IBM's Smarter Cities Challenge

Townsville

Report

IBM

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Introducton

The City of Townsville, located on the northeastern coastline of Queensland, Australia, is one of a planned 100 cities to earn a grant from IBM as part of the company's philanthropic efforts to build a Smarter Planet™.

IBM's Smarter Cities™ Challenge aims to contribute to the improvement of high-potential cities around the world. During a three-week period starting in July, 2011, a team of six IBM Executives worked in the City of Townsville to deliver their recommendations on sustainability to Councillor Les Tyrell OAM, Mayor of Townsville, and a wide range of stakeholders.

Challenges

Townsville is a tropical port city with a diverse economy with the current 190,000 population expected to double in the next 20 years. Located near the Great Barrier Reef with rainforests, beaches, a string of islands, and occasional cruise ship destination, the city has a warm climate that increasingly has driven up energy usage for cooling.

Townsville is well positioned for controlled growth. Resources are distant, with coal-fired power located far away and long supply lines for other resources. Earlier in 2011, Cyclone Yasi accentuated a need for sustainability in the area. Many solar and shared cooling projects are in place or planned, but the town advances on informal spirit and teamwork to accomplish its impressive portfolio to date.

Themes

Townsville has immediate and long-term goals for sustainability. The city has used the practical approach of showing the community the value of sustainable living, rather than relying only on ecological goodwill to drive decisions.

Solar energy is an abundant resource due to the climate, and the energy utilities and local and state government have many cooperative efforts. Photovoltaic panels, reflective roof coatings, and window design for shading and air flow are easily spotted throughout the city, but not to the level possible despite improving economics. The use of water is an Australian challenge, and the production of energy takes lots of water, while the delivery of clean water requires abundant energy. These related resources drive a further case for renewable energy, which neither burn coal nor waste the country's water.

New buildings and homes will make long-lasting energy decisions on cooling systems in the next few years, and Townsville is pushing for centralised cooling modelled after the local university's success. Peak load is a major driver since power plants and long cables are major capital outlays aggravated by distance.

Other sustainability challenges reach into the life of Townsville. Transportation is primarily by traditional western automobile, despite a reviving central business district and a suburban university. Internet connectivity will be improved with the National Broadband Network, which will hopefully accelerate applications and keep Townsville's creative class from fleeing to the larger cities. Finally, data primarily resides in silos, even data on an impressive array of green building projects and energy studies, awaiting assurances for protecting data privacy and intellectual property.

Recommendations

Townsville has a strong, informal collaboration via inspired leaders. The results are numerous projects and growing awareness of sustainability. Our recommendation is an acceleration of that progress via a focused city sustainability hub. Combining an open data and open applications approach with structured guidelines and key performance indicators (KPIs), Townsville's many constituencies can collaborate with each other, with regional sources of information and funding, and with global expertise enabled by digital platforms.

Townsville should assure that fast broadband connects as many entities – business, university, government, and households – as quickly as possible. The formation and structuring of the hub requires a committed open agenda, complete with guidelines and key performance indicators. A leadership team should assure continuity and select an early pilot for proving the value and direction of accelerating change. The development of learnscapes – focused on the power and reach of diverse digital communication and collaboration – will create awareness and support for the acceleration of a range of sustainability investments and activites.

Conclusion

Townsville has the challenges, the vision, and the will to become a model of sustainability for Australia and around the world. Bringing leaders, open data, and guidance together with expanding digital connectivity will accelerate the progress toward a sustainable community. Townsville's quality of life and city spirit for teamwork, combined with innovation and collaboration, can extend their portfolio of projects to become a model for sustainable cities around the world.

2. Introduction

By 2050, cities will be home to more than half the world's population, will wield more economic power and have access to more advanced technological capabilities than ever before.

Simultaneously, their core support and governance systems such as transport, water, energy, communications, healthcare and social services will struggle with a wide range of challenges and threats to their sustainability. These issues are not however unique to cities. All over the globe, federal, state and local governments as well as private sector companies are looking at innovative ways to reduce the problems of siloed and disconnected organisations.

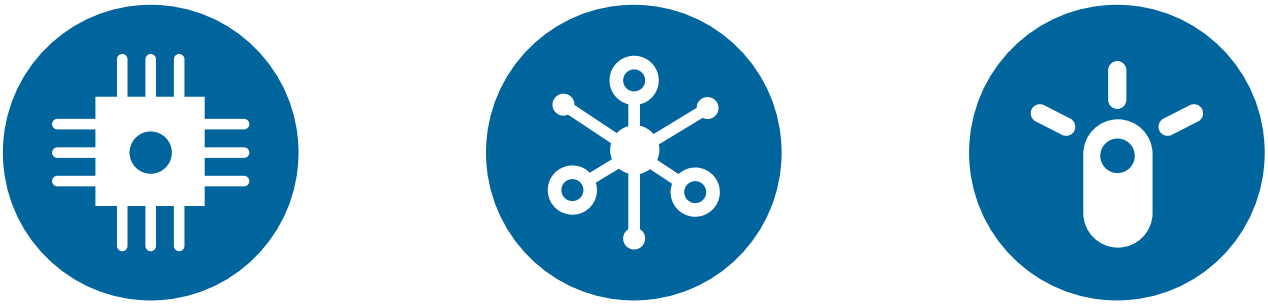
Meanwhile, trillions of digital devices, connected through the Internet, are producing a vast stream of data. All this information – from the flow of markets to the pulse of societies – can at last be turned into knowledge because we now have the computational power and advanced analytics to make sense of it. With this information, cities can reduce costs, cut waste and improve the efficiency, productivity and quality of life for their citizens. While these present mammoth challenges in a time of economic crisis and increased demand for services, ample opportunities exist to develop innovative solutions.

2.1. The Smarter Cities Challenge

In November 2008, IBM began a conversation about how the planet was becoming "smarter". Intelligence was being infused into the systems and processes that made the world work – into things little recognised as computers: cars, appliances, roadways, power grids, clothes, even natural systems such as agriculture and waterways. By creating more instrumented, interconnected and intelligent systems, citizens and policymakers could harvest new trends and insights from data, providing the basis for more informed decisions.

Since cities grapple on a daily basis with the interaction of many systems – water, transportation, energy, public safety and more – IBM is committed to a vision of Smarter Cities as a vital component in the building of a Smarter Planet. A Smarter City uses technology to transform its core systems and optimise finite resources. At the highest levels of maturity, a smarter city is a knowledge-based system that provides real-time insights to stakeholders as well as enabling decision-makers to manage the city's subsystems proactively.

Effective information management is at the heart of this capability with integration and analytics as the key enablers. A Smarter City uses technology to transform its core systems and optimise finite resources.



Instrumented
We can measure, sense and see the condition of practically everything.

Interconnected
People, systems and objects can communicate and interact with each other in entirely new ways.

Intelligent
We can analyse and derive insight from large and diverse sources of information, to predict and respond better to change.

Figure 1
Intelligence is being infused into the way the world works

2.2. The City of Townsville Challenge: Sustainability

Townsville City Council (TCC) and its extended community are motivated to advance toward three key objectives: amplifying its actions in sustainability, stimulating international cross-sector partnerships, and utilising tangible and intangible opportunities and resources.

