C O O K I S L A N D S

National Energy Committee

SUSTAINABLE ENERGY ACTION PLAN

v. 1.3: 12/24/2009

A Matter of Economic Survival

We are the "mine shaft canary"

Years ago, coal miners who worried about colourless, odourless toxic gases would take canaries down into mine shafts with them. Because the little birds were more-sensitive than big, burly coal miners to adverse conditions, they would faint at the slightest whiff of trouble. The miners, forewarned, would take the canaries and flee the mines ... and everybody would be safe.

Today, the Cook Islands — and other, similar regions — are mine shaft canaries for the environmental and energy-related problems faced by the world. Because we are small, isolated, and less-diversified economically, we have an exceptional sensitivity to world energy prices, shortages of goods, shipping costs, tourism levels, and variations in the patterns of human movement. We are going to faint first.

This gives us an early challenge: to learn how to deal with the current — and coming — energy shortages, because they have started to create serious problems now. We have to learn these lessons sooner than almost any other nation because of our unique position.

It also gives us a true advantage, one we have never enjoyed before: once we uncover the correct blend of government policy, industry initiatives, and consumer actions necessary to achieve energy independence, we will have a knowledge-based product that will be of immense value to the entire world. The mine shaft canary can help many people.



This document does not contain the answers to our energy problems. Our problems are a microcosm of the world's issues, and, if we knew how to solve them, we'd know how to solve the energy problems for the rest of the world, too. However, we do believe a solution is possible—more possible, in fact, for the Cook Islands than for most other nations—because of our unique situation.

This document contains a set of tools to get us to energy independence. Diligently applied, they should wean us from fossil fuels inside a decade.

Start small, think broadly, move quickly

We believe the four absolutely essential working assumptions to successful management and generation of energy in the Cooks are:

1. **The world is changing rapidly**, so a rigid, dogmatic approach will fail. We must be flexible, adaptive, and clever. Today's best answers will be wrong tomorrow.
2. **We must only take actions that make good economic sense.** If the government under-writes energy sources that are not economical, we'll simply overburden our tax base and, ultimately, fail.
3. **Unilateral actions will fail.** Government, businesses, and citizens must act together. Changes must take place in a series of short, rapid, coordinated steps that allow for constant evaluation and mid-course corrections. No one group has the foresight or the influence to cause effective change to happen, but a coordinated, cooperative effort has a good chance of success.
4. **We must plan for the worst, but hope for the best**. If we take no steps to renewable energy and the world finds itself in a dire energy crisis, the Cook Islands will face severe hardship. However, if the converse is true and we adopt renewable energy measures while the world manages to sort out its energy problem, we still have a workable, renewable energy infrastructure. To protect ourselves, we must only ensure the steps we take towards renewable energy make economic sense in any world scenario.

These working assumptions leave us with a moving target. If today's answers won't be as good as tomorrow's answers, how do we ever feel safe making a decision? What keeps us from perpetual inaction?

The approach the NEC recommends can be summarized in six key points:

1. Begin immediately to take dramatic actions...but look for the low-cost low-risk actions that can have that dramatic effect. **This allows us to make a difference immediately, but keeps our risk low.**

2. Recognize the speed at which alternative energy technology will change, and recognize that solutions will get better rapidly as technology and business practices evolve to meet the unfolding world situation. Our approach will need to be modular, flexible, and process-based, rather than monolithic, rigid, and policy-based. **This gives us the ability to take advantage of newer technologies as they come along.**

3. Since an understanding of our current situation is critical, we must consult all stakeholders early and often. We must meet with NGOs, private citizens, business, government departments, civil servants, and elected officials. These people not only know the issues our society faces: they also have many the best ideas for solutions. **This allows us to draw on the wisdom of the entire nation as as source for innovation, rather than just the thoughts of the people on the National Energy Committee.**

4. Create a situation in which private citizens and businesses find investment in alternative-energy power sources to be to their advantage. **This gives people the ability to adopt new technologies as soon as it is to their advantage, and lowers dependence on slower-moving policy-setting agencies.**

5. Provide the means to encourage a diversity of privately-held sources of energy to come into existence. **This gives the country a broad, diversified base of technologies, and reduces risk and dependence on any particular foreign supplier or industry dramatically.**

6. Aggressively adopt a suite of different technologies in small-to-mid-sized government-owned or government-managed power-provision projects. **This allows us to diversify our publicly-owned infrastructure, sever total dependence on potentially-unstable petroleum supply chains, and gives us growing expertise in economical and practical application of a suite of alternative-energy technologies.**

We believe the wisest path forward for the Cook Islands is to:

Start small, think broadly, move quickly and aggressively ... but be sure every step makes economic sense.

Vision, Principles, and Desired Outcomes

This is a living document

In February and March 2008 the NEC met to develop some "seed content" for the Alternative Energy Framework. Since the committee members could not hope to have all the answers, the content in this section is **deeply provisional**. It awaits the addition of consultative input from government, opposition, non-governmental organizations, business, and (perhaps most importantly) everyday citizens. The NEC expects this section to grow considerably in sophistication, breadth, and completeness over the next few months as consultations proceed.

Vision

In the Cook Islands, domestic and commercial energy use will be:

- **Economical**: affordable for every citizen and business willing to take prudent conservation measures
- **Sustainable**: ideally, infinitely replenishable with the least-possible impact on our Islands
- **Efficient**: the sort of energy that can be generated and distributed with minimal effort and expense, coupled with devices, appliances, and architectures that make the most-effective possible use of energy, which may possibly become expensive
- **Autonomous**: dependent on the simplest, shortest-possible off-island chain of supply for physical plant, distribution, and fuel
- **Responsible**: energy choices we make today will impose few or no adverse consequences on future generations
- **Complete**: we will adopt sustainable practices for every aspect of our energy consumption; not just for residential and business energy supplies, but also for marine and land transportation
- **Globally valuable**: the unique situation of the Cook Islands will allow it to become a world leader in the application of low-risk alternative-energy techniques; we will be able to export our approaches to alternative energies as a product in itself

Principles

Energy self-sufficiency is our ultimate goal, but to achieve our visions, we will follow these principles:

- The quality of life of our citizens and guests is of primary importance
- The natural beauty and cleanliness of our environment must be restored and preserved, since it forms our primary commercial asset
- We will take fullest advantage of our abilities to generate national revenues with our carbon credits
- Local expertise in the construction and management of our principal energy systems is essential
- Aggressive localization of primary physical components is a requirement for all systems: where something can be made here, it will be made here
- We will only adopt renewable-energy measures that make economic sense, since only those measures will be sustainable—not environmentally, but pragmatically

Desired outcomes

If we manage to make our vision into reality, the Cook Islands will:

- Have the lowest-possible energy costs; our energy costs will be the cheapest among our immediate neighbours
- Develop substantial capacity to store energy for off-production-peak use
- Be energy self-sufficient
- Decouple our well-being from offshore energy sources
- Vastly increase our local expertise in and ownership of alternative energy
- Have such well-managed and plentiful energy that we could become energy exporters if we so chose
- Have the smallest carbon footprint possible, and take every possible advantage this offers us

Relationship to Te Kaveinga Nui

In January, 2007, the Prime Minister's office published a forward-looking document called "Te Kaveinga Nui". It addressed dozens of different issues, but specifically set targets for Alternative Energy under "GOAL 5", a "Strong Infrastructure Base".

The NEC has been a result of—and wholeheartedly endorses—the general principle within this goal, which is reproduced here:

Rationalise the management of the energy sector by developing and implementing Cook Islands Energy Strategic Plan for all islands:

- *Implement priorities related to energy in the Preventive Infrastructure Master Plan.*
- *Develop in 2007, the Cook Islands Energy Strategic Plan consistent with strategies outlined in the Pacific Islands Framework for Regional Action on Climate Change, Climate Variability and Sea level Rise, 2006-2015, and, the Pacific Regional Energy Policy, which will address:*
- *Decreasing by 20% per capita energy consumption by increasing efficiency in energy use through the adoption of new technologies and energy conservation practices by 2010; and*
- *Reducing the reliance on high GHG based fossil fuel by identifying and adopting technically feasible and financial viable alternative energy sources.*
- *Increasing by 30% the use of renewable energy by 2010.*
- *Improve generation capacity, fuel supply, storage capacities and security.*

In fact, these goals may have to be even more aggressive to ensure continued prosperous life on the Islands. Since publication of Te Kaveinga Nui, the world petroleum market and biofuel markets have behaved in a most-alarming fashion. If this trend continues for the foreseeable future, the Cook Islands will need to move towards renewable energy rather more rapidly.

The Framework within this Sustainable Energy Action Plan will contain the measures through which **Goal 5** of Te Kaveinga Nui will be met.

The Process in a Nutshell

Why is a process needed?

We need a process because the final, definitive answer for energy independence for any nation does not exist today, not even for nations that are very worried about it and spend a lot of money on it. We in the Cook Islands can discover reasonable answers today, but those answers will not be complete; nor will they be as good as tomorrow's answers. Even so, we must begin to work now, because the pressures on Cook Islanders are increasing rapidly. The ship of our alternative-energy strategy must launch now, because people need relief now; but it will not travel without navigation to its eventual destination.

The NEC process is a first attempt at that navigation tool. In short, it:

1. Uses public consultation and expert advice to generate ideas about energy management.
2. Examines the implications of those ideas by using a Framework.
3. Uses a weighting tool called the Sieve to evaluate the difficulty, scope, and risk of each idea.
4. Requires that each idea be unpacked so we can see exactly what steps are involved and how we might measure success.
5. Bundles that unpacked idea up into a project definition for execution and passes it off to an executing person or organization.

