Remarks to Science for the People, Where do we go from here? SftP 2.0 panel
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Before I dive into my more political remarks, I want to briefly give you an idea of the things I am currently working on. As a postdoctoral fellow at the University of Michigan, my current research is both technical and non-technical. I study the combustion chemistry of alternative fuels and advanced engine strategies, whether ecological issues like climate change have changed the way engineers think about technological development, and how we might use notions of praxis, as has been elaborated on by Donna Riley, to create a paradigm of engineering called activist engineering. As a AAAS Fellow at the US EPA, I work on empowering people who live in environmental justice communities with low-cost air pollution sensors they can use to take legitimate data for environmental education and to fight for clean air, and on climate change resilience, specifically on governance issues and on linking colleges and communities to experiment with infrastructures and policies that will help communities cope with the coming impacts of climate change.

I want to focus my brief remarks on what young scientists and engineers face on three interrelated issues:

- shifting political targets and the diffusion of responsibility;
- moral and ethical conflicts in scientific and technical work; and
- the work environment we are entering.

Now, it seems evident to me that if written yesterday, the founding documents for organizations and movements like Science for the People and the Union of Concerned Scientists might read

very similarly. This is not to deny the huge progress many of you have helped achieve, whether analytical or practical.

Rather, it is to say that as scientists and engineers, we still operate in a world systematically shaped by vested interests that constrain our outlets for political engagement and power.

Today, we live in a world much more politically diffuse than the 1960s and 70s. The world is much more deregulated and corporatized and highly globalized; corporations are backed by nation-states, and nation-states back a global system. There has been a diffusion of responsibility for, say, the causes of climate change and social injustice, which makes it more challenging for us to hone in on the political targets of our activist work.

For example, instead of the division of the responsibility for creating and mitigating climate change in the Kyoto Protocol into Annex I or industrialized and Annex II or industrializing countries, a recent study published in the journal *Climatic Change* raises the question of how corporations and state-owned corporations might be held responsible for greenhouse gas emissions instead of solely putting focus on nation-states for greenhouse gas emission reduction.

There is also a widespread diffusion of the technical responsibility of scientists and engineers, making it extremely difficult to draw lines around the social, political, and ecological implications of our personal technical work. These implications are global and long-term. So the causes and complexities of whatever we define as “the problem,” mean that young scientists and engineers must strategically choose the avenues, maybe unexplored ones, for political engagement and activism if we are going to have an impact on the world around us.

According to the 2014 National Science and Engineering Indicators report of the National Science Foundation, over the last two decades, net tuition has more than doubled at public

universities, and over the last decade, tuition and fees for colleges and universities have grown faster than median household income. Young students saddled with college debt can be seduced by large salaries offered by big oil, big defense, and big pharma after a bachelor's degree in engineering, and even if, personally, students do not support the work of their employers. This can lead to a rationalization of career choice, of making oneself think, "I will do my best to build missiles that *only* kill the target," or that they can "change the system from the inside." The current technopolitical and economic system thus maintains its lifeblood—young recruits—and puts them in a situation where they fight internally, rather than against those in power. It seems that we have young people going into science and engineering without fully knowing the opportunities the current political and economic system provides them.

While significant strides have been made in the appropriate technology movement as Professor Tharakan has mentioned, while more conferences are being held on engineering, education and sustainability, while new student groups are emerging that work on technical projects with justice and ecological thinking at their core, and while the notion of community science is taking strong hold all across this country, we still have a great deal of work ahead. For example, while the development of alternative energy is being influenced by social pressures, the waxing and waning economic interest in these sources shows how alternative energy must fit within the current growth-minded capitalist system and must be politically palatable to businesses and others in power.

The influences of scientific work and technical infrastructure last longer than the general public's ability to understand and remember their risks and implications. For example, about two-thirds of Americans supported "allowing more offshore oil and gas drilling" in 2012, as opposed to half of Americans supporting this after the Deepwater Horizon oil spill just two years earlier. What this means is that our political power must be used to inform an alternative politics that fully appreciates the long term nature of the socioecological struggles we face. This is something

that scientists and engineers can do. We must take advantage of our young scientists' and engineers' ability to work for and in the long term to build on an awareness of the long-term nature of the socioecological problems we face. Young scientists and engineers are inherently equipped to deeply consider the power they yield, particularly when paralleled with the nature of the work they do.

Along those lines, we cannot continue to miss opportunities, moments, and incidents to use to mobilize around and build allied solidarity. Going back to the Deepwater Horizon Spill, my hope was that scientists and engineers could seize this devastating incident to link more openly with the broader environmental movement in very clearly laying out the risks of fossil fuels, both in the immediate present, such as the impacts of the spill on the Gulf ecosystems, and on the longer term, such as climate change. But this did not happen. Importantly, the Deepwater Horizon Spill was a missed opportunity to bolster and intimately tie public outrage with the power of strong science, perhaps to crystallize a movement.

We must stem the inflow of young scientists and engineers into extractive, violent, and profiteering industries. According to the same National Science Foundation report I mentioned earlier, by far the largest employer of scientists and engineers is the business sector with 70%, while the rest are employed in education (19%) and the government (11%). And *within* the business sector, for-profit businesses employ the largest number of scientists and engineers. While it is extremely difficult to piece together from the labor statistics just how many scientists and engineers work for extractive and violent industries, one may safely assume that the number is big enough that it must be strongly dealt with.

We must make community-based engineering positions, non-profits, and other organizations founded on principles of social justice, equality, and ecological holism viewed as legitimate contexts in which to engage in scientific and technical work for the average student. If

internships are used as recruiting tools for large numbers of young engineers specifically, how might we provide internships to young students that can give them a better understanding of their power and the powerful forces they must fight? What kinds of things should we be writing given the uniqueness of the socioecological challenges we face? And where?

We need to provide an outlet for those ethically and morally conflicted by their career options to reflect on their responsibility and alternative careers. We might develop safe spaces where scientists and engineers can talk freely among a group of peers about the work they do and the conflicts they have, without fear of losing their job or funding or authority. These spaces can also be used to train scientists and engineers to counter claims by peers and the broader public that any direct political involvement necessarily affects scientific and technical "objectivity."

I think one of the most encouraging things is that we have a wealth of experience we can draw on. And further, the National Science Foundation report claims that the broader public has "a great deal of confidence" in leaders of the scientific community. Political power today is not about *regulation* of violence or ecological degradation, but rather is about a deep dialogue, reflection and action that must happen to change the politics of alternatives, to make these politics powerful, to systematically act at points that can influence young students to dedicate themselves in ways that fundamentally redefine and change the expectations of science and engineering.

So here are some questions on power and responsibility I have for our discussion:

- What kinds of power do young scientists and engineers yield today *different* than scientists and engineers of years past?
- In what ways should the new tools available today be leveraged to bolster the political power that young scientists and engineers yield?

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- Have the responsibilities of scientists and engineers changed given our technologized and globalized world, and how do these responsibilities show where the power of scientists and engineers currently lie and ought to lie?