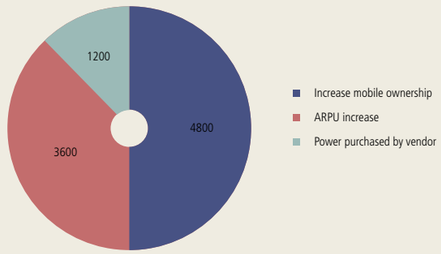
Benefits from CPM

Mobile Operators

The cost to operators is minimal, with minimum installation time required. The incentives of TEF are put on a minimum risk or operational impact on the base stations, and an improved community support to protect base stations. In return, the revenues of operators would rise thanks to 3 factors:

- 20% increase community mobile ownership
- 10 to 20% ARPU increase due to the availability of charging solutions
- Revenue from the power purchased by the charging station owner (0.40 kwh)

Figure 30: Revenue Increase from Charging Services Per BTS site (US$)



Source: The Ecology Foundation

This could led to a US$9,600 revenues per BTS, scalable across multiple operators site. Scaling across the operators country BTS and assuming 200 BTS deploying charging stations, this amounts to US$1.8 Million.

Vendors

Vendors have multiple sources of income:

- Sales of the BTS Installation Kit
- Margins on products sales (batteries, lamps)
- Revenues from the power the agent buys to the vendor (US$2-3 per kwh)

Table 11: The Steps to the Implementation of Charging Services

Step 1.	TEF and Operator select suitable off-grid (or sometimes grid connected) base station sites.
Step 2.	TEF appoints and trains a local "Energy Agent"
Step 3.	Operator installs the TEF standardised base station interface unit. This is a sealed access unit, which is mounted on the inside of the base station perimeter wall/fence. There is a single contact engaged at the BTS electrical distribution board. TEF monitors power usage at interface unit and man in BTS, with auto shut down if the BTS power requirement becomes critical. This ensures the BTS power usage always takes priority.
Step 4.	TEF delivers community energy sales kiosk, (approx. 6m² with devices for multiple phone & other battery charges)
Step 5.	TEF delivers energy services to community as follows… Individual/multiple phone charging. (from $0,15 to $0.00 fee) Airtime sales (charging free if bundled with airtime) Household electric lantern & battery exchange service ($3 per month, 10+ charges)
Step 6.	Community airtime usage and mobile handset penetration increases by 10-20%

Source: The Ecology Foundation

Schedule

The Ecology Foundation is conducting pilots in 2011 with an expected mass rollout in 2012. It is hoped that most off-grid base stations will have the standardised community power module fitted within a short period.

Appendix 3

Healthcare Opportunity from Community Power from Mobile

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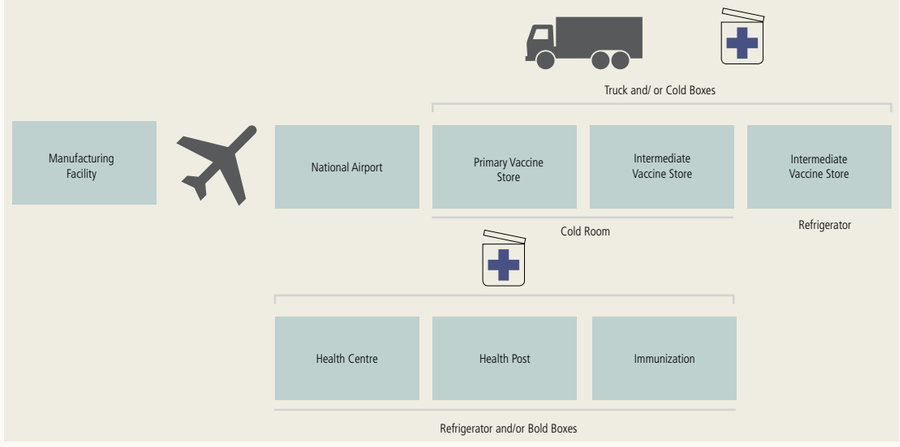
The Idea

We have all heard statistics concerning vaccine-preventable deaths – over two million each year – in developing countries. Although shortage of vaccines may be one key reason, another is that many vaccines must be kept at a prescribed temperature to maintain their potency. Typical distribution models have relied on delivering vaccines to remote destinations in insulated cold-boxes. An efficient "cold chain" normally ensures that temperature-sensitive vaccines remain effective, and any disruption of the cold chain severely impairs these prevention efforts.

