



REGULATED MONOPOLIES FOR SUSTAINABLE ENERGY SOLUTIONS?

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It seems clear to me that science and technology must come up with new means to provide the sustainable energy services needed by a world headed toward 10 billion or so people enjoying the same standard of living as those of us in the developed world. Somehow we must find a way to provide services such as transportation, light, heat, etc., without the carbon or other emissions/wastes inherent in today's energy service technologies.

From my engineering perspective, I believe paths to sustainable energy solutions can be defined using systems engineering approaches that take into account the full requirements of sustainability. Such systems studies would need to define the technology gaps that must be bridged to achieve such a goal, and then identify the most promising areas for scientific exploration in order to develop the new knowledge on which appropriate technological solutions can be based.

Past experience, described below, shows how such systems engineering studies can drive the directed science needed to develop such new knowledge. However, past experience may also show that in situations requiring long time frames to achieve a solution, such systems work must be part of an organization that is self motivated and resourced to achieve long-term results, and by reaping the benefits become self-sustaining.

So where might we find a model for such a closed loop, service providing entity. The type of model we need involves technologies that provide a public good or service, but which are not necessarily economic from the get-go. One that comes to mind, and with which I have some familiarity, is the building and evolution of the landline and long distance telephone system.

I was exposed to some of the history and philosophy around the telephone system while working at Bell Laboratories and Bell Northern Research early in my career. As I understand it, the telephone system in North America evolved as a government mandated and regulated monopoly because society at the time wanted steadily improving voice communication services at low cost. Two companies became dominant, AT&T and GTE. Eventually, it was decided that their monopoly position was no longer appropriate and the industry was deregulated. That said, relative to the government owned monopoly that existed in most European countries, North American society benefited immensely over the first seventy years of the 20th century from the government regulated but privately owned telecoms monopoly. As late as the 1970's making a long distance call in Europe was a nightmare compared to the service in Canada and the US.

Working in the AT&T Bell Laboratories, I was exposed to the ethic that achieved such results. The Bell System sought to provide ever improving communications services. It

used science and technology to discover the means, develop the technology, and deploy the equipment that provided such services throughout the Bell System in both the US and Canada. Obviously that ethic was enabled by the regulated profits that AT&T made in providing such services, and Bell Labs, which did the science and developed the technology was a very well funded organization.

One story that illustrates very well how the Bell System worked involves the invention of the transistor which has had such huge impacts both in telecoms and in the creation of the whole panoply of information technology industries.

The system engineering function at Bell Labs did the early analysis of technical options for improving telephone service. In the late 1920's they started to look at how high quality telephone service might be provided between the east and west coasts, a distance of about 3000 miles. Their analysis showed that microwave repeaters could provide many voice channels at the lowest cost, but they would have to be spaced about 30 miles apart which meant there would be 100 repeaters in series. which, At the time, vacuum tubes were the only amplification technology, but when they looked at their reliability, they realized that with 100 tube amplifiers in series the system would be down for repairs most of the time. So they decided that a new amplifier technology was needed, but tubes were all they had!

With the monopoly-rent resources at their disposal, they decided to go back to the basics and examine the state of various branches of physics and chemistry to see if there was any science on which a new amplification technology might be based. To make a long story short, they decided that solid state physics offered the most promise, and began a program in the 1930's of basic solid state physics research at the Murray Hill Labs in New Jersey which resulted in the invention of the transistor in 1948.

As it happened, in the interim, tube technology also advanced, so that the first transcontinental microwave systems in fact were built with tube amplifiers, but, as we know, in the end tubes were almost completely superseded by solid state technology.

Would this and the other scientific breakthroughs achieved by Bell Labs have happened without the monopoly-rents environment in which they existed? Hard to know, but it is fair to say that the North American approach of government regulated private sector monopoly was much more effective in providing telephone services than the government PTT monopolies of Europe.

So what observations can we make relative to the issue of providing sustainable energy services to present day society? Certainly we know that such services are not economic from the get-go! Could the granting of some sort of private sector monopoly in a regulated context provide a means to achieving sustainable energy services at steadily reducing cost? Could the profits from such a monopoly fund the on-going system engineering work that would drive the science, develop the technology and deploy the services?

An example of one such monopoly service might relate to capture of the CO₂ from the oil sands industries in Fort McMurray and Edmonton and its use in enhanced oil recovery in depleted fields in the Western Sedimentary Basin.

Another might relate to the CO₂-free provision of hydrogen and/or steam to upgraders and in-situ production facilities in Fort McMurray.

Establishing such monopolies could only be done after suitably broad discussion and decisions by society at large on the services desired and the means to achieve them. However, once such monopolies were granted, probably for a defined period, it would then be the responsibility of a regulatory body, with public intervention, to ensure that the services were provided at a decreasing cost per ton of CO₂ avoided.

It would be expected that such cost reductions would be enabled by investments made by the monopoly holder in systems engineering, science, technology and enhanced service deployment. They would be motivated to do so by the profits such investments would engender.

In conclusion, the above is just one model of how uneconomic but desired services can be fostered by society. Other past and present models that include the key system engineering function in a closed, motivated and well-resourced organization include:

- **The US Department of Defense and its suppliers**
- **Regulated Power Providers**
- **The European Railway System**

It is not lost on the author that most of these monopolistic models, including the telecom one described above, have been de-regulated, and for good reason. It appears that all monopolies succumb to the frailties of human nature, but in most cases society has benefited from the provision of steadily improving services from such organizations. Often the point is then reached when the services become economic, permitting deregulation. Market forces then provide the on-going competitive environment that fosters further service improvements.