The three key opportunity areas that Townsville proposed to address with the IBM Smarter Cities Challenge team were:

1. Build on TCC's partnership with Ergon Energy, the Solar Cities consortium, and local/regional sustainability businesses and community/education networks and the highly successful Townsville Network Demand Management Pilot;
2. Enhance opportunities ensuing from the National Broadband Network (NBN) trial and new Smart Grid energy projects in Townsville;
3. Continue to develop and apply Townsville's expertise in behaviour change methodologies such as Community-based Social Marketing (CBSM) and Thematic Communication by exploring smart technology information sharing, learning and social media networking".

The key question that the team focused on throughout the three week Challenge was:

…How do we integrate smart technologies, data, social media/networks and behaviour change to better plan and act for a future smart sustainable and energy efficient city?

3. System of Systems

We believe that the planet is comprised of a system of systems. Some of those systems are natural, some are man made, and some are networks of people who come together for short- or long-term reasons. Many of the systems have been around for a very long time, others have only begun to emerge.

"To compete in this new economic environment, cities will need to better apply advanced information technology, analytics and systems thinking to develop a more citizen-centric approach to services. By doing so, they can better attract, create, enable and retain their citizens' skills, knowledge and creativity."

(IBM website)

Humans have often optimised the way the world works within silos, with little regard for how the processes and systems that drive our planet interrelate – and those systems impact Townsville, Queensland, Australia and the world – such as energy, water, healthcare, and social change.

"Australia's per capita greenhouse gas emissions are the highest of any Organisation of Economic Co-operation and Development (OECD) country and are among the highest in the world. Only five countries in the world rank higher – Bahrain, Bolivia, Brunei, Kuwait and Qatar. Australia's per capita emissions are nearly twice the OECD average and more than four times the world average."

Garnaut Climate Change review 2011

3.1. Energy, Resources and Climate Change

Economic growth, energy production, energy consumption and climate change are all tied intimately together. The phenomenon of peak oil plays an integral part in the global energy picture. The fact is – energy systems use water, water systems use energy; and current energy sources in Australia are Green House Gas intensive. This is not sustainable. Energy conservation, management of peak demand, and the implications of energy-water-carbon intersections all need to be considered by the community at large. Without understanding the consequences of these interactions it is difficult to understand how to effectively move forward with positive and effective action on energy and water availability plus the impacts of climate change. Energy production and consumption, water treatment and consumption are truly a system of systems issue.

Energy Models and Peak Oil

Modelling has been done by the International Energy Agency and Australian Energy agencies, plotting the increasing demand for oil and other fossil fuels against the impact of declining oil production levels. Simply put, peak oil production has occurred[1] due to the increasing difficulty of extraction of crude (tar sands, deep sea extraction in the Gulf of Mexico and Brazil, etc) throughout the world. Whilst there is continued debate about the specific date on which peak oil occurred, the Australian position is clear. The Association for the Study of Peak Oil and Gas[2] confirms that Australia's Oil production peak was reached in 2000 and Australia's capacity is now in decline.

"We need to leave oil before it leaves us…"

Dr Fatih Bairol, Chief Economist International Energy Agency – Peak Oil and Australia's National Infrastructure Submission to Infrastructure Australia in 2008

At a given point in time increases in global consumption (driven exponentially by India and China) will meet head on the world's falling production capacity. At this point the price of oil will start to increase dramatically[3]. Some oil substitution will immediately occur; oil to gas; which will at a later point start to increase world gas prices; in a follow on, coal substitution for gas and oil will mean coal price increases will occur and act on top of the growing demand for coal in its unprocessed form[4]. In Australia, dependence on coal for electricity production undermines the ability of the industry to remain *sustainably*, globally competitive in the long term without transformation.

"The energy world is facing unprecedented uncertainty. Current moves still fall a very long way short of what is required to set us on the path to a truly sustainable energy system."

Nobuo Tanaka, Executive Director of the International Energy Agency (IEA) at the launch of the 2010 IEA's annual World Energy Outlook (WEO)

The following graph, whilst not trying to predict the crossover point of consumption vs demand shows the knock-on effect of pricing and constraints. At some point in the future the price of all fossil fuel based power will exceed the price of renewable based power – driven by increasing consumption and oil production capacity. Townsville, adopting renewables at a faster rate than Australia (or the world), will in the future be more sustainably competitive and will be a *price setter* rather than a *price taker*. A renewables strategy is a "futures competitive" strategy for Townsville.