In the absence of thermo-stable vaccines – an exciting, but distant possibility – preserving the vaccination cold chain requires immediate focus (See Figure 31). The current approach requires that vaccines be administered almost immediately upon arrival, as the cold-boxes are limited in their ability to maintain the necessary temperature conditions (between 2°C and 8°C). Due to these limitations, vaccines often either freeze or exceed their upper temperature range and are rendered virtually useless.

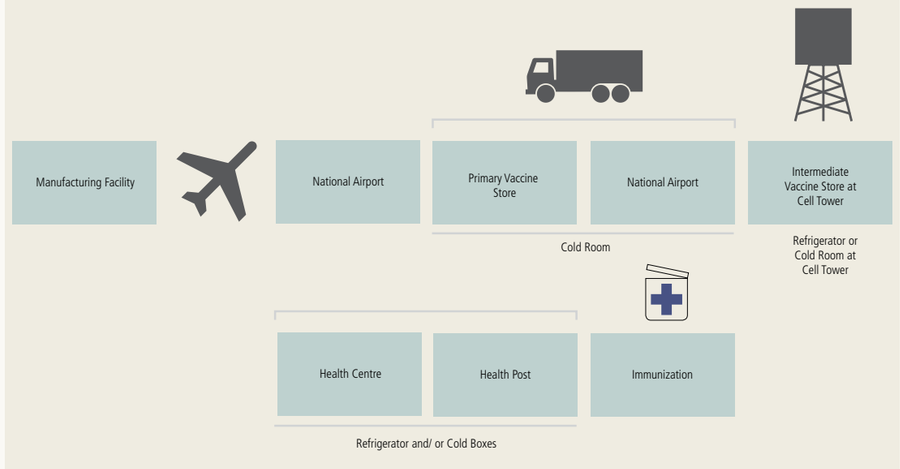
Energise the Chain (EtC), a recently formed, not-for-profit organisation, aspires to eradicate vaccine-preventable deaths worldwide by preserving the vaccination cold chain to ensure delivery of active vaccines. At the simplest level, EtC proposes to use power installations at cell towers as the energy source to power vaccine refrigeration units in remote locations that currently lack the energy infrastructure needed to preserve the cold chain. (See Figure 32).

Figure 31: Standard Vaccine Cold Chain



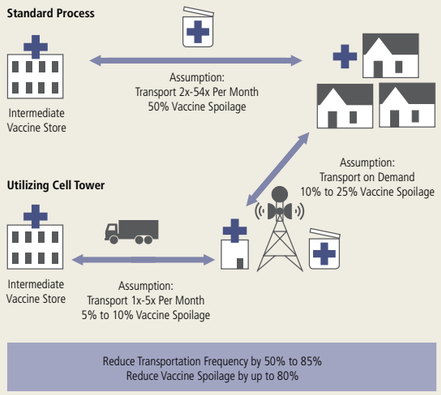
Source: Hip Consult, Etc

Figure 32: The Vaccine Cold Chain Utilising Cell Tower Power Facilities



Source: Hip Consult, Etc

Figure 33: Illustrative View of Efficiency Oppurtunities in Vaccine Cold Chain using Cell Power Facilities



Access to refrigeration at these remote destination points would enable vaccines to be stored for longer periods of time. This would allow for a critical mass of vaccines to be delivered at one time, warranting the use of a transportation vehicle (e.g., a refrigerated truck). This vehicle would provide more stable temperature conditions than a cold-box, thus preserving the integrity of the vaccines and eliminating the pressure to immediately administer them. All of this would not only improve the integrity of the vaccines but also reduce costs (Fig 33).

Approximately 75 percent of the world is covered by a mobile cellular signal, and that percentage is expected to reach nearly 100 percent by 2015.[44] This expansion of mobile coverage transports the presence of energy by necessity to remote locations, many of which are otherwise without access to centrally provisioned power. In off-grid regions, cell towers offer a constant supply of energy, sourced from any combination of diesel generators, battery backup, gas turbine, renewable energy, and other options.

A typical vaccine-storage refrigeration unit requires at least eight hours of daily power supply[45]. Harnessing the energy potential of cell tower facilities provides the means to power these refrigeration units. Research shows that base stations often have a surplus of power capacity of about 5kW for a diesel generator powered BTS and under 5kW for a BTS powered by alternative energy sources.[46] Considering that a refrigerator unit consumes between 0.5 – 1.9kWh/24h[47], there is ample power at most cell tower sites today to supply refrigeration units. Many tower sites also have some spare land available to support an additional shelter for these units.

