstated in these classes, as they wanted their efforts to be recognized and rewarded.

Students like Junhyoung Kwon immediately recognized the value of classes such as Strategic Learning and Leadership, and Applied Creative and Critical Thinking. "These courses were fundamental in teaching us how scientists think," he said. "First you break problems down, think about them, and then you collaborate with others to solve them."

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3

Supporting Trailblazing Students

Students also initially struggled in the new learning environment, which was exacerbated by the lack of upper-level students to turn to for advice.

KENTECH faculty asked their Minerva Project counterparts to devise a solution. A decade before, Minerva University students had been in the same position, having joined a new university with the same innovative learning methodologies. Minerva Project connected KENTECH students with Minerva University students and alumni, all of whom had gone through a similar educational experience. The

KENTECH students found answers and support in these conversations, helping them to adapt their learning styles and leverage this unique college experience for their careers.

KENTECH student Junhyoung Kwon said that these small group meetings were eye-opening. “Minerva University students had more experience in the curriculum and pedagogy than we did, and they shared tips on how there were different approaches to meet the learning outcomes identified in different classes.”

The dual mentoring programs wherein Minerva academic directors worked with KENTECH faculty, while Minerva University students worked with KENTECH students, were crucial for the program’s success. As part of this intentional capacity building, Minerva suggested institutionalizing this program, with KENTECH upper-level students guiding and supporting new cohorts as they start their learning journey.



Minerva University students share their experience on navigating new learning methodologies with their KENTECH counterparts.

Success and the Way Forward

With the inaugural year completed, all parties involved were keen to measure the program's impact. What was most astounding was the palpable transformation in students' engagement and critical thinking skills. "The Minerva courses are the only place the students can think for themselves and about themselves," said Dr. Cho.

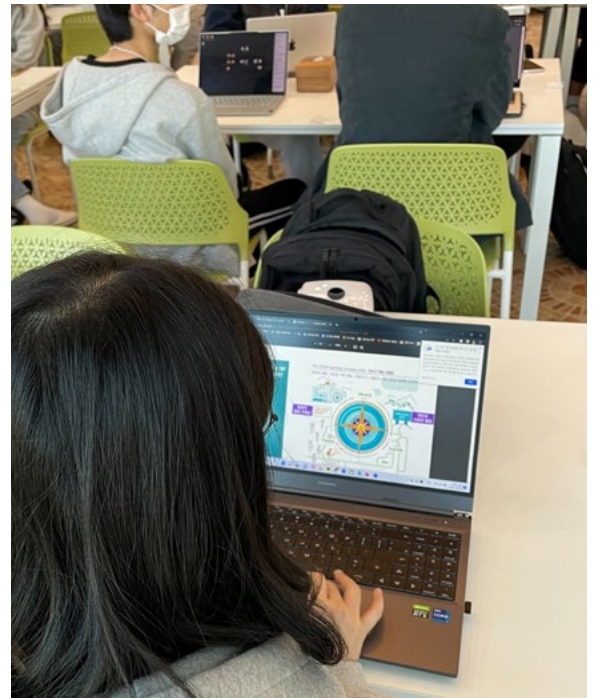
Student Junhyoung Kwon affirmed the sentiment: "In other classes, we learn things and facts. In Minerva classes, we learn about ways of thinking, processes and methods." He also started using Minerva-learned methods in other classes, such as chemistry. Student Minseo Park said that the collaborative nature of assignments made her feel as if she were in an accelerated professional program.

This anecdotal feedback is supported by student data, which shows that the majority of students rate the core learning components as either effective

or extremely effective in supporting their learning, with 80% of students agreeing that in-class discussions, breakout activities, and instructor facilitation and feedback are the most impactful tactics.

The humanities and social sciences curricula were also a game-changer in rounding out the students' skill sets. "Without Minerva, we could not have offered these courses, and therefore the students would not have understood how humanities and social sciences connect with natural sciences and engineering," said Dr. Yoon.

"The Minerva courses are the only place the students can think for themselves and about themselves."



A student participates in a class on Applied Creative and Critical Thinking.

As for the hybrid nature of the program, both faculty and students acknowledge its benefits. Student Minseo Park said she even prefers the Minerva classes on Forum to in-person classes. “Not only do the Minerva classes on Forum make me concentrate more than when I am in a physical classroom, but I feel the professors are also more engaged there.” Dr. Kyung Kim agreed: “Forum is the best online learning platform in existence that maximizes students-to-instructors, students-to-students, and group-to-group.”

As recruitment started for the second cohort, the first-year students acted as ambassadors to the institution, meeting with prospective applicants and answering their and their parents’ questions. While KENTECH remained incredibly selective, its early admission rate and regular admission rate for the second cohort increased — from 4% to 8%, and from 1% to about 1.6% respectively — as the reputation of the rigorous program and innovative pedagogy started attracting even higher-quality candidates.

As it welcomes its second cohort of 109 undergraduate students, KENTECH is well on target to meet its objective of around 1,000 students across both undergraduate and graduate programs by 2025. President Yoon feels that his initial vision is on track. “I want to show Korea and the world that KENTECH graduates will supersede students that graduate from traditional Korean universities,” he said.

Early signs are promising, with freshmen students competing and winning competitions that are often won by juniors and seniors from other universities. Most recently, a prominent administrative body ranked KENTECH second only to the Korea Advanced Institute of Science & Technology (KAIST) in Korea, after only one year of operations.

“The first-year students took a risk and KENTECH made a promise that we kept,” stated Dr. Jang. The young institution is well on track to deliver the leadership and talent needed to enable South Korea to successfully navigate its energy transition.

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In Minerva classes, **we learn about ways of thinking, processes, and methods.**”



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