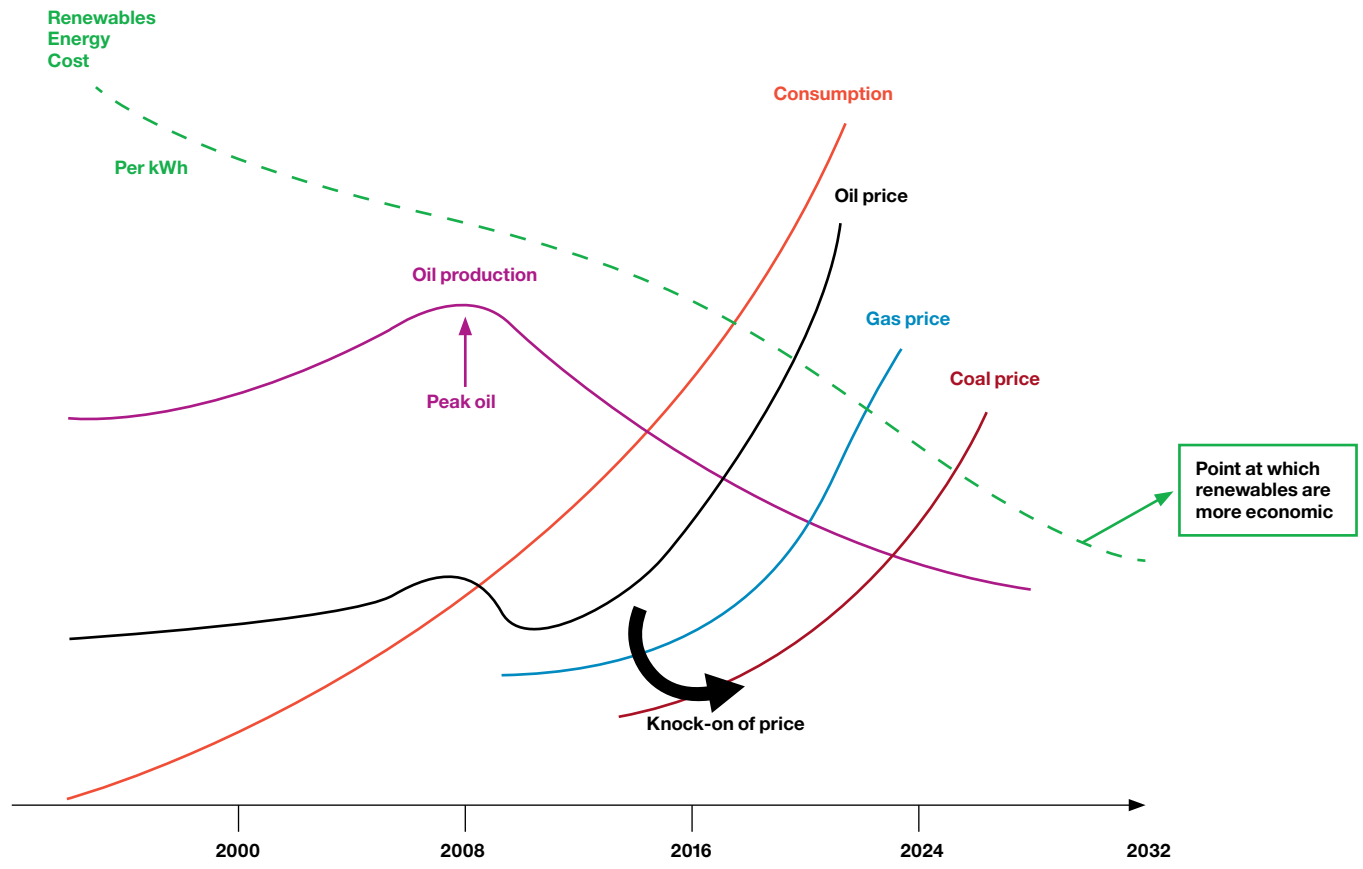


Figure 2
Peak Oil impact to renewable cost effectiveness

This view of source energy pricing is also shared and correlated to the electricity market in Australia by the modelling of AGL's chief economist[5]. AGL's research looks at two primary drivers in increased energy cost. The first is discussed above, due to the increase in source energy costs; and the next is the influence of Peak Network (electrical) Demand.

The report entitled "Peak Oil and Australia's National Infrastructure Submission to Infrastructure Australia by the Australian Association for the Study of Peak Oil and Gas – October 2008" includes a warning – "The nature of Australia's infrastructure is a key determinant of its oil vulnerability. Much infrastructure investment in recent years has exacerbated the country's oil dependence.

Despite growing awareness of peak oil, infrastructure planners have either ignored the phenomenon altogether or explicitly rejected the likely impacts. Many projects are already at risk of failure as their planning assumptions become invalidated by the combined impact of peak oil, the world financial crisis and related economic factors". Further on the report states: "The resilience of existing energy infrastructure needs to be improved, while a longer term transition to sustainable energy is facilitated".

Finally, part of AGL's economic modelling report canvasses the issue in clear linkages: "Australia's great wealth of energy resources, which have historically been sold to energy utilities at a margin above extraction cost, are now being developed at such scale for export that they have a potential to link with global energy indices and may cause a fuel cost shock."

These recognitions place an increasing importance on projects such as CopperString, and the significance of the Solar City programme undertaken by Townsville council and Ergon Energy.

Peak Network Demand

The Australia Gas and Light (AGL) economic modelling for energy cost in NSW and QLD have showed that increased peak demand, which is outstripping base energy demand, has consequences that result in "households in Sydney facing a combined network charge increase of 106% and 70% in Brisbane[6]" – during the period 2008 to 2015. The impacts to North Queensland are again further exacerbated by transmission constraints. Ergon, which serves much of the state of Queensland (and therefore Townsville), equally model the consequences of peak load growth. In fact, right across Australia, all electricity distributors are taking action to mitigate the impacts of peak load growth and are trying to influence the consumer behaviour that creates this serious situation.

Ergon Energy's response is manyfold. They have an aggressive demand management programme in which Townsville City Council is an active participant. As part of this they are planning an "Energy Sense Community" – a smart grid/smart city validation of technologies to reduce the impacts of peak load growth and trial smart asset management approaches.

Energy Conservation

Like peak power, energy reduction is an important part of creating an affordable efficient and competitive community. One hundred units of energy consumed by a coal fired power station produces about 0.3 units of light energy at the end of the distribution network when arriving in Townsville. Townsville's and Ergon's CitySolar programme has proved the economical effectiveness community engagement in energy conservation.

"Our findings were clear; electricity prices in New South Wales and Queensland have the potential to rise from about $130/MWh in FY08 to $255/MWh+ in FY15. Our worst case scenario breached $300/MWh."

Paul Simshauser – Chief Economist AGL

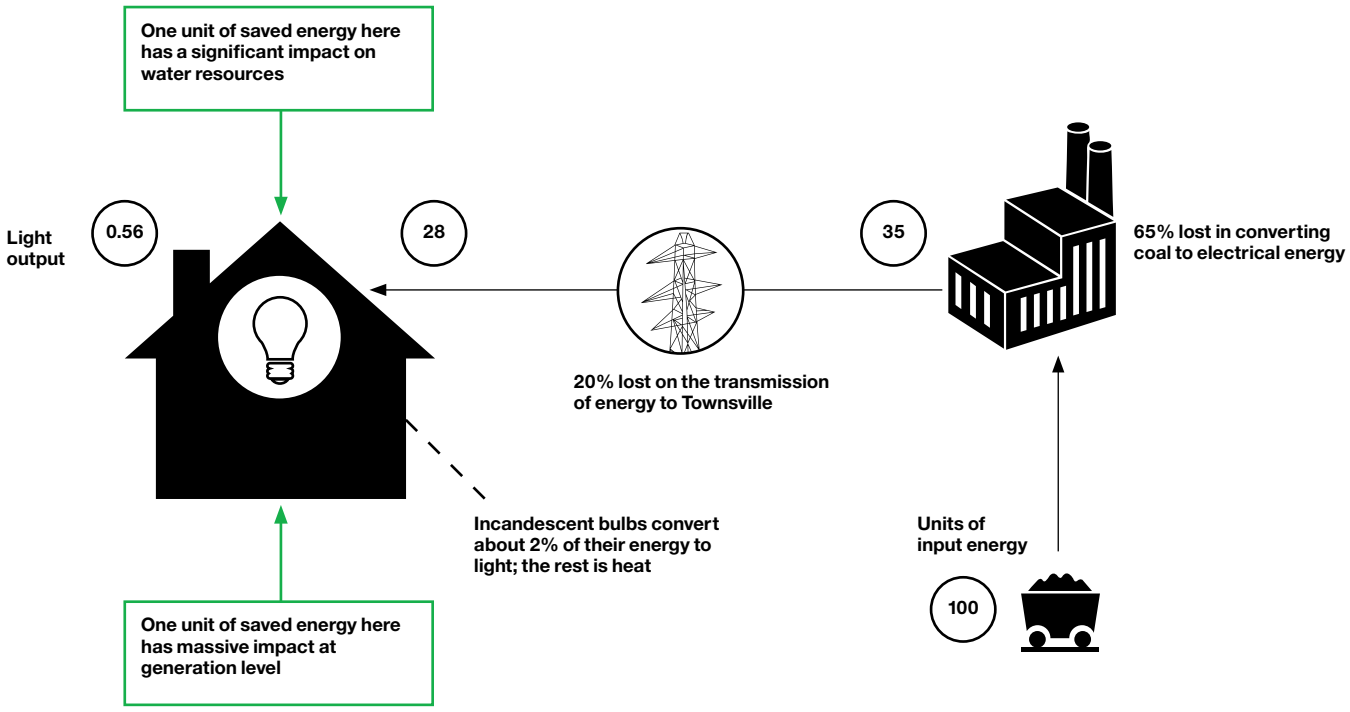


Figure 3
Energy loss and energy conservation

Climate Change and Energy Security

Whilst governments recognise and start to focus on Energy's impact on Climate Change, a second pressing issue of energy security may outweigh the momentum for faster action to reduce our dependence on fossil fuel. In the World Energy Outlook published in 2008 the executive summary starts with the following:

"The world's energy system is at a crossroads. Current global trends in energy supply and consumption are patently unsustainable – environmentally, economically, socially. But that can – and must – be altered; *there's still time to change the road we're on*. It is not an exaggeration to claim that the future of human prosperity depends on how successfully we tackle the two central energy challenges facing us today: securing the supply of reliable and affordable energy; and effecting a rapid transformation to a low-carbon, efficient and environmentally benign system of energy supply.

