CASE STUDY: Salter's 'duck' and the UK wave power project

I - The case in outline:

Research into a new and unorthodox energy technology that could displace traditional energy supply methods requires funding. The project receives funding via the administrative structure of the traditional and „competing" technical system. Funding is constantly delayed and then results of the research assessed by „experts" who work within the old technology.

QUESTION: *What are your first thoughts about any ethical implications of conducting and funding such research?*

POSSIBLE RESPONSES:

- What are the immediate consequences of funding new technologies that could undermine previous ways of producing energy?
- What „interests" are involved?
- What „larger" policies influence the research and the views of funders and government?
- Given such consequences does it matter who funds the research?
- Is there room for misconduct depending on how are funds disbursed?
- Similarly does it matter who analyses the results?

FEEDBACK OF DETAIL:

ThenewtechnologywasWavePower energy(specificallySalter"s Duck).The„old"technologywas nuclear power via the Atomic Energy Authority.

FURTHER RESPONSES:

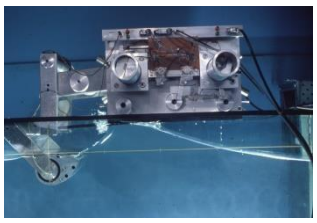
- Any further issues raised in light of further information?

II Background and Context

Research into marine wave power began in the UK in the early 1970s when Professor Stephen Salter of Edinburgh University began experiments using a dynamically shaped float that linked via a spine to a series of others which bobbed up and down in the waves. The Duck is a 300-tonne floating canister designed to drive a generator from the motion of bobbing up and down on waves like a duck. It is still regarded as the most efficient of any wave power system produced, converting up to 80% of the wave energy to electricity which was to be then cabled ashore. All the experiments were successful until 1982 when the work suddenly stopped.

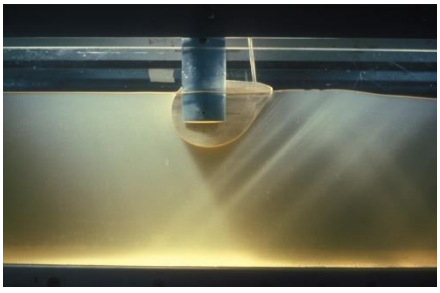
The problem arose from the control of all renewable energy research during the 1970s and 1980s coming from an organisation that was part of the United Kingdom Atomic Energy Authority. The Department of Energy's research and development advisory council (ACORD) committee operated at

long range from all the projects and was recruited largely from the nuclear and the depletable energy industries. In other words, wave power research was funded and controlled by the regulators of the nuclear, coal and gas industries.



By 1982, a consultant was able to report that the duck could be expected, with further development, to produce electricity at a cost of around 5.5 pence per kilowatt-hour, a price competitive with nuclear power (the most expensive commercial generation process in use in Britain). Clive Grove- Palmer, a respected department engineer seconded to work on the duck project, estimated that the cost could be got down around 3 pence per kilowatt-hour. ACORD met in 1982, excluding Grove- Palmer, and accepted a secret report, prepared by a unit based at British Atomic Energy Authority headquarters, claiming that wind power had more immediate commercial possibilities than wave power, and research funds should be shifted to it. The department, which was packed with nuclear supporters, had instructed ACORD to reduce its renewables research budget from £14 million to £11 million. At the time, the Department was spending around £200 million on nuclear research.

It was eight months before wave power researchers were allowed to see the report on which ACORD based its decision to junk their work. Then, in January 1983, a research unit based at the Atomic Energy Authority came out with another report concealing the good figures for the Duck by averaging them in with figures for all wave power projects. This gave a non-commercial figure of 8- 12 pence per kilowatt-hour. Apparently still not satisfied that they had killed the Duck, opponents of the project then produced figures overestimating capital costs by a factor of 10, massively underestimating the reliability of undersea cables, and claiming that in mass production each Duck would cost about the same as one prototype.



Grove-Palmer took early retirement as a result of the decision. "I resigned ... because they asked me to write the obituary of wave power. There was no way I could do that ... We were just ready to do the final year of development and then go to sea."

After a long campaign to save the project, Professor Salter's team was forced to disperse in early 1987. "We must not waste another 15 years and dissipate the high motivation of another generation of young engineers", wrote Salter in a memorandum to the House of Lords committee on renewable energy. "We must stop using grossly different assessment methods in a rat race between technologies at widely differing stages of their development. We must find a way of reporting accurate results to decision makers and have decision makers with enough technical knowledge to spot data massage if it occurs. I believe that this will be possible only if the control of renewable energy projects is completely removed from nuclear influences."