Figure 1 (below) is a graphic representation of the NEC process:

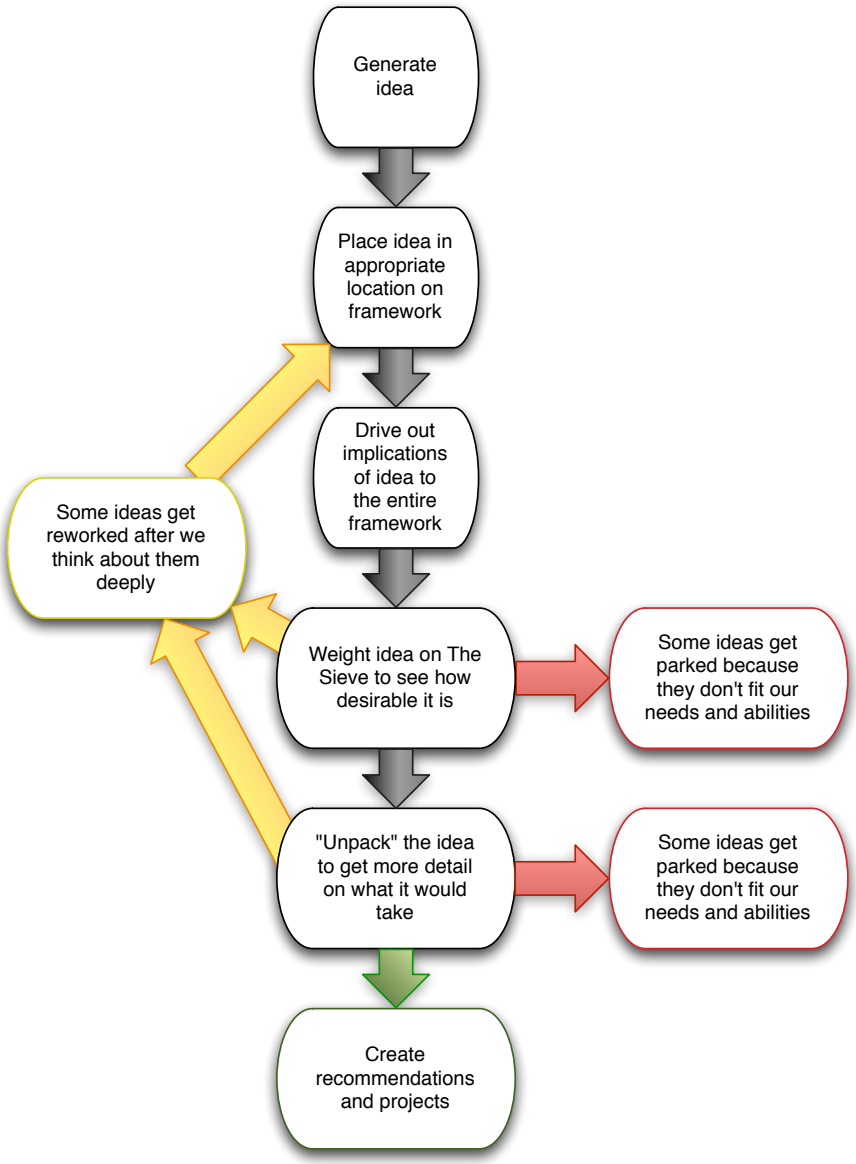

Figure 1: An overview of the NEC Process

The next four sections of this document contain detailed explanations and examples of:

- Our consultation process
- The Framework
- The Sieve
- Unpacking

Consultations

Government, NGOs, industry, and private citizens

Beginning in June, 2008, the NEC began a series of public consultations with government, non-governmental organizations, industry, and private citizens. As of this draft, the consultation processes have not yet been completed.

These consultations have three purposes:

1. To inform people that the NEC exists and is working hard to deliver a plan for relief from soaring energy prices and reliance on foreign economic and social policies
2. To listen very carefully to the energy problems people have encountered or expect to face in the future
3. To uncover good ideas, best practices, overseas connections, and local ingenuity that could potentially be applied to our situation, and to hand these ideas off to the NEC Process (see the previous section for a description of this process).

The NEC feels these consultations are vitally important. In other nations, where changes to the energy infrastructure has gone forward without public consultation, three formidable barriers blocked progress:

- Lack of public confidence in solutions
- Misalignment of potential solutions with problems
- Failure to capitalize on local talent, local ideas, and "built just for here" solutions

We believe that more consultations are better: the more we listen, the better our alignment with public concerns will be. We have also already seen the work of local heroes who, with determination and foresight, have begun to tackle energy issues at a personal level; the ingenuity and resourcefulness of these people are of very high value to the NEC in execution of its mandate.

The Framework: A Tool for Ideas Management

A blizzard of ideas

Although energy independence is the ultimate goal of the work of the NEC, to achieve this independence the Cook Islands will be forced to deal with a large, changing body of ideas over the next two decades. Nobody—from any country—knows what form energy independence will take or how to get there.

This has a profound implication.

In a very real sense, the core skill necessary for energy-management success will not be energy management itself, but rather the process by which we manage multiple technologies that make often-conflicting claims while we deal with multiple, high-priority demands from consumers. At this stage, we aren't wise enough to say what the solution looks like ... but we can easily envision the process we will use to develop the solution.

Characterizing ideas

As the National Energy Committee worked through the problems faced by the Cook Islands, we observed that "green ideas"—good and bad—come in a very limited number of forms. Here, drawn from our notes, are some actual statements we have heard from Cook Islanders during discussions on alternative energy:

1. *I saw a television show with an offshore wind project. You should do some research into that. It seems like the way to go!*
2. *The government should stay out of power generation. Pass a law to permit net metering. That's all you have to do.*
3. *Start a solar pilot project. Once people see how easy it is and how quickly they get paid back, they will readily adopt solar power.*
4. *Energy self-sufficiency is the most important thing.*
5. *We should be a net exporter of biofuels.*
6. *The Cook Islands should be a petroleum-free zone. We should make history by being the first nation on Earth to forego gasoline and diesel fuel in all forms.*

While the NEC doesn't necessarily agree (or disagree) with the ideas here, this collection of quotations illustrates the variety of forms ideas can take. The first is a research requirement, the second suggests legislative action, the third suggests a project, the fourth is actually a principle, the fifth is an industrial and economic outcome, and the last one is a vision of the future. All the ideas that have come forward to the NEC are one of these six types of statements:

- **Vision** (a grand statement of what we should be)
- **Principle** (a fundamental belief or foundational statement)
- **Outcome** (an end-result)
- **Information** (known facts or research required)
- **Action** (a piece of work to be done)
- **Policies and legislative actions** (work for the government to do)

The types of statements relate to each other; they don't stand in isolation. A desired outcome may be an implementation of a particular vision, be based on certain principles, require research and selected actions to be implemented, and be impossible without legislative support.

This observation allows us to represent the framework in which ideas occur with a rather simple diagram.

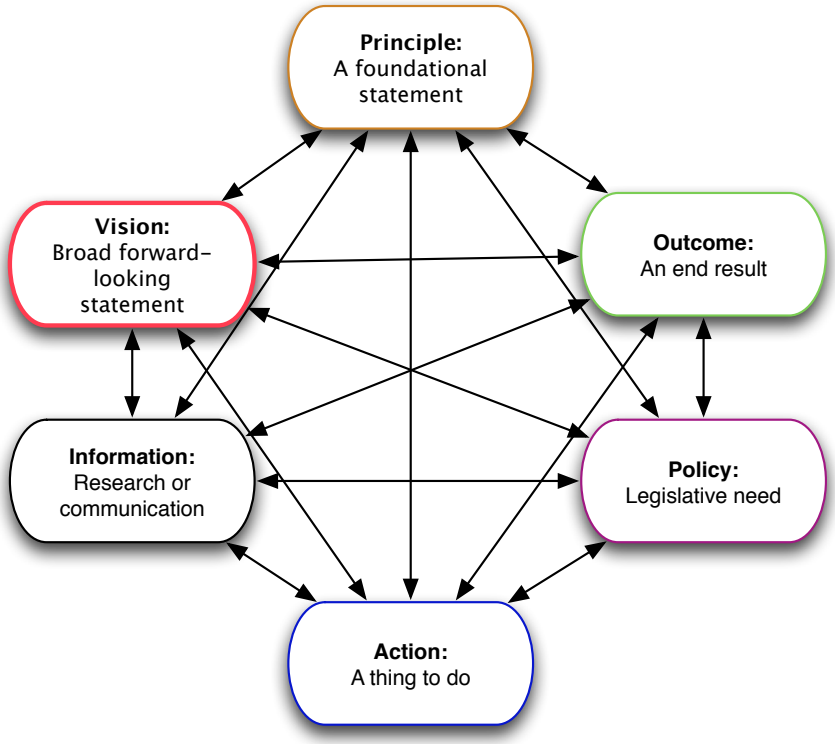

Figure 2: The NEC Framework

Although the diagram has rather a lot of arrows, they really only communicate the need to relate each type of statement to all the others; the example below will make the practical application of the Framework evident.

The Framework in action

The NEC has used this framework extensively to analyze ideas. The manner in which it is applied is straightforward:

1. When a new idea comes forward, decide what kind of statement it is: Vision, Principle, Outcome, Information, Action, or Policy.
2. Place the idea in that box.
3. Decide what that idea means for each other box.

Here's an example. One of the ideas offered to us was:

Impose a tax on import of high-consumption electrical appliances.

To understand the new idea—and whether or not it's worthwhile—we first must understand the implications of it. This is a legislative measure, but what else will we have to do to make use of it? Does it fit with our overall vision? To explore these—and other similar—questions, we place the idea on an empty version of the Framework:

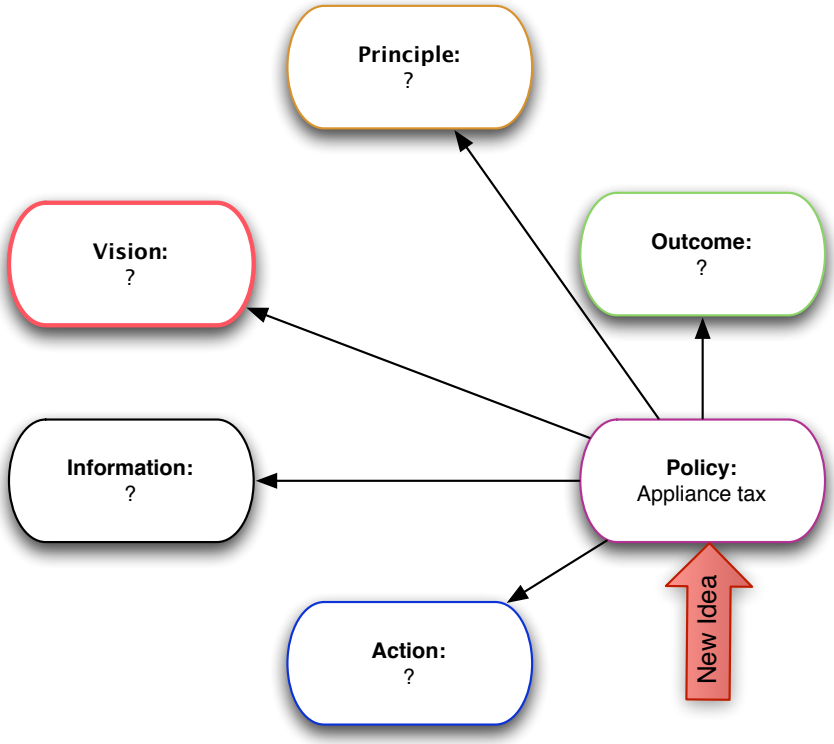

Figure 3: A Framework example

For each of the other five boxes, our hypothetical Appliance Tax would have an implication. The Appliance Tax might, for example, imply the existence of a Vision statement that reads, "Our energy use will be efficient and economical" and might be a manifestation of a Principle that says "We will use our joint purchasing power to influence the supply chain". It might produce several outcomes: the tax might cause importers to find energy-efficient appliances the best import choice, consumer demand for energy-efficient appliances might rise, and energy demand in the Cook Islands might grow more slowly. The policy would certainly have information requirements: research would have to be done to find an already-existing ranking system for appliances (many such have been created by others). Finally, some actions would be required: new standards would have to be published, brochures and Web pages would have to be prepared to communicate the new standards to merchants and

consumers, and some method would need to be developed to record serial numbers of unsold, high-consumption appliances that are already in merchant inventory, since these would probably be exempt. This would populate the framework so it looks like this:

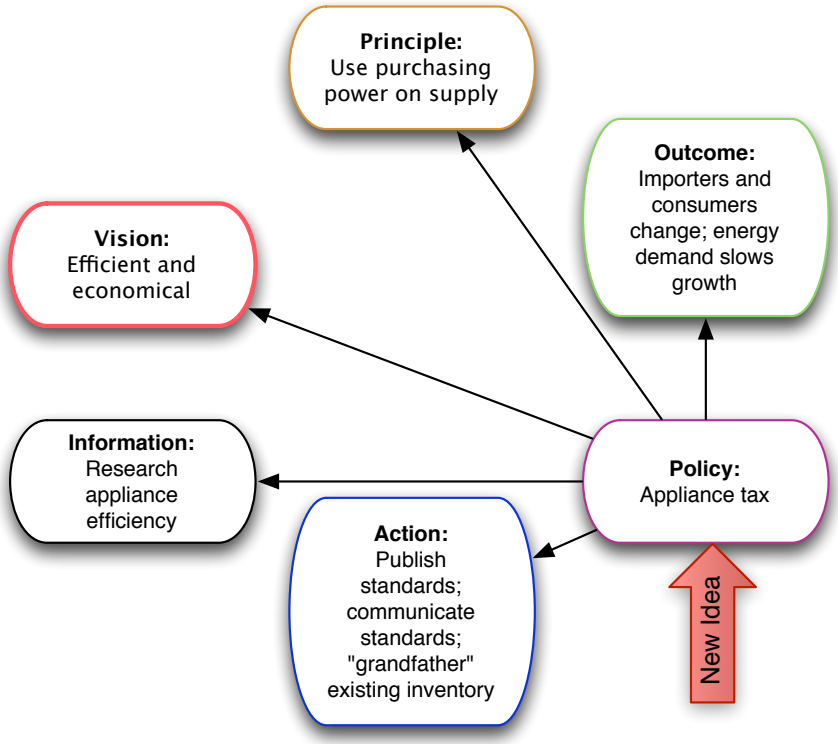

Figure 4: The example populated

In this way, the implications of any kind of idea can be explored fully. With very little work, we can form a regular picture of a large body of ideas and their implications.

What actions are useful?

Population of the Framework does not address the issue of the availability or efficacy of an idea. Although renewable energy is just beginning to come into its own, far more technologies and ideas exist than the Cook Islands can ever hope to embrace. Some are too expensive, some are too risky, some are too slow ... and some are just plain bad ideas.

The next section provides another tool that will allow us to discriminate among a large body of ideas and to choose ones that will help us the most.

The Sieve

What ideas should we implement? The NEC expended a considerable amount of debate on this issue, and finally settled on a strategic weighting tool that strains the best ideas out from the others. We call it "**the Sieve**".

The Sieve is driven by the things we care about. These things may be different at different times. For example, right now we probably want:

- To get started quickly
- To make some changes that are easily seen
- To make a difference, so that support for alternative energy builds
- To avoid technical and financial risk
- To avoid gigantic expenditures and mega-projects until a satisfactory direction is clear

With that in mind, we've created a version of the Sieve where we rank potential AE initiatives against three criteria:

- The **ease** with which we think a problem can be solved: Do we have the means within our grasp to cause a solution to come into being? For example, we can't do much about shipping costs from New Zealand: those will rise and fall with the price of petroleum and with a complicated set of human factors no matter what we do. Conversely, we might be able to make a little biodiesel locally.
- The **size** and/or importance of a problem: We're just starting out with our solutions. Very large problems or high-stakes problems might not be the best place to start; we may want to gather some expertise, success, and public momentum before we attempt massive expenditures. Of course, some problems will eventually be so urgent that we simply won't be able to wait.
- The **technical risk** inherent in a problem: We don't have the means at our disposal to perform significant original research into technologies and techniques. We will have some modest research to do, but we should attempt to confine it to assessing the appropriateness of technologies developed elsewhere. For example, would a wind-generator developed for the tops of Norwegian mountains have satisfactory meantime-between-failure intervals in our highly-humid, high-temperature, wind-volatile, salt-spray saturated environment?

Here, then, is the sieve with its axes populated to weight Problem Solvability against Project Importance and/or Size:

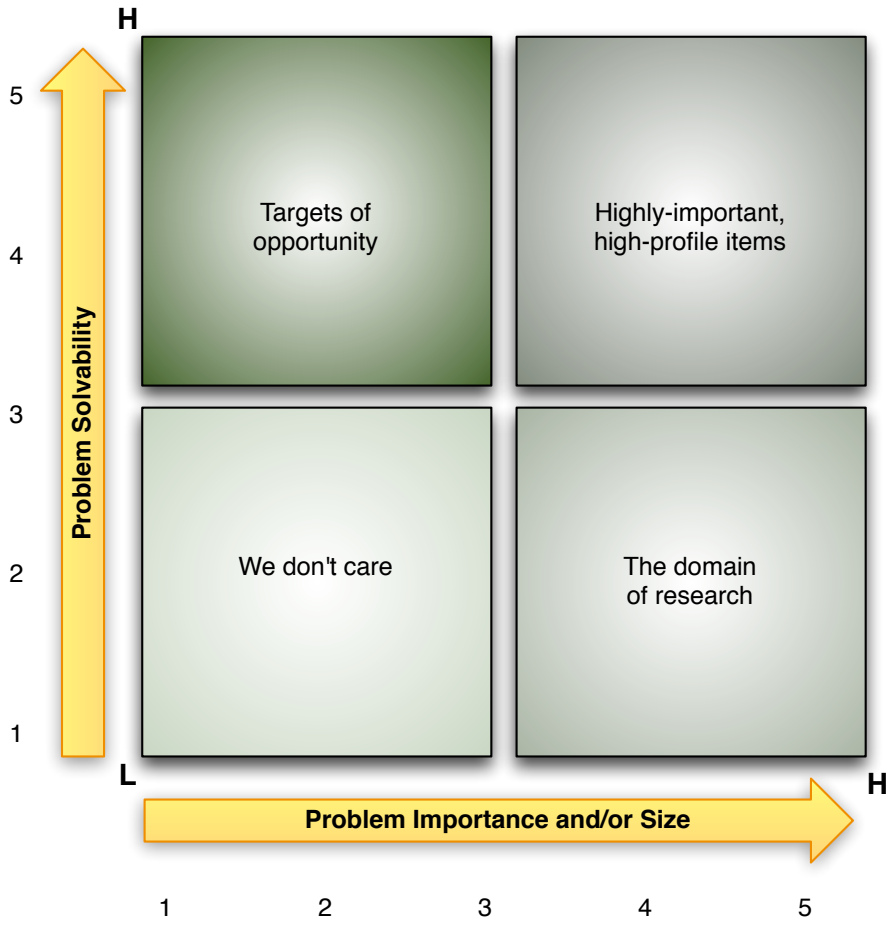

Figure 5: The Sieve, with axes appropriate for current concerns

(We should note that the **Sieve's** axes can be used to map against any quality we care greatly about. The current mappings have been chosen based on current need, but they can shift as our alternative energy strategies evolve.)

The labels on the quadrants are:

- **We don't care** (lower left): These unimportant, small issues can not be solved easily. We quite literally should ignore these issues. The effort to solve them is not, and probably will never be, worth the expense and effort. For example, most backyard barbecues use liquid propane gas. The effort and expense required to replace them with alternate-fueled devices (say solar cookers) are large: a solution would require

hundreds of thousands of dollars of new equipment, new fuel sources, and new supply chains. Yet a complete solution would have almost no effect on our national economy, the gross income and household expenses of our citizens, or on the welfare of our people. It's a problem that may solve itself in time, but we have other issues to deal with first.

- **The domain of research** (lower right): These extremely important problems offer no immediate solution. We cannot offer solutions right now, so we will have to rely on the world research community to solve them for us. For example, if we were magically to have enough solar capacity to meet all our power needs, how would we supply power when the sun doesn't shine? The traditional approach, to have large banks of batteries in which to store the power, isn't appropriate for an island nation. Batteries are expensive, heavy and hard to transport, and would create some serious toxic-disposal problems. Many countries have alternative solutions in pilot programs right now, including energy-storage in a hot-salt matrix, caverns of compressed air, or elevated tanks of water. We'll need to rely heavily on the work of others to develop solutions for problems like these, although we should also have the means to test new ideas in the local conditions when conditions warrant (Scientific American).

- **Highly-important, high-profile items** (upper right): These problems can be solved, but they are large, and likely to be expensive. To give an extreme example, we could replace Rarotonga's bus system with a solar- and wind-powered hydrogen light-rail transit system. It would generate no pollution, allow trains to run every five minutes, and vastly lower the net fuel consumed on Raro (not just because it would displace buses, but because it would be faster and more-convenient than cars). Other cities in the world have begun to do this already (Calgary, Alberta, Canada, has a windmill-powered light-rail transit system), but it is a solution outside our reach at the moment. When one of these highly-important high-profile, highly-solvable problems has a solution that is inexpensive and not risky technically, we should embrace the solution immediately. However, we should not expect such opportunities to be common.

- Targets of opportunity (upper left): These problems can be solved, and they are small and not terribly expensive. For example, our transit system's diesel engines could probably be entirely fueled by biodiesel generated from waste cooking oil currently being discarded by restaurants. Biodiesel is simple and inexpensive to make (in other countries, some households make their own), non-toxic, and easy to store. Pure biodiesel fuel requires modifications to the injectors of diesel engines, but no other significant change is required. When problems in this quadrant can be solved with

approaches that have low technical risk, we have to ask ourselves, "Why aren't we doing this now?

So far, the two-dimensional grid of the **Sieve** only allows us to assess the tractability and impact of potential solutions. How do we incorporate an assessment of risk into this tool?

Risk Ratings on the grid of the Sieve

We have chosen to use a five-point rating system for financial and technical risk:

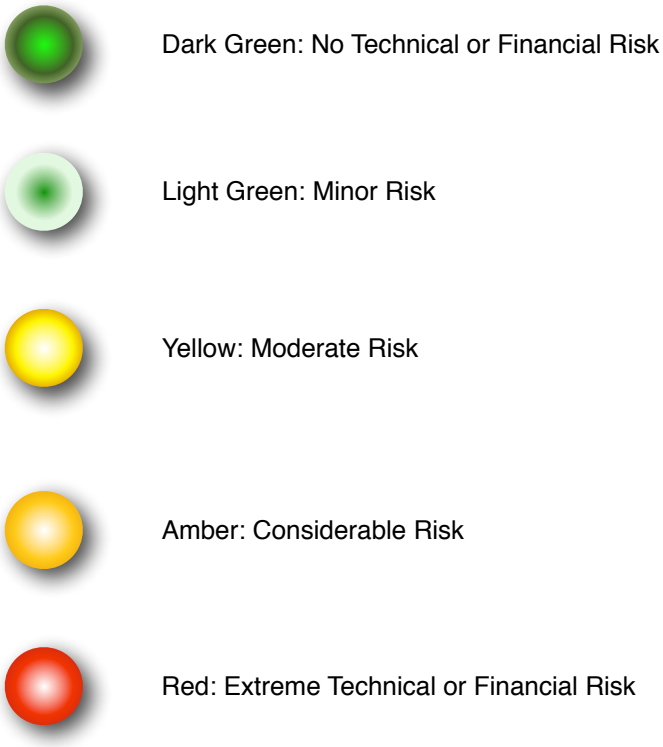

Figure 6: Risk Ratings

These risk-ratings allow us to evaluate an idea on the **Sieve** for the three criteria simultaneously, and they allow us to compare different ideas at the same time.