What is needed is nothing short of an energy revolution. *This World Energy Outlook* demonstrates how that might be achieved through decisive policy action and at what cost". This publication and subsequent IEA releases also describe clear consequences of failure to act on oil dependency and fossil fuel carbon releases.

Climate change science indicates increasing temperatures and frequency of weather events across the world. Increasing temperatures mean an overall increasing energy demand. The issue of peak demand also becomes more pronounced with temperature increases. Actions within the Townsville City Council and Ergon Energy addressing consumption and peak power reduction will therefore play an increasingly significant role in our ability to minimise impacts, both socially and economically. The solutions modelled in Townsville have implications for both tropical and temperate environments around the world. The Townsville Citysolar project has helped Ergon Energy and others understand how to better integrate solar renewable energy forms into our energy delivery systems. Whilst this capability is important, the rapid assimilation and distribution of this knowledge is an essential part of fast transformation of the energy sector.

Increased frequency of weather events requires greater resiliency and capability to respond. Gathering information from all sources, both contextual (typically from instrumented energy and water systems) and non-contextual (from social media and other non-structured feeds), processing information and developing probable scenarios is a key part of effective abnormal situation management. Better planning also aids recovery time, and greater food security reduces the impacts of any potential crisis situation. Ergon Energy and Townsville have some joint plans to explore platforms which can manage abnormal events, changing consumption patterns and more effective planning. These have the potential to be incorporated in the overall approach to information management and are covered later.

Figure 4
Water efficiency – various industries

3.2. Water Supply and Conservation

Water is a resource critical to Australia. Water is not only a critical resource for drinking; but needed within the whole fabric of maintaining societies structure (see right). Communicating the impact of society on water consumption is an important part of empowering the public to conserve resources.

In the recent past water shortages have caused major changes in State and Federal Government strategy. For instance to improve sustainability and reliability of water supply the Federal Government has initiated a number of programmes for water buy-backs, and redistribution of water allocations. At the State and City level Australia is now in a position where most of the major Australian capital cities have built desalination plants to secure adequate supplies of drinking water for their residents.

Whilst building this desalination infrastructure, we continue to consume an enormous amount of water in the production of power (predominately coal fired power). In 2004 and 2005 Australia *consumed* 271 gigalitres (GL) of potable (drinkable) freshwater to generate electricity. This has continued to increase until the present day. Conversion of coal fired to gas fired power assists in this reduction of water consumption, but a true transformation would occur with other renewable forms such as Solar PV and Wind Energy. Even Hydroelectric power whilst using water to generate electricity does not *consume*[7] water. Generally the same water that falls from a high level dam to a lower level through hydro generation is available at the lower level for treatment and use as drinking water. With coal fired power, the mining, processing, and generation processes consume a large amount of water that is not recovered.

Figure 5
Water efficiency

In addition to the issue of water consumed for power generation, there is an issue of power consumed for water distribution. In Townsville, the average consumption of water is approximately 1,300 litres per house per day[8]. In order to treat water for drinking, to pump water into reservoirs, and to treat the subsequent waste water, Townsville Council uses 22,813MWh of energy per year. Every litre lost through leakage or overuse by residents represents a significant amount of energy wasted.

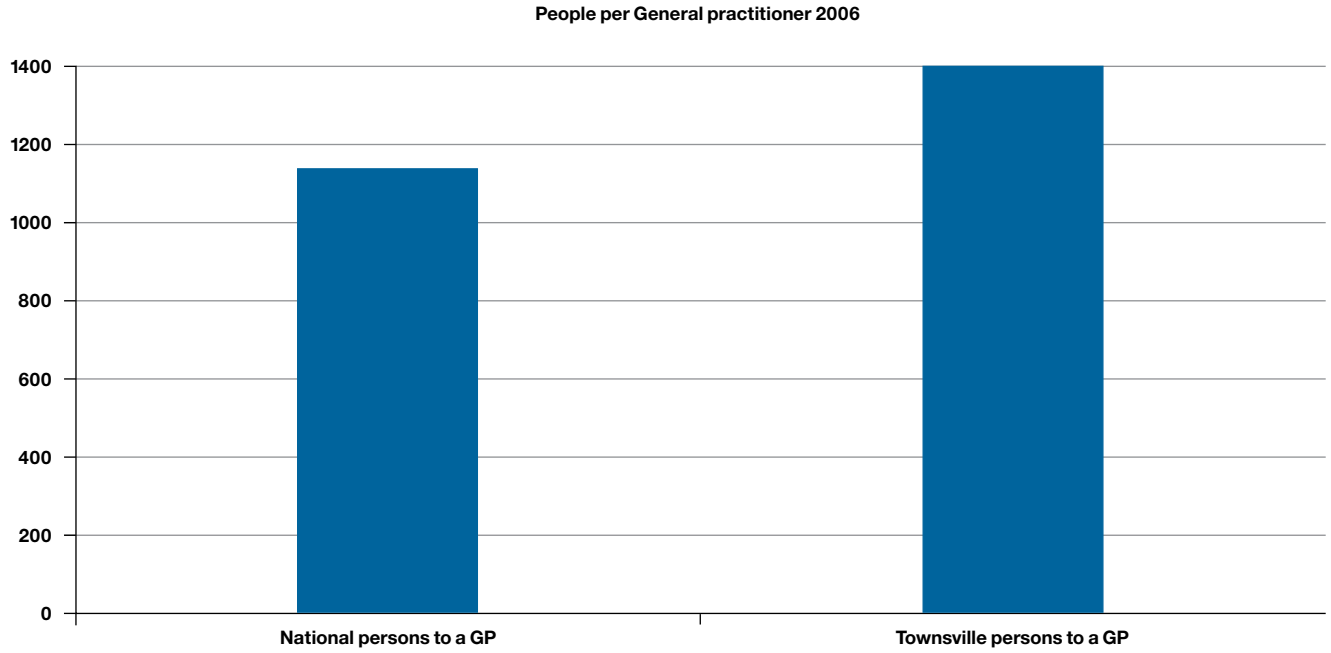
No direct correlation of this information is made and fed back to residents. This action may have significant capability to build a better understanding and behaviour change in Townsville if tracked and made available.