The Potential Socioeconomic Impact

The numbers of lives impacted by increasing the delivery and access to effective vaccines may extend well beyond the two million lives lost to vaccine-preventable illnesses each year. It is estimated that under the current coverage of vaccine delivery and utilisation there are almost 400 million life years saved and 97 million disability-adjusted life years saved annually by vaccines. The same study showed that there are almost six million deaths prevented annually by vaccination[48] (Fig 34). The World Health Organisation has declared that "… in sub-Saharan Africa only half of the children have access to basic immunisation against common diseases such as tuberculosis, measles, tetanus and whooping cough. In poor and isolated areas of developing countries, vaccines reach fewer than one in twenty children." Such statistics demonstrate that EtC's efforts to ensure an adequate and expansive cold chain could positively impact hundreds of millions of people.

Figure 34: The Benefits of Vaccination

J. Ehreth/Vaccine 21 (2003) 596-600 599

Annual World-wide Benefits of Vaccination and Global Health Improvements

Disease	Deaths prevented per year	Life years saved	Disability-adjusted life years saved
Varicella	57,879	1,615,252	NA
Diptheria	60,000	3,900,000	151,000
Tetanus	862,000	56,030,000	12,020,000
Pertussis	600,000	39,000,000	10,905,000
H. Influenza B	287,000	18,655,000	6,242,000 (Bacterial Meningitis)
Hepatitis B	1,172,500	76,212,500	2,790,000
Measles	1,100,000	71,500,000	29,838,000
Polio	650,000	42,250,000	1,725,000
Tuberculosis	1,188,476	77,250,940	33,287,000
Total	5,977,855	386,413,692	96,958,000

Source: Hip Consult, Etc

Studies have also demonstrated that there are positive economic impacts of vaccination extending beyond life years saved. In a widely influential paper, Bloom, Canning and Weston argue that immunisations not only prevent illness but also provide long-term benefits in cognitive development, physical strength and emotional stability[49].

These factors, they argue, have significant positive downstream effects on the workforce size and productivity, educational accomplishments, savings and investments as well as economic growth of communities. Consistently, we believe that an increase in the delivery and utilisation of effective vaccines will have a scalable impact on millions of lives, both life years saved and economic wellbeing.

The Potential Business Impact

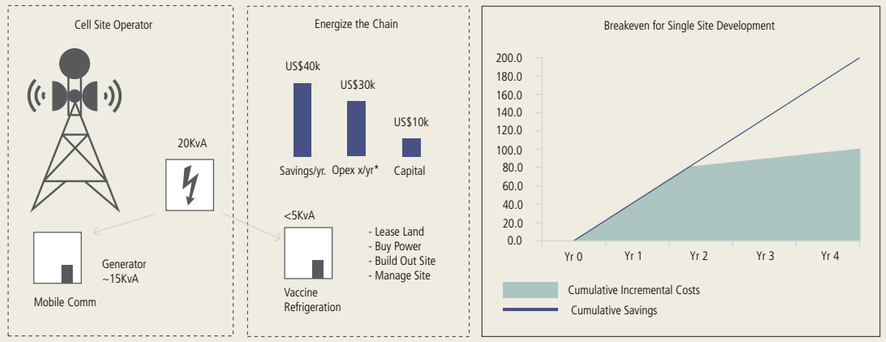
While the opportunity to extend and sustain the vaccination cold chain is clearly compelling from social and macroeconomic standpoints, the attendant challenge is to identify a suitable business model which will allow for a scalable implementation and sustainable operation of this concept. Due to the lack of proven business models, initial funding will need to come from governmental agencies, foundations and other public and private non-for-profit sources. Pilot programs will likely be funded by one time grants, with the goal of working the projects into a more sustainable government or NGO budget. Once the economics of a business model are solidified, then private enterprises may be compelled to enter this space, creating a more competitive and dynamic market which focuses on the cold chain application or uses it as an anchor tenant to support other services.

Base Operating Model

Energize the Chain is hoping to demonstrate the proof of a concept, that using cell site refrigeration will help to improve vaccine integrity and reduce costs in the cold chain. In order to do this, it will need to take on the capital and operating expense required to support the refrigeration site. Economic benefits from this are only realised if EtC participates in the portions of the cold chain where costs are reduced; primarily vaccine spoilage and transport efficiencies (Fig 35).

As an example for potential savings, consider that the aggregate value for a DPT vaccine batch stored in a typical district level refrigerator is approximately US$9,400. This equates to roughly 6 times the value of the refrigeration unit in which it is stored. And as newer, more powerful vaccines are developed, the cost increases dramatically. The liquid pentavalent DPT-HepB+Hib vaccine aggregate value in the same refrigeration unit is US$46,000, about 31 times the value of the unit[50]. When considering vaccine wastage can be as high as 50% and cell site refrigeration may reduce that waste by half or more, savings may be as high as US$40,000. Savings in cold chain transportation and maintenance costs may add another US$3,000, but true savings are difficult to estimate, as one frequent low cost cold box transfer is replaced with a less frequent, but expensive, refrigerated truck.