The Sieve applied

To work through a practical example, let's use the **Sieve** to evaluate the differences among four Alternative Energy ideas:

1. An extensive tidal power project that puts a micro turbine in every reef gap surrounding Rarotonga. Impacts on the reef are uncertain, particularly since the turbines will need to be secured in such a way that it will not be affected by large volumes of water or cyclone conditions.

2. A pilot project where a government office uses leased electric low-speed vehicles (with a maximum speed of 60 kph) instead of gasoline vehicles, and where the vehicle vendor guarantees to take back the batteries after they are depleted.

3. A classroom project that makes four wind generators out of old car alternators recovered from the bush, and then uses the generators and a donated inverter to sell power to the grid at the Displacement Cost of $1.21/kwh; this money is used to buy solar panels, which also sell power to the grid. The intent is eventually to make the school into a net energy producer. The idea presumes the Government has enabled full Displacement-cost Net Metering.

4. A resort that uses waste cooking oil and solar heat collectors to fuel fermentation of wind fallen fruit and coconuts to make methyl alcohol, which the resort adds to normal gasoline, thereby tripling the fuel efficiency of the resort's three vehicles. Although the project would pay for itself in 24 months, the chief gain to the resort is one of positioning. It helps them establish a reputation as a VERY green place to stay, and to appeal to a unique and growing tourist market.

To perform our analysis, we give each idea a ranking on each of our three criteria sets:

To see more easily how the ideas compare, and to see which ideas are most-tractable now, we can now place them on the **Seive**:

IDEA	PROBLEM SOLVABILITY	PROBLEMSIZE/ IMPORTANCE	TECHNICAL/ FINANCIAL RISK
1. Tidal Power Project	4. Above average	4. Fairly large	Amber: Considerable risk
2. LSVs in Gov't	4. Above average	3. Average	Yellow: Moderate
3. Class Generation Project	5. High	1.Tiny	Dark Green: None
4. Resort Fermentation Project	4. High	2. Fairly small	Light Green: Minor

The exact rankings of the different ideas could be debated (the rankings are real and have been given much thought), but that debate is outside the scope of the discussion on this page. The point of the example is to illustrate the fully-weighted **Sieve** in operation:

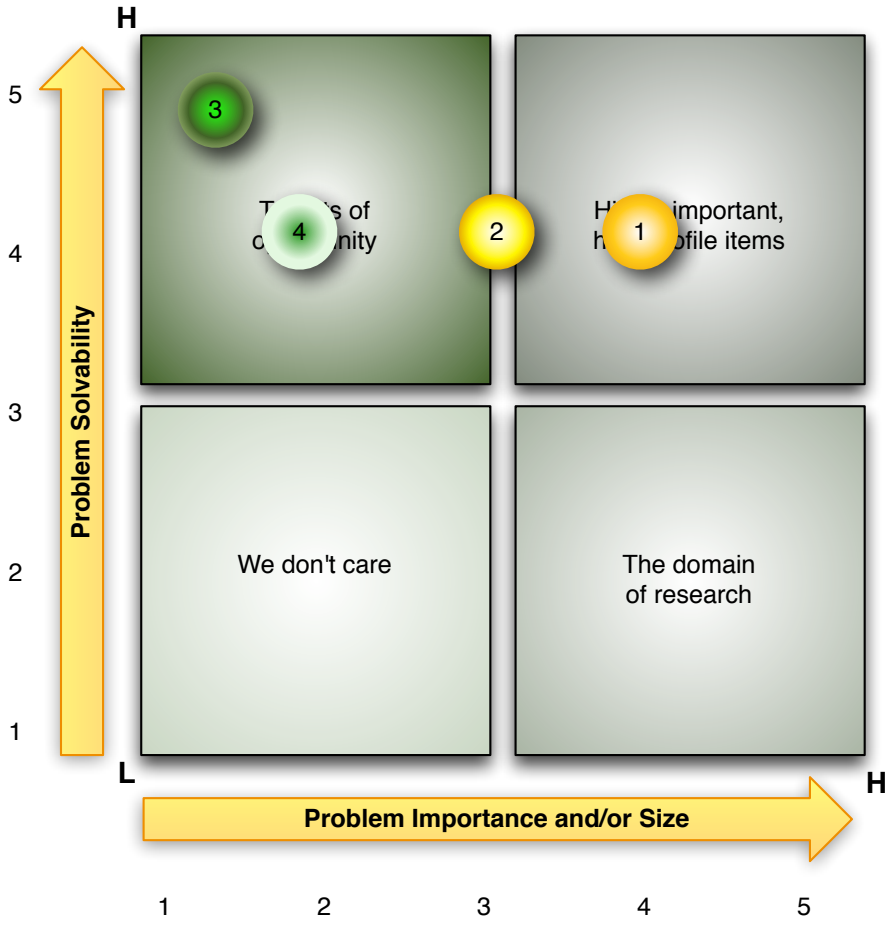

Figure 7: The Sieve with sample Risk Ratings applied

We can see that idea 3 (the class power-generation project) and idea 4 (the resort biofuel project) are easy to decide on: they are small, easily-solved problems with little technical or financial risk. Why would we NOT do them? Idea 2 (low-speed vehicles in government) is a bit tougher: the problem is a little bigger, a little more visible, and requires some careful negotiations with vehicle suppliers. As well, it carries some moderate financial risk, since a vehicle supplier who fails to follow-through on the battery take-back arrangement would cause us to incur considerable extra cost. Idea 1 (the Tidal Power project) is formidable. Although the problem is one that can be solved, it could cost millions. Further, it will require extreme technical care to be sure it does not accidentally harm the reefs or even impair their aesthetic value; the soundness of the anchors during cyclones will be extremely important. It is likely to be extremely controversial.

So, the **Sieve** helps us decide which ideas are the best candidates for action, but it doesn't yet tell us much detail what we have to do for a particular idea. For that, we must "unpack" the ideas: we must open them up and examine in detail what is contained inside each one.

Unpacking ideas

More detail in ideas

Once we have used the **Framework** to understand the implications of an idea and used the **Sieve** to discover how suitable an idea is for our present situation, we must next explore:

- What actions we would have to take to execute on the idea
- How to measure the success or failure of the idea during and after execution
- What person or organization might best execute an idea

The NEC has come to all this process "**Unpacking**": it's where we attempt to rough in some detail for an idea. Unpacking is best understood with a real-world example.

A critically-important component of alternative energy strategies in nations that have had some success is a concept referred to as "Net Metering".

A note: the since implementation of a full net metering program is an actual recommendation of the NEC, this material is repeated later in the document. Here, it's an example to help us understand unpacking, but it is repeated in our "Actions" section to keep all the recommendations together.

Example: Net Metering

A brief explanation of Net Metering is in order. The logic behind net metering is simple: given that an Energy-displacement Gap exists (see **Easy First Steps** later in this document for a discussion of this), different governments have given powerful incentives to private citizens and private businesses by simply passing legislation that guarantees the government will buy power at its own cost, and sell power at the Consumer cost (see the **Glossary** to understand these terms). At the time of this document, Rarotongans could buy power from the government at $.85 /kwh, but this same power cost the government $1.21 / kwh to produce. This latter price is referred to as the “Displacement Cost”: it’s the true price of power.

If the displacement cost is higher than the billed cost, every kilowatt hour is subsidized. The government is actually rewarding people who consume the most power, and paying for it with hidden subsidies drawn from the general tax base. This can be rapidly reversed through net metering, which would allow power meters to move more and more slowly at

the meter-head as a facility generates more and more power. Eventually, a consumer who produced more power than she could use could allow her meter to be run backwards. In a given time-interval, if the consumer produces more power than she consumes, she is paid the government's full Displacement Cost for her excess power. At the end of the month, the government would be obligated to send a cheque to the consumer ... and why not? If the government spends $1.21 to generate a kwh, why not pay its citizens that same price to put that same kwh into the grid? The government then acts as an electricity clearing house, selling power from one consumer to another at no profit. Nations that have tried net metering rapidly discover that consumers are very anxious to drop their power bills to zero, and to have the sun and the wind make money for them. Typically, governments will subtract the cost of tracking the power and maintaining the transmission system from the Displacement Cost fee paid to consumers. This is generally viewed as reasonable: to get a pig to market, you'll have to pay someone with a truck, and to get your power to market, you'll have to pay someone with a power line.

The example, part 2: Steps in net metering program

The analysis above only would take us so far. We'd have to do some real work to implement a basic net metering program:

1. Analyze real vs. actual costs from the existing information stream
2. Decide what costs to include in our Displacement Cost figure (fuel, maintenance, labour, and others)
3. Decide what costs to exclude from our Displacement Cost figure (transmission lines, administrative overhead for the net metering program)
4. Develop a process to monitor Displacement Costs and Consumer Costs on an ongoing basis
5. Develop a fair and open pricing mechanism that reacts to changes in the difference between the two costs in a reasonable time without being needlessly confusing or too detailed
6. Use local expertise, paid expertise, and the Internet to source metering equipment
7. Use local expertise, paid expertise, and the Internet to source inverters and related equipment

8. Publish standards for inverters and meters to be certain that only useful equipment is connected to the grid
9. Find local volunteers to act as pilot projects
10. Set pilot project measurements and goals
11. Publish installation standards for net metering sites
12. Develop and deliver inverter and meter training programs for local electricians
13. Establish and maintain a registry for trained installers
14. Operate and measure pilot projects (probably on a perpetual basis)
15. Collaborate with the NEC information initiative to communicate results of net metering pilots
16. Use standard cost models to analyze benefits of net metering
17. Inform policy-makers of results of pilots and studies (ongoing)
18. Based on local experience and a brief examination of net metering legislation in other countries, recommend wording of legislation to government
19. Source bulk purchases of net metering equipment for island vendors

The example, part 3: Execution

A net metering initiative is typically executed by a combination of:

- Legislative measures (permissions and standards)
- Technical oversight
- Marketing and public relations

The easiest path is probably to form a small team of two or three people inside government. The team should be charged with moving the net metering initiative forward as quickly as possible.

The example, part 4: Measurement

To measure success of the setup activities for net metering, we should track and publish numbers to measure:

- Time from foundation of the net metering team to the first pilot project
- Time from foundation of the net metering team to delivery of the "go ahead" to the public
- Time from foundation of the net metering team to publication of a full Displacement Gap study and price recommendations
- Time from foundation of the net metering team to passage of necessary legislation
- Time from foundation of the net metering team to the date when net metering hardware is available to the public

To measure ongoing success of net metering we should track and publish numbers to measure:

- Percentage of electrical installers trained on net metering installs
- Percentage of total electrical generation delivered through net metering
- Median change in domestic energy bills from net metering
- Median change in commercial energy bills from net metering
- Percentage of electrical meters being used for net metering

Key Issues

As it has done its work, the NEC has come across facts and issues that are necessary to understand the current energy situation in the Cook Islands. We expect this list of issues to shift a bit as we continue to consult stakeholder groups.

Strongly-emotional views

In our public consultations, we often heard (and continue to hear) strong moral and political views. "We must save the planet," "Oil companies are evil," or "Carbon credits are a stupid idea."

