



## *Turning Waste into Fuel*

**Azza Faiad**

**Egypt**

In Alexandria, Egypt, 14-year-old Azza Faiad was sitting in an idling taxi. It was July 2010, a looming energy crisis was taking hold of the world. Her driver was waiting in a long line of cars at a filling station, hoping to refuel before the pumps ran out. Which wasn't guaranteed—nothing was during the crisis. There was a massive shortage in oil supply, and this sort of wait had become normal.

As she waited, exhaust came through the windows, polluting the air she breathed. It clouded the atmosphere around the lines of cars as well. Everything felt cramped and suffocating. The streets were polluted. The expressions on worried faces all around her were difficult to take in. As Azza looked around at the seemingly hopeless scene, a thought struck her: *Why are we so dependent on oil?*

There had been peaks and valleys in the price of oil before. But this time it was particularly harmful. In the year from July 2007 to July 2008, the price of crude oil had risen from \$60 a barrel to nearly \$140. This impacted all sectors of the economy, and wreaked havoc in the daily lives of countless people around the world.

Many factors were contributing to this situation. Climate change. Political hostilities in the Middle East. Dwindling oil reserves. An increase in global demand for oil from developing regions. Financial speculation.

But as complicated as these reasons may be, the reality for the average person was quite simple: a crushing increase in the price of oil. And since oil is so entangled in global markets, an oil shortage makes the prices of many other goods and services rise dramatically as well.

This obviously affects lower income people disproportionately. The price of heating oil skyrockets. People have to make this-or-that choices at the market. Stress levels go off the charts. And of course, there is that one hallmark of any supply issue surrounding oil: long lines at every filling station in sight.

But sometimes, out of chaos, can come clarity. And in a somewhat ironic twist of fate, it was in one of those frustrating filling station lines that Azza's journey as a youth leader in alternative energy began.

"After that day, I often thought about how to approach our dependency problem," she says. Then one day at 14, she had a moment of revelation on another car trip, from Alexandria to Cairo.

"As we were driving, I saw this huge landfill. We passed by it slowly. It was so big I thought it was never going to end. At that point I thought, there's just so much raw material here. What if somehow we could use all this waste to solve the energy crisis?"

It all started moving really fast from there. Azza had a lot of questions. And so, with the support of her family, who are all very scientifically minded, she dove deeper into learning about plastic waste. "That's the second biggest category of waste, behind paper waste," she explains. "So there was no shortage of material to work with. In time, I started studying how waste can be converted to fuel." But of course, as just a teenager, she was limited in her knowledge.

Luckily, at 15 years old, she was welcomed by the Petroleum Research Institute in Cairo, to work with two of their scientists, Dr. Tarek Fahmi and Dr. Mamdouh El Melawy, on the project. “They were amazing mentors to me,” she says.

Azza and her team ended up utilizing an existing catalyst in a different process that can break down plastic waste and turn it into fuel that can power vehicles. Even more amazing, this catalyst is significantly cheaper than the catalysts that were being commonly used prior to their discovery.

This discovery has huge implications on the climate change front and beyond. Because the process is cheaper, more people will adopt it. Waste will be reduced in more places, more quickly. This in turn, will lead to communities having a reduced dependency on oil. And, as with any discovery, new knowledge leads to additional advances and discoveries. And all of these component parts can produce jobs in a variety of new sectors for local economies.

In 2012, Azza won the European Fusion Development Agreement award at the European Union Contest for Young Scientists for her work. Still only 16 years old, she beat out more than 125 contestants from nearly 40 countries.

But while it’s true that Azza is a gifted research scientist, she hasn’t always succeeded academically.

“Going to Europe and winning this contest really changed my way of seeing things,” she says. “It gave me an interest in traveling, and in competing in other international competitions. So, I decided to study abroad. I applied to a university in Canada, to study electrical or environmental engineering—but I didn’t make it. I didn’t get the required scores to qualify. That was a really devastating period for me. I’d won these competitions. Received praise for my accomplishments. And then, just like that, I suddenly felt like a failure.”

But sometimes, fate has a way of pointing us in the right direction, even though it’s hard to see sometimes, especially at the time.

“I continued to study electrical engineering at Alexandria University. But I wasn’t motivated. I had dreams of studying abroad, and now here I was, right down the road from where I’ve lived my whole life. And for the first few years, I wasn’t studying anything I wanted to. But then, out of nowhere, I stumbled into an opportunity in research. There was a spot open in with the energy materials research group at the American University in Cairo, and I was accepted. So, I traveled to Cairo, and once again I found my spark!”

The work was focused on the micro and nano structures used in solar energy, as well as water splitting for hydrogen production. It wasn’t relevant to electrical engineering per se, but Azza realized that here were avenues to work on a variety of sustainability issues all at once. It was this holistic approach to scientific research that really intrigued her.

Knowing how discouraging hard times can feel for young people, she has some words of wisdom for those who might be struggling with similar issues.

“Having a setback doesn’t make you a failure. You won’t succeed at everything you do. But I’d urge any youth to explore their full potential, by learning about something that brings you fulfillment, no matter how many times you failed before. And then, when you gain knowledge, pass it on to others. Young people are always looking for someone to inspire them. They need someone to push them forward. Give them support. Perhaps you can take some time to teach your skills to another. Or maybe you can tell others about how you reached your own goals in life. We are all looking for that kind of support. It’s a gift, to teach and be taught. It’s what my many mentors instilled in me, and what I hope to instill in others too.”

Then she explains how exploring a passion in one discipline can lend itself to many others.

“Although my work is in energy research, the knowledge I acquire won’t simply be applicable to the energy sector -- there are many places it can impact sustainability. More efficient power supplies can contribute to a smaller carbon footprint in many industries, such as electronics. And it can be used to create low-volt, higher-amp outputs in consumer products, and in industrial applications too. A research ‘win’ becomes a climate win. That’s what’s so exciting for me.”

Azza has other plans to change the world of sustainability. Her dream is to one day work with her twin sister, who is a mechanical engineer. Together, she hopes they can address some of these problems, while having fun.

If at her young age, she could already figure out a more sustainable way to convert plastic waste into fuel, there's no telling what she and her sister will be able to contribute to creating a more sustainable world in the future.

"I hope to develop a product, or technology, that can contribute to pressing problems in energy or climate. I don't have a specific plan as of yet. But my sister has been thinking about efficient sources of power. So maybe some we can combine our studies and scale up a product that deals with sustainability. Yep. That is my dream."

*The use of alternative energy is inevitable as fossil fuels are finite.*

**Gawdat Bahgat**

*We have on this earth what makes life worth living*

*Original quote in Arabic: على هذه الأرض ما يستحق الحياة*

**Call To Action:** Ride bikes or walk to school/work, encourage your community to install more solar panels. To drive, use electric or hybrid cars.

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