Figure 35: Energize the Chain Operating Model



Source: Hip Consult, Etc. *Assume site personnel only required in year 1 and 2, at which point local health workers can manage site.

44. World Telecommunication/ICT Development Report 2010. "Monitoring The WSIS Targets: A mid-term review." International Telecommunication Union
45. UNICEF. "Handbook for Vaccine & Cold Chain Handlers 2010." Department of Health and Family Welfare. Ministry of Health and Family Welfare, Government of India
46. "Community Power. Using Mobile to Extend the Grid." The GSM Association Green Power for Mobile. January 2010
47. Harvey Rubin, Alice Conant: Energy For Health: Cell phone expansion and disease prevention
48. Table 4 in Ehreth, J., The Global Value of Vaccination. Vaccine (2003) vol. 21, 596-600
49. Bloom, DE., Canning, D., and Weston, M. The Value of Vaccination. World Economics (2005) Vol. 16, 15-39
50. USAID: Immunisation Basics, Snap Shots News, documents and tools on routine immunisation and sustainable financing July 2008 | Issue 8
51. HIP Consult analysis based on data from EtC, World Health Organisation and UNICEF.
52. cMYP data from 45 countries, WHO/Geneva, Global Immunisation Meeting, February 2008, presented by Patrick Lydon

Figure 35 illustrates the estimated site costs and payback for a single site deployment assuming savings are captured by the EtC[51]. Within this model there are a number of additional considerations such as damage or theft on site, monitoring and alarming requirements, economies of scale, and some staffing considerations, which are assumed to be initially non-incremental. With total costs related to the cold chain reaching over $5B;[52] however, the overall opportunity for cold chain participants is significant.

Cell Site Operator Opportunity

A mobile operator or tower company, which already operates the power generation at its sites, would be the logical support provider for co-located refrigeration shelters. The question is whether supporting the EtC endeavor makes sense for these operators. In terms of pure business merit, supporting the power and shelter requirements for vaccination could represent a high margin business, but requires scale and contains risk (i.e., a simple reality whenever dealing with peoples' lives). However, there are other indirect benefits that may be attractive to operators, such as social responsibility and community goodwill.

The revenue opportunities in supporting this application are multi-fold. Initially there is the straightforward opportunity of selling power as well as leasing land and offering site management services. This may generate an additional $400 to $1,200 per month per site using excess power[53]. The margin on these services is high as the investment is sunk and the site is already in operation. Investment in additional power capacity to supply larger refrigeration units could double or quadruple revenue at somewhat lower margins provided demand exists. Beyond the direct revenue potential, there is an opportunity for the operator to offer value added data services related to the refrigeration units and the shelter, such as remote monitoring and alarming on temperature ranges and unit operation, inventory control and tracking, and security monitoring. These revenue opportunities are less quantifiable, but may prove more meaningful for providers.

Extended Opportunities for Additional Players

Cell site operators are well positioned – if reluctant – to enter the energy market, as they are one of the few enterprises in less developed countries with the necessary capital, customer base, flexibility, and free market mindset. Given the high demand for power in these often underserved locations, and the energy the telecom industry is able to supply, there is a natural economic case supporting this relationship[54]. Seeking to expand local participation in the energy market by creating business opportunities, for example with independent power producers, would create positive externalities in the operation and scaling of the vaccination project (e.g., increased participation in maintaining the vaccination cold chain by embracing the mission as a business opportunity).

The development of an independent service provider sector would yield the most promise in not only developing the cell site refrigeration initiative, but also in the broader utilisation of cell sites to deliver more utility services to the community. Entrepreneurs developing independent business models would remove the burden of project subsidisation either from the public sector or from mobile operators who may feel pressured to do so. This would also help to develop many more business opportunities that may otherwise be ignored by organisations that have a single agenda.

Plans for Pilot Program

While EtC's concept is in its nascent stage, many stakeholders have expressed enthusiastic interest in the program. Currently, EtC is pursuing multiple options for early sites, including locations in India and Africa. They are also developing initial pilots to take place in Andhra Pradesh, India, and in a region in Kenya, which is yet to be selected. In many of the potential early locations, EtC is working with representatives from the government agencies that currently administer most of the vaccines. Given the dependence on multiple stakeholders to implement this concept and ensure its operational success, cross-sector collaboration is essential.