We find no need to debate such points—on either side of the alternative energy "divide". Some opinions are no doubt correct; others certainly are not. In most cases, though, we need neither the ambition nor the wisdom to resolve them. We simply need to compare the true societal cost of our current energy production to the true societal costs of alternative energy production: if alternative energy is cheaper or more practical in some significant manner, then we can begin to adopt it. Our studies indicate enough economic advantage for alternative energy that, by the time we look after our health and livelihood, our contributions to "saving the planet" (whatever they might be) will take care of themselves. Countries with access to cheaper energy are not in such a position of luxury: they often must decide between the "practical thing" and the "moral thing". The NEC believes the Cook Islands has fewer choices. Our situation is certainly more dire, but our path forward is more clear, since the time for debate has certainly passed.

Energy impact on the food stream

Over the last two decades, food costs in the Cook Islands have risen to command a much-larger than traditional share of household incomes. In the first instance, consumption has shifted dramatically from local small-holding produce to foreign, factory-farmed, processed and shrink-wrapped foods. This has dramatically raised the amount of energy embodied in the foods we consume: tractors and fertilizer are inherently more petroleum-dependent than traditional methods of husbandry. These days, food embodies energy.

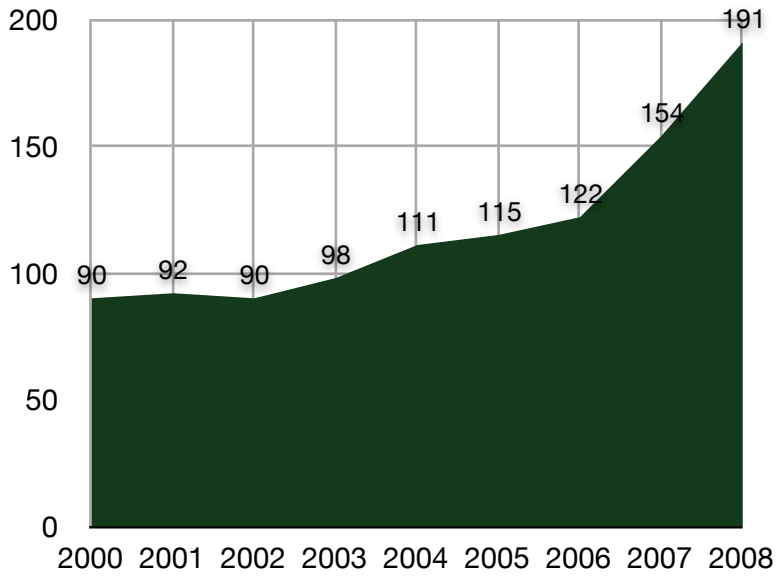

Figure 8: Cook Islands Food Price Indices

While food prices globally have increased in cost of production, the Cook Islands experiences larger increases from the FAO food index primarily due to the transportation and storage costs of food being much higher than in other parts of the world. Since 2004 the Currency Adjustment factor and Bunker Adjustment Factor for international freight has had increases of over 100%.

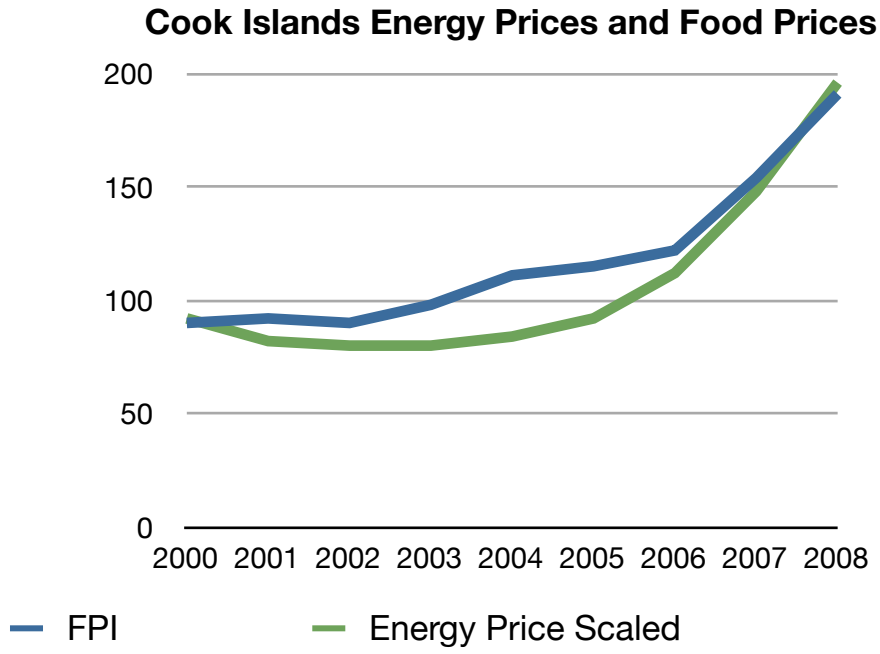

Figure 9: Correlation between food and energy prices in Cook Islands

In Figure 9 (above), energy prices and food prices are plotted on the same graph. The energy price has been scaled to make it visible on the same graph as food prices, but the correlation is clear. In fact, the relationship is not just correlative: it is causative.

Case study: Energy impact on a family of four

Families in the Cook Islands are under a good deal of financial stress, largely caused by higher costs that are driven by energy issues. Average income has not changed much, but spending pressures have:

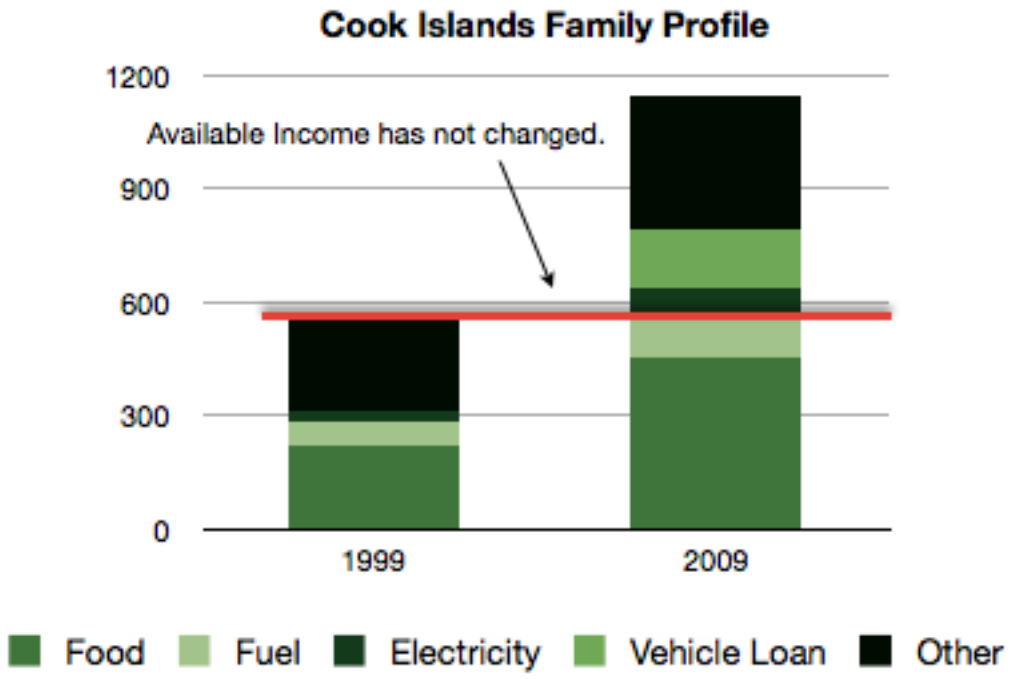

Figure 10: Financial stresses on Cook Islands families

This case study is based on data drawn from an interview with a typical Cook Islands family.

In the year 1999, this typical Cook Island family of four had a total net income of $560 per week. During that week, the family would spend $220 of its income on food, $65 on petrol and diesel, and, with a home energy consumption of 70 kwh per week, about $25 on electricity.

Fast forward to 2009. Expenditures have increased remarkably, but the family weekly income remains $560. The children are growing up and the entire family wants more

entertainment, which has resulted in higher home energy consumption: about 112 kwh per week. Since electricity rates have increased with world oil price increases, the lowest possible domestic price is 0.86 cents a kwh. and with the increased consumption the home now has a total electricity bill of about $85 each week ... an increase of nearly 300%.
To manage to stay ahead of the curve, the family has borrowed from the bank using family land as collateral. This debt has been created to purchase a larger 4 wheel drive double cab pickup, and this vehicle has now become the main mode of transport for the family, which has increased fuel consumption despite the vehicle's better fuel efficiency than the previous 1988 4 cylinder Mazda Capella.

Food is more expensive too. Here is a snapshot of changing consumables prices over a decade, from 1999 to 2009[1].

COMMODITY	1999	2009
Rice (500 gm)	0.78	2.15
Sugar (1.5 kg)	2.64	4.44
Banana (12)	1.80	6.12
Butter (1 lb)	2.79	5.58
Bread (1 loaf)	2.51	4.70
Milk Powder (900 gm)	8.49	13.09
Petrol (1 litre)	1.16	2.56
Electricity Unit (1 kwh)	0.23	0.86

All the items listed above require energy to produce transport and store, and though many commodities have not increased as much as expected in the Cook Islands, this is partly due to increased competition in the grocery business and to lower import levies on most food products in 2005. If the 2009 figures included 1999-level import levies, then items would be far more expensive.

Do not underestimate the seriousness of this family's situation: it is dire. To maintain its modest lifestyle, the family spends more than it takes in, and covers the difference with a "cash advance" given at the time the vehicle loan was made. This cash advance, too, was secured with a lien on the family's land: sadly, the interest rates are many times higher than the current world average interest rates.

The prospect of paying high interest on a secured loan is something that the family had not really considered. These stresses are just beginning to affect this small family: **the true impact will manifest itself during the working lives of the children**, who may be forced to sell the family land and to choose emigration to eliminate the accumulated secured loans.

[1] Source: Cook Islands Government

Energy costs are the primary contributor to the higher costs of living. This is a near-certain recipe for further depopulation, particularly in the outer islands.

Dependence on world markets in a volatile economic period is undesirable

Two centuries ago, the trail of production for the goods to feed, shelter, and clothe the roughly 25,000 Cook Islanders didn't lead far offshore. Although the Cook Island trade-canoe routes are famous, the actual mass of goods moved through that route was relatively small. By most definitions, we were self-sufficient and self-contained. Today, however, a vast majority of our clothing, food, building materials, and transportation comes from thousands of kilometres away.

This is the case for most modern people—even in the poorest of nations—and analysts don't expect this to change. However, at the heart of all these goods is a very heavy reliance on petroleum production and on supply lines that lead into the politically-volatile Middle East. As petroleum gets more scarce, the volatility will increase. This will send the prices of petroleum—and the production of goods and services it supports—climbing rapidly.

Difficulty of calculating total energy costs

Total cost of ownership of the diverse electrical-production mechanisms on the Cook Islands is very difficult to define. What things should be considered to be component costs of a unit of electricity? Certainly, the fuel itself, the generation facility, and the power-transmission lines. What about the cost of land, the labour involved in maintenance, the cost of fuel storage, the cost of clean-up after fuel storage, the disposal of fuel drums, and the cost of fuel spills? What about damage from seepage out of underground tanks into water aquifers? What about spills into lagoons and damage to our reefs? What about the tariffs that protect the line of supply?