3.3. Healthcare

The Health system is under pressure with issues of ageing population, increasing incidence of chronic disease and resource shortages. A key issue for Australia is the lack of access to services, in particular in the primary care setting, increasing pressure on hospital services through avoidable admissions. According to the Primary Health Care Research & Information Service in 2006, Townsville had fewer general practitioners or family doctors per person when compared to the rest of the nation leaving the area under serviced.

In 2006, Townsville had a Full time Working Equivalent General Practitioner (GP) to population ratio of 1,399, or 1 GP for every 1,399 residents. The national average was 1 GP for every 1,129 people. Townsville is 20% below the national average.

Depending on other factors, this means it is more difficult to get access to a doctor than many other parts of the country.

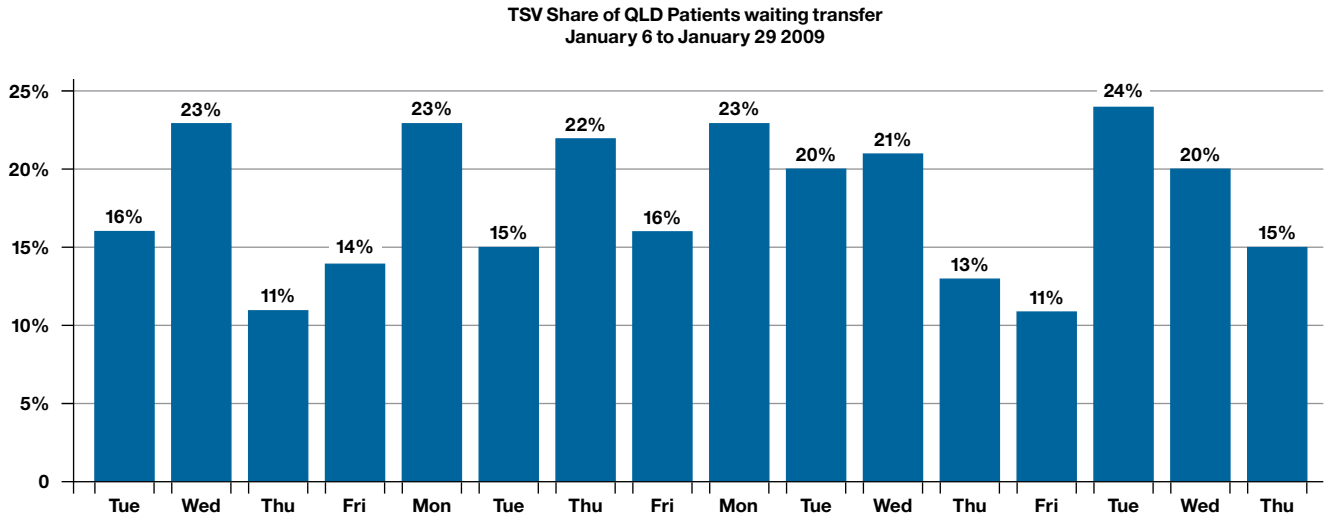


Source: Primary Health Care Research & Information Service

Figure 6
GP availability in Townsville

As well as primary care services accessibility difficulties, Townsville hospital is one of the busiest facilities in the State. In January 2009, for 12 of the 16 days (75%), where records were obtained, Townsville was the busiest hospital in the State. In 2007-08, the hospital had a median waiting time for a bed of 7 hrs and 27minutes, and deteriorating. Given expected population growth, considering appropriate improvements in medical technology, and even allowing for promised new beds, Townsville's health facilities require further expansion. (source: A Healthier Future for all Australians – Final Report June 2009, National Health and Hospital Reform Commission, Australian Government).

The Australian Government is implementing reform for the national health services to assist in addressing the aforementioned challenges. One of those reforms is the introduction of Personal Controlled Electronic Health Record (PCEHR) for all citizens, which will connect all of an individual's health information into a single record. The implementation of electronic records will support better health decisions by providing more complete information for health professionals. "Ensuring access to a national network (or alternative technology, such as satellite) for all Australians, particularly those living in isolated communities will be critical to the uptake of the person-controlled electronic health records as well as to realise potential access to electronic health information and medical advice."



Source: QLD Health, January 2009

Figure 7

(Page 34 "A Healthier Future for all Australians – Final Report June 2009, National Health and Hospital Reform Commission, Australian Government.)

Townsville has the opportunity via the NBN fast broadband service to develop new approaches, using electronic health for health system improvements, in the primary care setting supporting programmes that enable the more efficient and effective use of health facilities in the region.

3.4. Social Technologies

One of the systems that is rapidly changing today's world is the emergence of social technologies and digital networks that allow people and organisations to connect to one another across time and space. Social computing and information management software and platforms allow individuals to connect, learn, share, collaborate and co-create in new and exciting ways. While much emphasis in the media has been on entertainment and games, people and communities are breaking down traditional boundaries of organisation, geography, and demographics to create new opportunities as individuals come together around common interests and concerns and share data, information, knowledge and tap the collective intelligence of the group to inspire action.

In practical terms what does this mean? It means that the new social technologies are innately disruptive. They do not spoon feed content and allow for passive watching like television. Instead they allow and encourage individual people to search, find, connect, check-in, post, read, comment, rate, react, download, upload, analyse, act… using a multitude of technologies and media such as individual profiles, microblogs, blogs, wikis, documents, raw data sets, photos, geographical information systems (GIS), interactive maps, quick response (QR) codes, mashups, video and social networking sites, that leverage a fast broadband connection and devices such as a computers, laptops, smart phones, or tablets.

Countries around the globe have begun to embrace open data as an enabling technology. Leaders in this adoption include the United Kingdom, Denmark, Canada, New Zealand, Spain and the United States. The Australian Government embraced open data in its response to the Government 2.0 Taskforce report and the Declaration of Open Government.

"Once public sector information (PSI) is liberated as a key national asset, possibilities – foreseeable and otherwise – are unlocked through the invention, creativity and hard work of citizens, business and community organisations. Open PSI is thus an invitation to the public to engage, innovate and create new public value."

Engage – Getting on with Government 2.0, Government 2.0 Taskforce, December 2009

At IBM we've been experimenting with social computing technologies and open information for many years, out of necessity. We have a distributed workforce that spans all corners of the globe, we want to connect and tap the wisdom, skills, ideas and capabilities of each and every IBMer, and we recognised that in the digital age we needed to embrace social technologies in order to attract new talent and to be agile and responsive to our customers in a fast paced world. What have we learned from this ongoing experiment?

There is much to be achieved when people and organisations are open, transparent and engaged. Typically, organisations are structured around command and control management principles invented during the last century. These principles have permeated business, government and education, resulting in cultures where people "wait and see" or "look up" to see what their manager or leader or teacher thinks. Social networking and computing technologies are a strong antidote to these 20th century pathologies because they provide individuals with platforms that allow them to openly connect and share.

Individuals and organisations need to manage risk. If an organisation is going to encourage individuals to use social technologies as part of their job, then there should be clearly articulated guidelines about appropriate and inappropriate behaviour. Digital communities typically self-correct, which is what Townsville experienced during Cyclone Yasi. At IBM we published our first blogging guidelines in 2005. (http://www.ibm.com/blogs/zz/en/guidelines.html) We've updated these guidelines twice since 2005 as technologies evolve and questions arise from the user community.