QUESTION: Are there any obvious errors of judgment – challenging principles of ethics and integrity in how this research was developed and managed?

POSSIBLE RESPONSES:

- Are there clear conflicts of interest involved here? What might they be?
- Could the degree of funding be considered realistic? (Is that an issue of ethics and/or integrity?)
- Is „relative funding" of any consequence?

- How could the figures have been allowed to be deliberately misleading? Was there adequate peer review of the process?

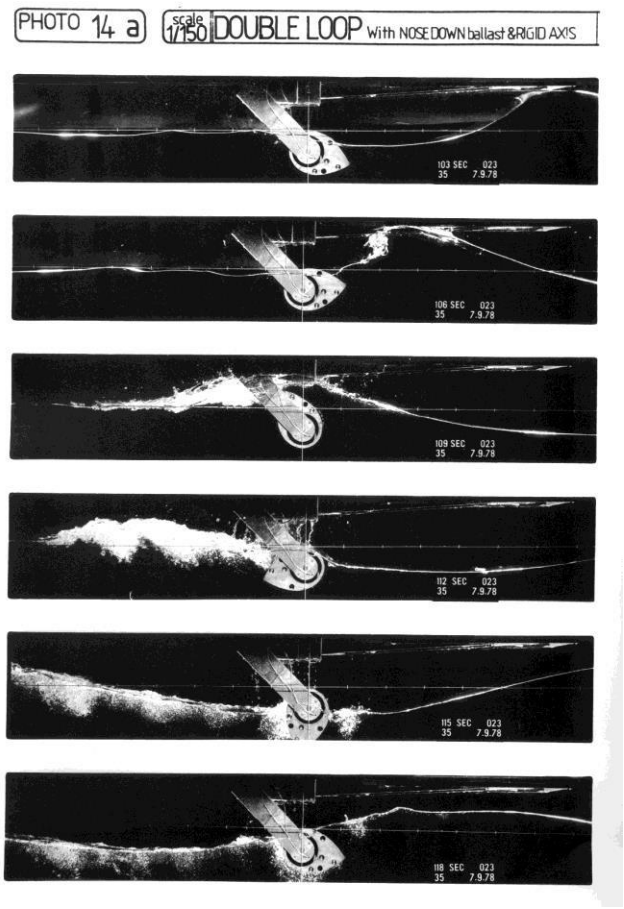
III The View from the Researchers

Prof. Salter gave the following assessment of reasons for the failure of the Project to a House of Commons Parliamentary Select Committee in 2001:

"If I had to supply reasons for the failure of the first UK wave programme I would cite over-optimism, the attempt to make very big (2GW) power stations and to assess infant devices too quickly. The programme was properly supported and enthusiastically led from 1976 to 1983, a period of only seven years, and then entered a very unhappy phase where researchers felt that they were always on the defensive. An account of this has been given to a Committee of another place (HL paper 88, 21 June 1988 page 178 and 190-206) and it does not, at present, seem helpful to repeat it here."

Salter went on to answer the Committee"s question:

What role should wave and tidal stream energy have in the Government's renewable energy strategy? Should they have a higher priority?



"This must depend on whether the Government and its civil servants really want renewable energy to succeed or whether they want to appear to be supporting a programme but really want it to fail. Over the years many of the officials with whom we dealt certainly seemed to want success but this often proved to be a dangerous career move. I must warn the Committee that this danger is not confined to officials. There was a Commons Energy Committee which looked into renewables in 1992. A copy of my evidence (pages 62 to 68 of volume III) is attached. One of the Committee's recommendations was the resurrection of the wave energy programme. The Energy Committee was immediately disbanded!

Always there seems to be a layer, or indeed layers, of senior people with negative views about renewables and the power to make them stick. This power seems to be inversely related to technical knowledge of the subject or technology in general. If the concerns about carbon levels, global warming and long-term supplies of fossil fuels are well founded, then the Government policy should be that every possible renewable source should be thoroughly researched to the point that it could rapidly be employed at some stage in the future. The demonstration of this capability would do much to limit the dangers of a manipulated market for oil or gas and could be regarded as part of a nation's defences. The costs of a vigorous research programme are very small compared with the total spending on fuel or the possible future consequences of having insufficient energy supplies.