The problem is far from simple. Most countries have great difficulty with an accurate calculation of the real cost of domestic electricity.

This is a critical first step in a rationalized energy program for the Cook Islands. To know whether wind, solar, micro-hydro, biofuels, or some other generation method are economical, we must first understand what our baseline costs for "traditional" electricity are. Without this, we can't make good decisions.

The Cook Islands operates an energy tariff deficit

When the electrical bills go out each month, most countries do not charge the full cost of electrical production, but rather bill out at a lower, subsidized price. This is partly motivated by a desire to keep consumers happy, but it is also partly a practical matter: electrical production costs are volatile, and consumers do not react well to moment-by-moment fluctuations in price. A slight difference between the real price is therefore inevitable. However, the difference between the consumer cost and the true must be made up somewhere, either as higher taxes or as an accumulating debt.

Spain provides us with a cautionary tale. For years it has maintained a tariff deficit, and is painfully trying to unwind the practice. Spanish electricity consumers have racked up a staggering €14 billion debt (not including the interest), merely by turning on the light switch.

In collaboration with TAU, the NEC has worked for some months on an initial estimate of true electrical costs in the Cooks. We have arrived at a tentative per-kilowatt-hour cost of $1.21.

Though the numbers have yet to be fully quantified, the NEC believes, based on the data at hand, that the consumer-electricity deficit is a massive and alarming 57%.

We know this cost is quite probably incorrect, but we are quite sure that it is not low. But even if we were to halve this figure to 25% or approximately half the numbers to date, it would still mean the Cooks present methods of electrical production could not continue under the current fiscal arrangement. No country would be able to sustain such a margin.

The true cost of diesel-generated domestic electricity is unknown

In 2009 the billed domestic price of electricity varied, but was, for a period, $.86/kwh on Rarotonga. This price includes some portion of the operating budget for electrical generation, most (but not all) of the fuel cost, some (but not all) of the cost of the generation facility and power lines, and none of the indirect costs of storage and environmental cleanup. It also excludes transmission inefficiencies/losses of 13%, very high transport costs to the outer islands, and replacement generators paid out of aid monies. As this price exists today, we hypothesize the constituents of the currently-billed 86 cents/kwh probably look something like this:

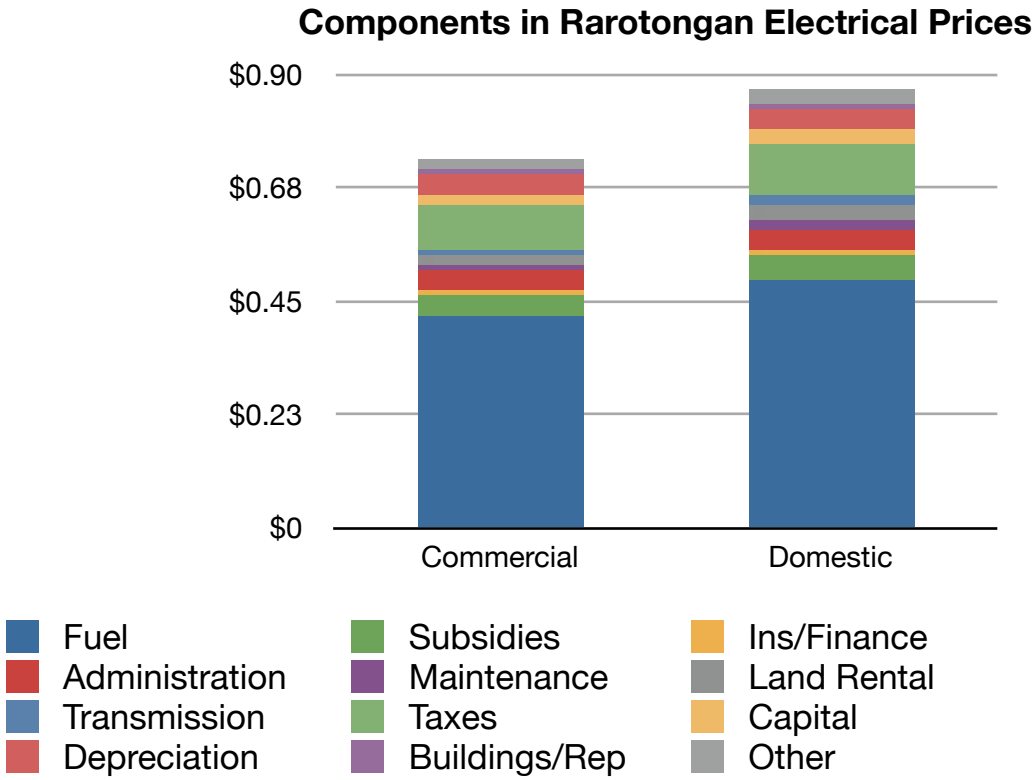

Figure 11: Components in Rarotongan billed energy prices

The true cost of domestic electricity is usually referred to as the "Displacement Cost": the amount the government would save in total if the power simply did not have to be generated at all. This is a rather more-complicated number that the Consumer or Retail Cost, so it follows that as much as we are unsure about the constituents of the Consumer Cost, we are even more unsure about the constituents of the Displacement Cost.

However, in July, 2008 the Cook Islands government performed a brief study that suggested the Displacement Cost of electricity in the Cook Islands averaged out at $1.21/kwh. We are still gathering historical data and making projections, but we expect the gap between the billed cost and the Displacement Cost of electricity to continue — and to grow — if current trends are not reversed, if only because consumer tolerance for visibly-inflating energy costs is limited.

Our current best data suggests relative direct and indirect costs for the Cooks looks something like this (source: TAU—excludes investments for the outer islands):

ISLAND	DIRECT	INDIRECT
Rarotonga	15,105,601	3,776,400
Aitutaki	2,474,550	824,850
Mangaia	355,854	237,236
Atiu	398,940	265,960

Mauke	379,786	310,734
Mitiaro	110,105	110,105
Palmerston	44,603	66,904
Suwarrow, Nassau, Pukapuka	77,607	77,607
Rakahanga	59,048	59,048
Manihiki	220,280	220,280
Penrhyn	172,874	172,874

Impact of alternative energy would be great here. In high volumes, thin-film photovoltaic panels can be purchased at $US0.99 or less, and these prices can be expected to drop even further. Inverters and supporting infrastructure remain expensive. But even so, national-scale photovoltaic power — including all infrastructure and transportation to the Cook Islands — has been the cheaper alternative for at least a decade.

Cook Islands energy costs represent an opportunity

Like every other place in the world, the Cook Islands have seen a more-or-less continual escalation in electrical energy costs.

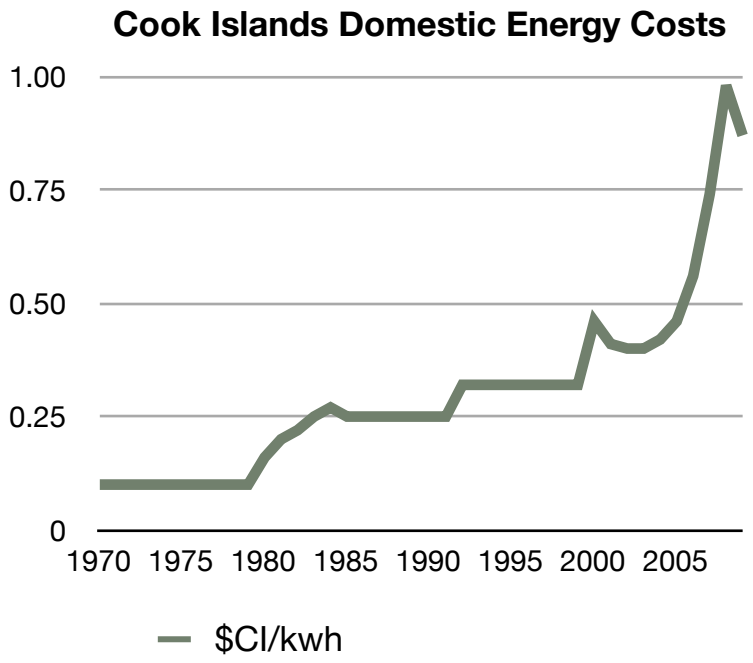

Figure 12: Historical Cook Islands Energy Prices

In the year 2002, the average household spent $56.87 on electricity at $0.19/kwh. In the year 2008, the same level of consumption would cost $223.89 at $0.86/kwh.

This represents an increase of approximately 293% ... and it doesn't allow for the increases in consumption that are nearly universal among all Cook Islands households. The family-of-

four case study is certainly more typical than not. Even further, the baseline electrical rate represents the cheapest-possible current rate: higher-volume consumers will generally pay more. And, as we have pointed out above, the real cost of electricity in the Cook Islands — allowing for tariff concessions, hidden subsidies, and indirect costs — is much higher, certainly at least $1.21/kwh on Rarotonga and two to four times that on some of the outer islands.

How is this an opportunity?

Simply put: fossil-fuel power in the Cook Islands costs at least twice as much as wind or solar. Even in North America, where electricity costs run from $0.06 to $.18 per kilowatt hour, solar power is beginning to contend with traditional fossil-based production for cost-effectiveness (see, for example, "A Plan for a Sustainable Future", Scientific American, November, 2009) . If solar and wind can compete with $.06 power, how much more-competitive could it be here in the Cooks where our true power cost is well over $1? This is especially true because return-analyzes are based on amortization schedules that generally run from 10-15 years at most, and solar panels will keep on producing—without any consumables at all—for thirty years or more.

Not only is the Cook Islands' energy cost growing at an increasing rate, but the gap between world energy costs and CI energy costs is increasing. This is because the Cook Islands depends almost solely on diesel-generated electricity, and the world generates electricity using fossil, hydro, coal, nuclear, geothermal, solar, wind, tidal, biomass and a host of other techniques too numerous to list here. Diesel-generated electricity is, at the moment, among the least-economical and most price-volatile generation methods. Newly-applied economies keep the slope of the world's average energy cost at a moderate rise rate, but electrical energy in the Cook Islands is solidly tied to what some see as the "worst-case scenario": diesel.

The gap between Cook Islands power costs and power costs in the rest of the world gives us an exceptional amount of purchasing leverage for each consumer. Alternative energy has been affordable in the Cook Islands for at least a decade. We are in the fortunate position to be able to amortize the cost of energy independence more-rapidly than almost anywhere else in the world.

Initiatives

Not all ideas make the grade, but all ideas are heard: we start with 15 with more to come

As we have mentioned above, the NEC has been collecting ideas for nearly two years in its internal sessions, as part of stakeholder meetings, in public consultations, and through casual conversation with committee members. Not all these ideas are recommended actions.

However, an important part of the work of the NEC is to listen to, record, and assess all ideas that are brought forward; an idea that is recorded but not recommended is still a valuable piece of information, because it tells us a lot about the current attitudes of citizens and about our situation and the sorts of ideas that will (and will not) be useful. At the moment, we have roughly 120 different ideas collected in a database. This is far too many for such a small nation!