See further discussion in the appendix on the IBM's journey into social technologies.

Imagine if a city sustainability hub was available to support home owners…

As a home owner, you could determine the most effective type of roofing. Maybe you knew a white roof is a cool roof. However, better information might be knowing that, in a climate that needs predominantly cooling, (like Townsville), 10% to 15% less energy can be consumed by air-conditioning with a white vs. darker colour roof. This better information lets you justify the amount to spend on your roof rather than air-conditioning.

Also, imagine if you also knew that in tropical Australia, zinc-galvanised (silvery) sheeting does not reflect heat as well as the truly "cool" colour of white; especially as metallic surfaces fail to emit infrared back to the sky.

Imagine putting your options in a simple tool with your roof area and the answer is provided to you. Easy access to information, such as metal and paint types, recommendations from neighbours about local businesses who can help, and implementation costs enable easy decisions on more sustainable alternatives.

4. Observations

4.1. Becoming Part of the Living System of Townsville

The IBM Smarter Cities Challenge team experienced a packed agenda of tours, workshops, and gatherings – essentially becoming a part of the living system called Townsville. The City uses an approach to encourage citizen participation and collaboration called Collective Social Learning. The IBM Team experienced it on a grand scale when 180 people from across Townsville city and regional government, business, academia, not-for-profit and local interest groups came together to explore what should be, what is, and what could be. This seemingly simple approach, created by Dr. Valerie Brown OA[9], is incredibly powerful in the way it allows for different perspectives, wants and needs to be expressed, probed, and cultivated by small groups of people working together. By the end of the workshop, each individual commits to do one thing to encourage change, in our case for sustainability.

Our involvement in this workshop was important for multiple reasons:

1. We heard from a broad spectrum of Townsville stakeholders.
2. We were part of the process and co-created new ideas with the Townsvillians.
3. We walked away with a better understanding of how people energy is created and individual and collective action is achieved within the community.
4. Each IBMer personally committed to doing specific things to further sustainability.

4.2. The Townsville Difference

The citizens of Townsville have a passion for community betterment, innovation, and self reliance. Champions in all levels of government, education, utilities, and industry showed strong evidence of willingness to brainstorm, cooperate, commit and act to change. The strategies defined in multiple planning documents, and in workshops conducted with inclusion of the IBM team during our project, revealed a vision beyond the expected scope of a town of 190,000 citizens.

Commitment: Townsville's city government and its extended community are committed to becoming leaders in tropical sustainability. Townsville City Council includes a department of Integrated Sustainability Services, which attracts global expertise. This department develops programmes for collaborating and motivating the community at all levels, from citizens to large businesses, to change behaviours and advance sustainability solutions in the community, supporting a wide range of sustainability projects.

Collaboration: Intelligent collaboration to aggregate funding and to "do more with less" is engrained in the Townsville community culture. Organisations pool funds for major projects and pilots, avoiding spending waste, and leveraging maximum results from investments. Cooperation is strong and healthy across federal, state, and local government budgets, as well as with utilities, educational institutions and businesses. Townsville's size also makes it a prime target for pilots and feasibility projects that can scale more broadly across Queensland and all of Australia, once methods are proven in this manageably sized environment.

Townsville's tropical climate and northern location create a need to take action to grow the City's capacity for self-reliance and self-dependence to strengthen resilience in the face of cyclones, flooding, and drought. The increasing growth of the population will put more demand on the city's power grid as well as the communications networks and water supply systems.

Councillor Les Tyrell OAM, Mayor of Townsville, demonstrated his support for the IBM Smarter Cities Challenge, saying that "By further exploring the application of intelligent technologies, high-speed broadband and data-driven decision making to address local issues, the IBM Smarter Cities Challenge team aims to help Townsville secure that future, and make the city an even better place to live and work."

4.3. Townsville Context

Growth predicted by state and local studies of the diverse Townsville economy will continue to drive challenges in Townsville, and the longer term planning predicts a doubling in population in the coming decades. The mix of military, tourism, manufacturing, education, and government employment drive this estimate of growth, though resources, transportation, and healthcare are already challenged at current levels.

Climate Change is driving the need to protect ecological amenities, incorporate green infrastructure and consider development constraints from natural hazards. These constraints include increasing temperatures, more severe storm events, decreased annual rainfall, increased severity of droughts. Furthermore, Townsville includes low lying adjacent coastal areas which are at moderate to high risk of storm tide inundation.

Land Use Planning can encourage well-planned activity nodes, which are key to remaining a strong centre for employment, productivity, and livability. The creation of activity nodes (industry, education and research, sporting, commercial) facilitates clustering of industries, enabling greater productivity and efficiencies.

Transportation Networks and Logistics are required to support a well-planned and integrated city. There is a high need for road infrastructure to move the increasing population between work, home and leisure activities, and a need for more frequent and efficient public transportation modalities, linked with transit-oriented developments. Townsville is now large enough to support its own regional warehousing and distribution facilities for wholesale market and farmers' markets, which in turn can create opportunity for regional fresh produce outlets, decreasing transportation costs, carbon emissions, and decreasing dependencies on other centres and increasing self-dependence.

Imagine Water Management…

You are trying to manage your water consumption both from a conservation view and a cost to your budget. You understand that cost of water has been increasing and you want to manage those costs.

Imagine you can access your water consumption via a smart metering system that enables you the homeowner to know your consumption on a daily basis. You now know how to make sure you are decreasing the use of water in your home whilst looking for supply issues in your home water supply – leaks or significant changes.

Imagine Food Quality…

You are a young parent and a you want to make sure your children have a healthy diet with access to good quality vegetables and fruits. But currently you are aware that the local produce is being transported to Brisbane and then back to the supermarket.

What if the local produce providers can now see the demand for their produce in the region and are able to make local produce available to those families looking for fresh produce for local growers.

Note: This service is already available to many townships.

Long term energy supply and security is a key requirement for this growing city, in face of the additional base load power requirements, a recognised need to accommodate growth and to enable value adding of products and services. Supplying energy to Mount Isa, Townsville and communities along the way are key to planning. There is an increasing need for more sustainable forms of energy and a shift to cleaner power over time. Key is the ability to influence citizen awareness of climate change and to increase willingness to support changes toward reducing energy needs while enabling alternative renewable energy generation capabilities.

Water supply strategy must be considered to meet residential and industrial needs and self-reliance. Townsville is endowed with abundant water supplies – both current and future potential sources. Water security could propel the city to comparative advantage in terms of accommodating growth relative to other centres.

Fast Broadband – Access to fast broadband will deliver major benefits for Townsville's future development and growth, specifically around green energy management, health services, economic development and education. The National Broadband Network (NBN) has begun deployment, with a launch in Aitkenvale & Mundingburra in September 2011. Release 2 rollout is scheduled for 2011 and 2012, touching a large number of suburbs in Townsville including the Central Business District (CBD). This rollout will provide the fast broadband infrastructure for Townsville to support the growth.