The spin-off in unexpected directions has, so far, been quite sufficient to justify what has been spent. Diversity between renewable sources with different availability reduces the problems caused

by lack of firmness of supply. This could be further reduced by the use of renewable sources for the manufacture of hydrogen, methanol, ammonia or even potable water."

Question: There appears to have been (still is?) a group of people in senior levels with the power to impose their own agenda? What issues does that raise?

POSSIBLE RESPONSES:

- Can and should political responsibilities be kept separate from those of the scientists/researchers?
- Should those officials (elected and/or appointed) be in a position to override the scientific findings?
- Is the problem one of honesty and transparency?
- Is there any way in which both the scant funding and the deliberate sabotage could be justified?

IV Lessons learned: How should national funding for new technologies be managed?

Prof. Salter"s further responses to HoC Committee"s questions offer lessons:
"…Private investors must protect their investment by secrecy in a way that is totally foreign to academics, even if a large fraction of the money is coming from public sources. There are even stronger motives for secrecy following poor productivity or the loss of a prototype. Mistakes will then be repeated by others. It does not have to be like this. Following an aircraft accident there is a very expensive investigation with the most detailed information supplied to and carefully studied by the entire industry. This should be an obligation in return for receipt of public money."

Strict central/ministerial direction would violate the independence of research funding councils.
"…This independence is important because there is also documentary evidence that an official from the Energy Technology Support Unit (ETSU) at Harwell (then part of the United Kingdom Atomic Energy Authority) tried hard… to discourage support for wave energy from Brussels. Over-strict co-ordination stifles original ideas. I am, therefore, on balance in favour of open published consultation between independent bodies and a degree of anarchy."

However, this general view has been suddenly challenged by a serious co-ordination problem concerning test tank facilities which I would like to draw to the attention of your Committee. It concerns test facilities for wave energy research, which I regard as essential and which are expensive enough to have to be nationally co-ordinated."

"Funding for most academic work, now including waves, is the responsibility of the Engineering and Physical Sciences Research Council, which is given money by Government but notionally makes independent decisions. I have some evidence that this independence was not complete when, in 1986, a proposal for work on wave energy was rejected on the grounds that it was not strategic, as defined by the Renewable Energy Advisory Group set up by the DTI."

Question: How can an effective balance be struck between central government funding, private investment and research councils?

POSSIBLE RESPONSES:

- Government control of private enterprise should be limited. (Why?)
- Government control of research council funding should be limited. (Why?)

- Governments have the right/duty to direct „strategic research and funding". (Why?) Should peer review be entirely separated from funding and strategic issues?
- Is full transparency realistic?
- What ethical issues arise from striking the balance for new technology research between „national coordination" and „anarchy"?

SUMMARY LESSONS LEARNED: GUIDANCE FOR POLICYMAKERS

This case offers an example of trying to do research with integrity while the researchers were placed in a „no win" situation. This is a „real world" example and considerable ethical reflection is required to fully understand the „context" in which the research had to be conducted. The lessons are apt for new technologies that are framed by political, economic and ideological constraints – together with the evident research misconduct that took place and can only be described as „sabotage". Again such actions must be understood in terms of the balance of many interests, most of which are not linked to the „profession" of research.

Policymakers and regulators have a responsibility to consider how best to manage emergent technologies in light of strategic contradictions. What may be seen as „anarchy" from one perspective, may be legitimately viewed as „healthy competition" from another. For example, in the later 1990s there was a distinct drive towards the globally co-ordinated regulation of genetics research – the „risks" estimated to be so high that such uniform standards were seen as a necessary alternative to a dangerous anarchy. Little consideration was given to the possibility of allowing diverse national regulation leading to a 'regulatory competition' which could then be studied to assess what sort of regime worked best rather than having global standards imposed by unaccountable bioethicists.

Thus Salter"s Duck illustrates the problem of balancing independence in research, free markets in technological developments and governmental dirigeism. Centralised coordination can stultify genuine innovation if researchers are prevented from pursuing their own promising lines of thought. The possibility of „dead ends" and the „waste" of scarce funding resources might have to be risked for exciting and productive innovation to win through.

The major ethical lesson arising out of these observations is that though transparency in governmental actions may seem the most moral course, that may be balanced against strategic requirements that ensure societal safety and stability. How to identify such a rationale against „political expediency" remains moot.