Using our ranking tools and the **Sieve**, we have identified a small number of ideas that can solve important, approachable problems with low-risk initiatives. These initiatives are described in the following pages. The NEC has analyzed each of these initiatives, and has prepared a summary for each that outlines the next steps to take in quite a bit more detail than is presented in this summary-level document.

These initiatives do not represent the complete path to energy independence for the Cook Islands: that will require a much larger implementation, incorporating many of our 120 initiatives. These first steps, however, are the actions our analysis tools have indicated will be possible, palatable to our people, and will make a difference quickly.

1. Adopt net metering and post-production incentives

Recommendation: **Immediately pass legislation that will allow consumers to run their meters backwards, and, if a meter shows a net loss during a billing period, to require the power authority to send the consumer a cheque for the amount of extra power produced at the same price it would cost the government to produce: the full Displacement Cost.**

Recommendation: **Work with aid agencies to offer post-production incentives for power —above and beyond the Displacement Cost—to help amortise solar panels and wind generators.**

Explanation

At the time of this document, Rarotongans could buy power from the government at a minimal base rate of $.86/kwh, but this same power costs the government more to produce. This is an undesirable situation: since every kilowatt hour is subsidized, the government is actually using the tax base to reward people who consume the most power. This can be rapidly reversed through net metering, which would allow power meters to move more and more slowly at the meter-head as a facility generates more and more power. Eventually, a consumer who produced more power than she could use could allow her meter to be run backwards. In a given time-interval, if the consumer produces more power than she consumes, she is paid the government's full Displacement Cost for her excess power. At the end of the month, the government would be obligated to send a cheque to the consumer ... and why not? If the government spends $1.25 to generate a kwh, why not pay someone else that same price to put that same kwh into the grid? The government then acts as an electricity clearing house, selling power from one consumer to another at no profit. Nations that have tried net metering rapidly discover that consumers are very anxious to drop their power bills to zero, and to have the sun and the wind make money for them. Typically, governments will subtract the cost of tracking the power and maintaining the transmission system from the Displacement Cost fee paid to consumers. This is generally viewed as reasonable: to get a pig to market, you'll have to pay someone with a truck, and to get your power to market, you'll have to pay someone with a power line.

Further, because we want to give strong motivations to consumers to produce their own power and to reduce their consumption as much as possible, we will seek a way to offer post-production incentives to consumers. When a consumer installs grid-tied solar panels or wind generators, we will offer a premium price for power put onto the grid of $2/kwh until the solar panels or wind generators have been paid for at the differential rate between the displacement cost and the post-production incentive. So if a consumer spends $1000 on a solar panel and the displacement cost is calculated to be $1.25/kwh, we will pay that consumer $2/kwh — a bonus of $.75 /kwh — for the first 1333 kwh. This will offset the cost of equipment for consumers. Unlike a simple grant or subsidy, however, it will create a strong culture of independence and conservation.

Assessment

IDEA	PROBLEM SOLVABILITY	PROBLEMSIZE/ IMPORTANCE	TECHNICAL/ FINANCIAL RISK
Adopt Net-metering	4	4	Yellow: Moderate

2. Determine power-cost metrics and funding models

Recommendation: **Immediately form a National Working Group on Energy Costs to determine the true cost of power production in the Cook Islands. This group will publish its report in the first quarter of 2010. As part of this report, the group will create a simple process to monitor the cost of power production on an annual basis, and tie it to world production rates. This cost of power production will be the cost at which the government will buy power from consumers who produce more than they need.**

Explanation

This permanent working group should monitor costs of energy services in the Cook Islands and compare the costs to benchmarks for energy technologies around the world. The primary goal is to understand the true costs of power — referred to as the Displacement Cost — but also to understand which technologies perform best economically at the individual, community, and civic scales. This is easier than one might think; the scale of the Cook Islands makes comparison to the more-accessible civic programs an extremely useful activity. Actions should include:

1. Analyze real vs. actual costs using data from the existing information stream
2. Decide what costs to include in our Displacement Cost figure (fuel, maintenance, labour, and others)
3. Decide what costs to exclude from our Displacement Cost figure, if any
4. Develop a process to monitor Displacement Costs and Consumer Costs on an ongoing basis
5. Develop a fair and open pricing mechanism that reacts to changes in the difference between the two costs in a reasonable time without being needlessly confusing or too detailed

In some parts of the world, alternative energy enhances the value of a property. This is most likely true in the Cook Islands, but we don't know for sure. This working group will also

model multi-decade life-cycle costs of comparable houses with and without alternative energy, and track them over a period of time to see if this is the case.

The results of this should be shared freely with homeowners, banks and realtors.

Recommendation: This National Working Group on Energy Costs should analyze the cash-flow within the current power-payment infrastructure. It should determine points at which a displacement-cost and post-production incentive approach will require external funding, and should make recommendations on how this funding might be secured.

Explanation

Although the end-result of the National Energy Committee's efforts will create a vastly cheaper energy-provision structure for the Cook Islands, we expect to spend more in the near- and mid-term to reach this cheaper structure. The payback for this expenditure will be manifold, but we must secure financing to cause this to happen.

In particular, we must find sources for homeowner and small-business loans to enable them to install grid-tied equipment. See Item #1 for details on how funds will be channelled through post-production incentives.

Among the sources to consider for funding are:

1. New tariffs or shifts of existing tariffs
2. A modest carbon tax, particular on airline flights
3. Foreign aid
4. Low- or no-interest loans from equipment suppliers
5. Sale of carbon credits
6. Redirection of existing indirect, subsidisation expenses from traditional, diesel power production to modern, renewable power production

Assessment

IDEA	PROBLEM SOLVABILITY	PROBLEMSIZE/ IMPORTANCE	TECHNICAL/ FINANCIAL RISK

Cost Metrics and funding models	3	4	Yellow: Moderate

3. Establish standards for alternative energy generation

Recommendation: Immediately establish a working group to set standards for distributed-power equipment. Before the end of 2009, this group will be required to publish a list of approved equipment and approved offshore suppliers for solar panels, wind generators, and inverters.

Explanation

Not all power equipment is suitable for a net-metering environment. The type, capabilities, and measurement tools associated with inverters are particularly important. This working group will ensure that all equipment hooked to existing power grids will be useful, well-made, and compliant with the highest standards.

As part of this effort, we will establish new standards for meters and meter-reading to permit net-metering and post-production incentives. We will also develop a set of templates for small residential, large residential, and small business installations.

Recommendation: Work with experienced purchasers from the business community to make national-level buys of approved, critical equipment. Resell this equipment to consumers and businesses at cost.

Explanation

Consumer-grade solar panels are commonly sold for $US 10/watt, but large-volume purchases of emerging, economical technologies are available now for $US 0.99 /watt. Similar price differences can be found for wind generators, inverters, monitoring devices and storage.

The difference between a successful and a failed national implementation may well be careful sourcing.

Assessment

IDEA	PROBLEM SOLVABILITY	PROBLEMSIZE/ IMPORTANCE	TECHNICAL/ FINANCIAL RISK

Standards for facilities	3	3	Light Green: Minor

4. Immediately pass monopolies legislation

Recommendation: Before the end of 2010, the government should pass anti-monopoly legislation for wind generators, solar panels, inverters, micro-hydro and tidal turbines and other important infrastructural equipment. In particular, the equipment listed by the working group on distributed-power standards should be protected.

Explanation

Since we expect very few suppliers to be found in some categories of consumer alternative energy equipment, we want to be sure that singular commercial interests do not sign exclusive distribution rights agreements for strategically-important technologies. Human nature being what it is, the emergence of monopolies in this area is almost inevitable, and yet such monopolies are counter the the national interest. We have been distressed to see the number of people who come forward in our consultations with the very obvious intent of securing monopolistic relationships with key suppliers.

Assessment

IDEA	PROBLEM SOLVABILITY	PROBLEMSIZE / IMPORTANCE	TECHNICAL / FINANCIAL RISK
Monopoly Legislation	2.5	5	Dark Green: None

5. Adopt an official "Transportation Migration" strategy

Recommendation: Pass immediate legislation to set fuel-economy standards for new imports.

Recommendation: Research and publish a fuel-economy guide for new imports, and make this research available to all consumers (this work has already been done by most industrialised nations).

Recommendation: Provide tax incentives for consumers who buy vehicles in the top 10% of the fuel economy guide.

Explanation

Whereas the world is going to move rapidly towards alternative-fuel vehicles, the government must create powerful incentives in the Cook Islands for consumers to lead in this adoption, and introduce new legislation to lower our dependence on fossil fuels for transportation. As the Cook Islands adopts alternative energies, we will almost certainly move towards alternative vehicle fuels. This may be electrical vehicles charged from wind, solar, or tidal power, or it may be internal-combustion vehicles that can run on fuels from supply lines we can control (non-destructive biofuels, for example). However, this is going to take a bit of work. The steps to do all this are complicated. In the meantime, we can see some early wins, including the actions above.

Recommendation: In 2010, the government should pass a bill to make electric low-speed vehicles legal on all islands. To prepare for this bill, the government should strike a National Working Group on Low-speed Electric Vehicles to recommend at least three brands of electric low-speed vehicles, and to base the wording for an enabling bill on similar legislation elsewhere.

Recommendation: Based on the recommendations of the National Working Group on eLSVs, the NEC should contact leading manufacturers of eLSVs to negotiate a bulk purchase price of these vehicles for consumers.

Recommendation: Pass legislation to make import of all forms of LSVs tax free.

Recommendation: Pass legislation to provide a subsidy for all electric vehicles that will be charged at residences or businesses that use alternative energy.

Explanation

Electric low-speed vehicles (scooters, cars and trucks) are much much cheaper to run that petroleum fueled vehicles. They have a top speed higher than the maximum speed on Cook Islands roads, and have a range suitable for several circumnavigations of the largest islands; no practical barrier exists to their adoption, and the technologies have been proved for decades in campuses and industrial parks around the world.

We would have to find a way to convince the manufacturers to take back the batteries. As well, these vehicles don't help us much if they are charged with diesel-generated electricity,

so the working group will be charged to recommend a subsidy or tax refund for electric LSVs for those homes that elect to generate their own electricity.

Because LSVs are only manufactured in low numbers right now, the Cook Islands would have relatively significant purchasing power by becoming an early, high-volume adopter of this technology. This opportunity will not last long. At the same time, the NEC will seek and secure technician training for the servicing of these vehicles, and will negotiate a battery and chassis take-back program that will remove all post-consumer waste from the Cook Islands.

Assessment

IDEA	PROBLEM SOLVABILITY	PROBLEMSIZE / IMPORTANCE	TECHNICAL / FINANCIAL RISK
Transportation migration	4	5	Dark Green: None

6. Begin carbon-credit refunds to consumers

Recommendation: **In 2010, the government should secure enough information from a qualified external consultant to allow the Cook Islands to sell carbon credits from commercial and alternative energy placements. Once this is secured, the government will amend its Net Metering Act to ensure that carbon credits generated by a consumer-owned carbon-free facility result in benefits directly TO that same consumer. The goal will be to issue the first refunds in 2010.**

Explanation

In short, if we can find a way to sell carbon credits you create with your solar panel, windmill, or other device, we should sell the credits for you and make sure you get the benefit.