Societal Challenges – During the July 17th 2011 "Emergent Business Practices Workshop" a number of challenges surfaced:

- **Demographic Assumptions** – Citizen engagement is essential to moving Townsville forward toward its sustainability goals. Engagement is increasing within certain Townsville communities at the same time that the 18-40 year old segment of the population are not embracing as fully as they could be. This may be because this age group tends to be a more mobile and transient population that includes fly in/fly out workers, university students, and military personnel. This group also includes new homeowners, new business owners, employees and caregivers, as well as parents of school aged children. The youngest portion of this age group are digital natives who grew up with computers, while the older portion of this group are digital immigrants. What may be common for all across this group is that they are frequently on their laptops and smart phones and tablets using Facebook, Twitter, eBay, RSVP, and other social networking sites.

Imagine Healthcare…

You have just been told by your doctor you are a Type II diabetic and he has told you are at high risk of kidney and heart failure as well as blindness. To ensure this does not happen you need of change your diet and monitor you blood sugars daily. This is a major change to your life.

The doctor said to assist you in these changes that you can be monitored at home vie NBN and have access to a diabetic nurse who will assist with any issues. Also there has been a new application developed by JCU students that will allow you to put in your diet preferences and indicate the best diet to manage your diabetics. This is "digital hand holding" to make it easier for you.

- **Digital communication** – fast broadband (fibre, satellite, or wireless) is essential for Townsville to advance toward collective goals. The community lacks world-class connectivity that is pervasive and available to all of the community, and there has been relatively slow adoption of social media. Data to support fact-based and data-inspired choices and decisions is essential and growing in several areas, but information is often siloed and not often shared. However, the community is seeking ways to increase collaboration and holistic approaches to planning and decision-making.

  Cyclone Yasi demonstrated the value of digital communications. While telephone connections were interrupted by the cyclone, the community could often access low bandwidth websites. Both Townsville City Council and Ergon Energy used online platforms to communicate with and respond to citizens. Starting with a small base of "friends" and "followers", community leaders and news organisations picked up posts, creating a much larger network that included concerned families and friends in other cities and countries. Townsville also experienced the collective intelligence of the community – incorrect tweets and posts occurred, but citizens in the community proactively corrected them without the need for an "authority" to step in.

The TCC Library Services department is already leveraging digital technologies on multiple fronts. Recognising that people have gone to libraries for information, knowledge, social interaction, the news and to learn, and not just for books; the TCC libraries are working to extend those capabilities into the digital realm. While some people who are looking for information about the community may automatically think to go to the local library for information, there are groups within today's population who will start by searching Google or asking their question on Twitter.

At St. Anthony's College in Townsville, a maths teacher is encouraging secondary students to help one another learn and apply their math skills by asking and answering each others' questions using Twitter. His online curriculum encourages parent and community interaction. Students at Hermit Park School and Cathedral School showed their interests and skills in digital communications, as well.

Residents and visitors to Townsville will not find an abundance of insight generated about neighbourhoods, businesses, products and services. Much of what is available is connecting individuals to static information and not connecting people to people or people to communities. Historical data and information such as local government reports are often posted for a short period of time. Local information is limited.

An example: a citizen searching Google for information on tropical gardens in Townsville found information from different parts of the world but almost no information originating from Townsville, despite large numbers of tropical gardens in the city. He could not search online to connect with others locally to ask questions, troubleshoot, and share ideas and lessons learned.

- **Mobile Devices** – Townsville's use of mobile devices to check-in to locations, extend personal learning and knowledge, share data, pictures or information is lower than expected, possibly due to lack of fast broadband, or because there are fewer platforms and applications like Snap, Send, Solve targeted at Townsville.

Figure 8
Challenges identified in a community workshop

5. Recommendations

Table 1 – summary of recommendations

Steps	Cost to implement	Resulting value	Time period and driving body	Global examples
Sustainability Hub	Medium	Increased engagement of whole community Platform for communication during critical events (e.g. cyclones – enhanced safety)	3-12 months initial then expansion and scope ongoing with sustainability program TCC, Ergon & DEEDI	Peterborough, UK – sustainability focus; New York, USA – data example
Early Fast Broadband	Low incremental	TCC and Ergon connections critical	1-3 months NBN	Numerous countries
Open Data Agenda	Medium	City-wide open data architecture	3-12 months TCC, DEEDI	Freiberg, Germany
Collaboration Guideline Development	Low	Expansion of online services, guidance for employees	3-6 months TCC, utilities	Austin, USA; IBM; many cities and organizations
Sustainability KPIs	Low	Baseline performance metrics at city level	1-3 months TCC	Tianjin Ecocity, Singapore
Pilot Data Project	Medium	Learning from a data project	12-18 months TCC, Ergon, JCU	Peterborough, UK (visualisation)
Digital Learnscapes	Medium	Apps, innovation	Ongoing TCC	Ottawa, Canada Portland, USA

Future project examples benefiting from these steps:

- CBD central cooling (data will help with feasibility and design)
- Operations centers for water and power (cross-city focus will optimise costs and impact)
- Healthcare applications (acceleration of apps will improve care and lower costs)

The City Sustainability Hub

There is something special happening in Townsville. The people of Townsville are working across communities and organisations to create action. They're learning, collaborating and doing. Private citizens and individuals representing business, academia and government (sometimes wearing multiple hats at the same time) come together through workshops to learn from each other. People are then acting independently and collectively to promote sustainable practices in homes, schools, businesses and across the community. Yet, what is happening in Townsville is largely dependent on being in the same time and space.

People come together, sometimes travelling great distances to learn from one another. The energy created by workshops waxes and wanes with the physical event. There are few ways to extend the learning beyond the event on a continuous and broader way to connect people with one another across Townsville, with people in other cities within Australia and around the world.