Locations are being prioritised based on the following conditions, considering a lack of reliable centrally provisioned power as an implicit factor: (1) high prevalence of vaccine-preventable diseases coupled with a high penetration of immunisation drives; (2) cell tower site in close proximity to villages covered by a typical primary health centre; (3) supportive local government and/or health organisation; and, (4) collaborative local telecom partner.

After a 12-month period (one full round of immunisations for children in region), the team will evaluate performance data to compare against a baseline. The plan is to run the pilot for three to four additional years to capture multi-year trends.

In preparation for and throughout the course of pilot implementation, EtC will collect data and adjust the pilot parameters as appropriate. Main outcomes of interest will concern the vaccine's maintained integrity at the end of the cold chain. Additionally, EtC will collect data on the availability of cell tower power to assess the efficiency of this energy resource. EtC is sensitive to the fact that partnerships with the public and private sector can be challenging and may even fall through. As such, it will be important to establish relationships with several key stakeholders in a pilot site so that the program's success does not depend on any one partnership. More generally, EtC is eager to collaborate with others to implement these demonstrations and lay the foundation for the progression of our vision—the eradication of vaccine-preventable deaths worldwide.

The authors would like to thank Erik Schmidt of HIP Consult and the Energize the Chain Team for their contributions to the development of this paper.

53. Estimates based on market land lease and power circuit rates

54. HIP Consult. "Africa's Energy Conundrum: Can Telecom Save the Day?" November 2010

Appendix 4

Mobile Money for Charging Services

At the end of 2010, the Mobile Money for the Unbanked Deployment Tracker[55] reported 147 mobile money initiatives in developing markets, 60 of which have already launched. The eight largest operator groups, which together represent over 2 billion consumers, all have live mobile money deployments and strategies to further roll out mobile money across multiple markets. Today, mobile money represents a mainstream strategy for mobile operators in developing markets. Most advanced markets are Kenya, Uganda, Tanzania, Ghana, Thailand; Indian market is low for now but developing fast.

M-PESA in Kenya is one of the most successful mobile money deployments. Since its commercial launch in March 2007, it has been adopted by 11.9 million customers (corresponding to 54% of Kenya's adult population and 73% of Safaricom's subscriber base).

Table 12: Mobile Wallet Deployments in Africa

Country	Service
Burundi	Econet (EcoKash)
Cote d'Ivoire	Orange Money, MTN Mobile Money
Ghana	MTN Mobile Money, Zap, Txtnpay
Kenya	M-PESA, Zap, Yu
Madagascar	Orange Money, mVola
South Africa	MTN Mobile Money, M-PESA, MoPay, FNB, WIZZIT, Standard Bank
Tanzania	Zap, M-PESA, Z-PESA
Uganda	Zap, MTN Mobile Money, M-Sente

Source: GSMA Mobile Money for the Unbanked

One of the biggest hurdles to the implementation of mobile banking for charging services may remain in the high fees charged to end users for small transactions. These fees are fluctuating based on the transaction amount. As mobile operators are fixing their own mobile money tariffs, they differ greatly from one country to another and some countries allow propose very low tariffs (<US$0.1) for mobile money transfers.

Table 13: Mobile Money Tariff Structure[56]

		Minimum Amount	Charge
MPESA Kenya	Registered users	US$0.6	US$0.12
	Unregistered users	US$1.2	US$0.9
MTN Uganda Mobile Money	Registered users	US$2.1	US$0.34
	Unregistered users	US$2.1	US$0.67
Airtel Money Tanzania			US$0.1
Orange Money Niger		US$0.6	US$0.1
Ecokash Burundi			US$0.4

Source: Mobile Operators websites

The trend is now however to lower transaction fees. In December 2010, Safaricom modified its tariffs to allow for both smaller and larger transactions. The minimum transaction size has been halved from US$1.2 to US$0.6.

Top Up as a Currency

Top up as currency is another mobile solution used for now to pay only for digital goods– ex. ringtones, wallpapers - or airtime. However, topup does not have to be limited to enabling phone calls. Instead of traditionally using mobile topup to load an airtime credit onto a phone, the credit can be converted into a stored value in a mobile wallet. This value in return can be used to pay for goods and services or even as a mechanism for saving money.
If this method is easy and ready to use for small transactions, it may face a regulatory barrier as top up as a currency is aimed at virtual goods only for now. Regulation should be reviewed to allow customers to pay for physical services with this method.

55. www.wirelessintelligence.com/mobile-money/

56. http://www.safaricom.co.ke/index.php?id=255