The Cook Islands may have an opportunity to generate revenue with carbon credits under the Kyoto accord or under new and emerging legislation. The NEC is currently creating a list of consultants qualified to give an opinion how best to do this, and is seeking brokers to make sales on our behalf. The government should have a plan in place to fund this consulting work from agencies outside the Cook Islands at no obligation to our taxpayers.

Rather than a cash refund of carbon-credit money to a consumer, the NEC strongly favours using the cash to improve the local power-generation capability of that consumer, thus

ensuring lower power bills and even more carbon-credit refunds. However, the exact mechanism for this will need further conceptual development.

Assessment

IDEA	PROBLEM SOLVABILITY	PROBLEMSIZE/ IMPORTANCE	TECHNICAL/ FINANCIAL RISK
Carbon credits	2	3	Dark Green: None

7. Standardize low-electricity methods of refrigeration

Recommendation: In 2009, establish a National Working Group on low-cost, low-carbon refrigeration and air-conditioning. This group will publish its results in 2010, and will secure equipment and will perform government-sponsored pilot projects that will complete in 2010.

Explanation

The current, common methods used for refrigeration work well, but are not very cost-effective. Better, cheaper, more-sustainable methods exist, including the highly-acclaimed World Fridge, solar-powered air-conditioning, and biofuel-powered ice plants. This working group will not perform any original scientific research, but will merely locate and catalog existing technologies. It will recommend a list of approved equipment, and will also suggest financial incentives that might assist consumers who wish to adopt these technologies. As with other strategically-critical equipment, the government wishes to prevent a monopoly that will not be in the best interests of consumers, so this working group will recommend amendments to the new monopolies legislation (see number 4, above) that will safeguard supply lines for the public.

Assessment

IDEA	PROBLEM SOLVABILITY	PROBLEMSIZE/ IMPORTANCE	TECHNICAL/ FINANCIAL RISK
World fridge	2	3	Light Green: Minor

8. Begin demonstration projects

Recommendation: Establish a National Working Group that will begin demonstration projects for solar, wind, and biofuels, and will make companion legislative recommendations in 2010. The results of the demonstrations will be published in 2010. Legislation will be passed in 2010.

Explanation

The Cook Islands are drenched in wind and sun; our calculations and simulations show that a moderate national capital expenditure could easily supplant our traditional diesel-generation-based power production, provided we make economical puproof-of-concept projects based on easily-replicated installation templates. The pilot projects will be carefully measured, and a study will project the lessons, benefits, problems and issues to a national scale to predict the efficacy of a whole-scale, radical transformation of our power infrastructure.

Generating biofuels locally and at a small scale has proven to be easy. These fuels are controversial, but only when they interfere with food production. As a result, this working group will determine the best practices to turn restaurant waste and local high-fat high-sugar produce into biofuel, but will not investigate commercial bio-mass cultivation for purposes of biofuels. It should enlist the cooperation of restaurants and local farmers, and look at how this can be combined with new and existing compost projects. It should consider both biodiesel and alcohol production. Of particular interest is the possibility to use alcohol as a means to store peak-production power generated by wind, solar, and tidal generation for use at a later time or (some day) for export to neighbouring nations. The group will make recommendations for legislation to ensure that biofuels are generated and stored responsibly, will set national standards for their purity and quality, and will suggest incentive programs to engage consumers beginning in 2009.

Assessment

IDEA	PROBLEM SOLVABILITY	PROBLEMSIZE / IMPORTANCE	TECHNICAL / FINANCIAL RISK
Demonstration projects	2	3	Yellow: Moderate

9. Develop local expertise, awareness and capacity

Recommendation: In 2009, the government should begin programs to identify and train local experts in alternative energy technologies and to identify and bring forward existing local best practices .

Explanation

Since we can accurately foresee an increasing demand for expertise and capacity related to alternative-energy services, the Cook Islands government will undertake activities to build this capacity now.

These include:

1. Establish a self-registry for alternative energy contractors: To help guide policy and to inform consumers where help can be found, the Cook Islands government will establish a self-registry for contractors with experience in alternative-energy installations.

2. Establish a self-registry for existing demonstration projects: Several conspicuous alternative-energy successes operate within the Cook Islands. The NEC is certain it has not found all the local instances where wind, solar, biofuel, tidal or microhydro power is being generated. These implementations are very important, because the entrepreneurial souls who have done them have solved problems that we have yet to encounter. The government will establish a self-registry for these projects. This will allow consumers to see how well these technologies can work in our environment, and encourage collaboration and sharing on alternative energy topics. The government will offer an annual cash prize of $5,000 to be granted to the best homeowner alternative-energy project in actual use.

3. Perform case studies of existing AE facilities: The number of alternative energy installations in the Cook Islands is unquestioningly going to grow quickly. To save consumers the frustration and expense of repeat lessons already learned by others, the NEC will collect, analyze, and publish case studies of success stories and conspicuous failures.

Assessment

IDEA	PROBLEM SOLVABILITY	PROBLEMSIZE/ IMPORTANCE	TECHNICAL/ FINANCIAL RISK

Develop local expertise	3	3	Light Green: Minor

10. Start a public research library and conversion guide

Recommendation: Before the end of 2009, the NEC will begin an online library of resources for the public to use.

Explanation

Since alternative energies can be implemented on a relatively small scale, thousands of different Web sites exist to publish alternative-energy techniques and lists of resources. These are of varying quality. Using government funds, the NEC will work a small number of selected local consultants and with high school classes undertake a special for-credit project to create an online research library for the NEC and government to use as a tool in analysis and policy-making.

In our public consultation, we found that many consumers would convert to alternative energy if they only knew how. As a follow-on to this project, the NEC will publish a homeowners guide to self-conversion. This work will be complete by the end of 2010.

Assessment

IDEA	PROBLEM SOLVABILITY	PROBLEMSIZE/ IMPORTANCE	TECHNICAL/ FINANCIAL RISK
Research Library	2	2	Light Green: Minor

11. Start an alternative energy B. Eng scholarship program

Recommendation: For the 2010 school term, the government should offer two full four-year scholarships for university degrees in alternative energy technologies.

Explanation

In collaboration with local school authorities, the government will establish a scholarship program to help local young people get Bachelor of Engineering degrees in technologies that relate to alternative energies. This scholarship program will be patterned after successful

practices in other nations: recipients of these scholarships will be required to practice in the Cook Islands for a period of time after graduation as part of the scholarship conditions.

Assessment

IDEA	PROBLEM SOLVABILITY	PROBLEMSIZE/ IMPORTANCE	TECHNICAL/ FINANCIAL RISK
Start AE	3	3	Light Green: Minor

12. Rework national budgets and lines of authority to reflect the coming changes

Recommendation: The government should empower the Minister of Energy to locate all renewable-energy-related expenditures and to move them under his control. Further, all authority for renewable energy projects and their adoption should move to the Ministry of Energy.

Recommendation: For the next budget cycle, the Ministry of Energy should produce a comprehensive renewables budget intended to fund and control all the initiatives recommended in this plan.

Explanation

The priorities of Government's budget take direction from the annual Budget Policy Statement. Over the past few years Government has acknowledged the importance of alternative energy. In the 2008/2009 Budget Policy Statement, Government stated that "… [it] will attempt to resolve the fuel issue of the Cook Islands and will look at the development and initiating dependence on renewable energy." However, despite renewable energy being a priority, this is not reflected in the national budget. Our national budget does not allocate adequate resources to addressing our energy situation.

In fact, what renewable energy initiatives exist are scattered across the budgets of different stakeholders and diverse authorities. The Cook Islands has neither the luxury of resources or time to permit this uncoordinated approach.

Assessment

IDEA	PROBLEM SOLVABILITY	PROBLEMSIZE/ IMPORTANCE	TECHNICAL/ FINANCIAL RISK
Rework National Budgets	3	5	Yellow: Moderate

13. Impose tax on high-consumption electrical appliances

Recommendation: Consulting the appliance legislation in California, impose similar limits on appliances imported to the Cook Islands, identifying the specific items/appliances whereby tax would be imposed (brand, model, importer, country of origin, energy consumption standards).

Recommendation: Conduct a communication strategy to inform border control agencies, suppliers and consumers on the new tax imposed goods.

Recommendation: Develop a "grandfathering strategy" that would allow the existing stock of high-consumption appliances to be sold or returned without penalising merchants or consumers.

Explanation

With the rise in electricity bills, the Cook Islands' vulnerability to increases in world oil prices has never been so obvious. Government must be seen to be working towards helping to save electricity in the long-term. As other countries in the region adopt minimum standards on appliance energy use, the Cook Islands risk being left behind to become a dumping ground for inefficient appliances. These appliances drain our electricity network, increase greenhouse gas emissions and cost the people thousands of extra dollars in electricity bills.

Assessment

IDEA	PROBLEM SOLVABILITY	PROBLEMSIZE/ IMPORTANCE	TECHNICAL/ FINANCIAL RISK
Impose tax on high-consumption electrical appliances	3	4	Light Green: Minor

14. Institute a "Carbon Challenge" for electrical consumers

Recommendation: Following best-in-class examples from other countries, begin an awareness campaign and contest to reduce carbon emissions — and therefore energy consumption — in Cook Islands households.

Explanation

People are usually motivated to change behaviour when they can see a tangible reward for the change desired. We will institute a "carbon challenge" for electrical consumers. By participating in the challenge, consumers will be rewarded with tangible prizes. The challenge will emphasize the need to reduce energy consumption through partnerships with schools, towns, local energy committees, faith-based organizations, civic groups, and regional entities.

Assessment

IDEA	PROBLEM SOLVABILITY	PROBLEMSIZE / IMPORTANCE	TECHNICAL / FINANCIAL RISK
Carbon challenge	3	4	Dark Green: None

15. Take advantage of Kyoto opportunities

Recommendation: Seek expert opinion on the ways in which the Cook Islands can take advantage of this initiative.

Recommendation: Establish appropriate institutional structures to ensure that this initiative will ultimately benefit the Cook Islands.

Recommendation: Develop a clear strategy for CDM bearing in mind that while foreign investment may be attractive, domestic investors should also be encouraged, possibly in partnership with overseas companies. To a certain extent the market will decide what type of CDM projects will go ahead, but it is vital that Government negotiate the best possible outcome, with minimum risk and maximum local benefits.

Explanation

The Kyoto Protocol, which finally entered into force in January 2005, sets binding greenhouse gas (GHG) reduction targets for developed countries. An important innovation in the Kyoto Protocol is the CDM, which promotes investment in developing countries with the aim of reducing emissions.

The CDM works as follows. An investor (either public or private) funds a project in a developing country, which results in a net reduction in GHG emissions. Each year the

project creates carbon credits equal to the tonnes of GHG saved. The investor can sell these credits to buyers looking for cost effective ways of reducing their own emissions.

Ultimately, the carbon credits generated by CDM projects will help developed countries to meet their Kyoto target. For developing countries, such as the Cook Islands, the CDM helps to attract investment in sustainable development.

IDEA	PROBLEM SOLVABILITY	PROBLEMSIZE / IMPORTANCE	TECHNICAL / FINANCIAL RISK
Kyoto opinions and opportunities	3	3	Yellow: Moderate