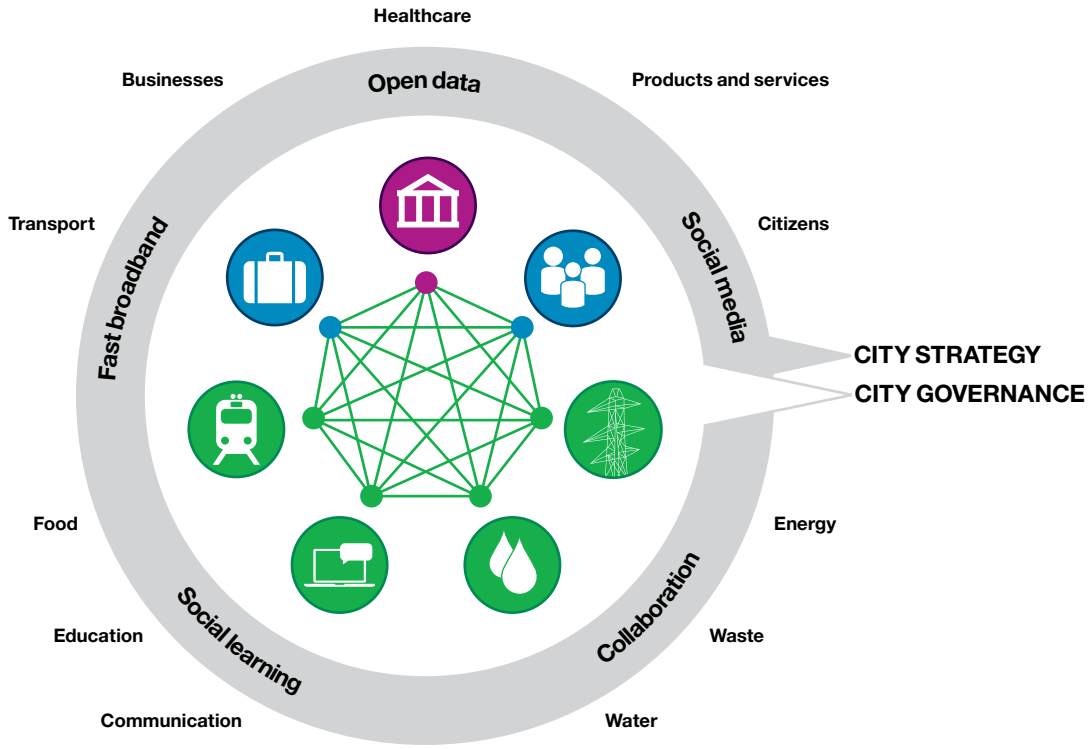


Figure 9
City Sustainability Hub

A City Sustainability Hub is a platform that aggregates digital services and products that mirror, extend and accelerate current capabilities within Townsville. Visitors, citizens, businesses, and communities are able to easily connect, learn, organise and collaborate in ways that change individual and group behaviour. Collaboration supports sustainable living, learning, working, and tourism as well as sustainable systems of energy, water, waste in homes, and private and public buildings.

A City Sustainability Hub could aggregate information and knowledge from private and public sources. Such a hub would also provide insight and data to the local business community and entrepreneurs as they look for opportunities to provide new products and services.

Recognising that individuals have different skills, experiences and expectations, a City Sustainability Hub could be thematically inspired to serve citizens at different levels of technology use and experience. We know in social spaces there are some common usage patterns that are often based on context and personal comfort. People may contribute, read, comment, rate, like, share and aggregate data, information, pictures, videos, ideas and knowledge.

Not all people do all things – some people may only do one thing (e.g., read posts, share pictures). We do know that people new to social spaces often are quite fearful of "doing something wrong" such as pushing the wrong button or looking silly. It is our experience that successful social spaces encourage a community culture of helping, whereby people proactively help one another find things, answer questions, provide coaching on how to use the technology.

This may be done in a very interactive ways through microblogs or discussion forums, or it may be done through short videos demonstrating how to do something.

There is no right or wrong way, and multiple methods appeal to different learning styles and personal preferences.

A city based social hub would be a way to keep sustainability in the common citizens' day-to-day consciousness, to continue to tap their creativity, to leverage data, information and feedback loops that create a personal and community sense of urgency are key to influencing and changing beliefs and behaviours.

Ergon Energy are investigating the concept of a unified platform to supply business managers, planners and operational managers improved insights in their energy networks and surrounding systems. The platform is designed for use during routine operations as well as in the case of abnormal events such as extreme weather. The platform could make use of social hub data fed into social analytics software to identify issues and correlations – providing Ergon with more detailed insight than manual processing of social media that was carried out during Yasi.

Imagine the Townsville City Sustainability Hub… (a scenario proposed by Penny Claringbull of the Townsville Integrated Sustainability Services Team)

High Mansion Towers is a (hypothetical) four-story 1970s office building in the Townsville central business district. It has undertaken significant retrofitting – solar, LEDs, water saving devices, insulation etc. Current communications around this building include formal meetings with builders, financers, project managers, staff, a JCU intern and their supervisor, local electricians, plus informal, mainly conversational, sharing info with workplace and social networks.

Most of the Townsville community doesn't know that the energy usage in this building has dropped 30%. Half of the staff using the building don't know either. The next-door restaurant and local property managers know a bit but only because their staff had a beer with the property manager.

Enter the Townsville Sustainability Hub:

- Due to open data sharing, energy usage in the Towers is mapped per square metre, per capita, by time of day in the CBD.
- The company that worked on High Mansion Towers can see how new buildings or old ones in the precinct are performing and approach them for business.
- HMT staff are proud of their achievements. They become more well informed and share what's been happening with businesses next door. TCC shares thematic behaviour change communications with the HMT staff online, plus publicises stories of what's going on. This digital communications gets the broader community interested.
- The JCU intern shows the data to her professor, who decides to recruit some postgrads to survey CBD buildings for sustainability features, and gets agreement to share the data openly.
- As a result, the CBD Taskforce becomes the CBD Sustainability Taskforce and puts together a group tender to enhance sustainability infrastructure in the CBD.
- This work is so successful that the model is exported and promoted using our super fast broadband, in brilliant 3D.

In a nutshell – the Sustainability Hub allows High Mansion Towers to link, promote and expand its insight out to the community, university and businesses – a multiplier effect.

The Hub's success requires a number of actions:

5.1. Accelerate the Delivery of Fast Broadband

The City Sustainability Hub is predicated on the availability of ubiquitous fast broadband enablement businesses to have an online presence and widen the business reach to global.

Participating in e-commerce can deliver efficiency improvements for businesses:

- Just-in-time inventory, lower delivery costs, and improved forecasting
- Expanded opening hours to 24 hours, seven days a week, unrestricted to physical shop hours and open to a global marketplace
- Reduced distribution costs and need for physical office/ retail space.

There is also a capability to develop new businesses through the broadband enablement, particularly ICT applications that operate only on fast broadband (www.nbn.gov.au/for-business/why-is-this-important).

Recent research by the Australian Bureau of Statistics (ABS) demonstrated that there was a strong relationship between the intensity of technology use and innovative activity in businesses. Based on firm level data for 6,442 businesses tracked over time, the ABS concluded that: that there was a strong relationship between the intensity of technology use and innovative activity in businesses. By enabling closer communication and collaboration, technology assists businesses to be more responsive to innovation opportunities and provides significant efficiency gains. For example, having technologies such as faster broadband, web presence, and automated system linkages, assists businesses to keep up with customer trends, monitor competitor's actions and get rapid user feedback, thereby assisting them to exploit opportunities for all types of innovations.

Drivers

The National Broadband Network is managing the roll-out for connectivity to Townsville. Given the advantages of early enablement of Townsville, especially the TCC network, and advancing plans for applications and open data, use and value of the NBN would accelerate. Townsville should be a "mission critical" rollout partner.

5.2. Shine Light on Open Data and Open Applications

During our meetings, it is clear that there are excellent sources of data currently available in Townsville. This data exists in numerous organisations including Townsville City Council, Ergon Energy, James Cook University, DEEDI, local businesses, schools and individuals. It was observed that much of this data exists in silos or is disconnected from others that could benefit. While the data is very deep and powerful, the use of the information is limited by the access to the information.

Townsville could be well served by unleashing the power of the current data. In other communities, the adoption of an open data environment has allowed the sharing of information in very meaningful ways. Organisations from the private sector have made information available to public organisations and very strong outcomes have been achieved. Likewise, public information has been shared with those beyond their organisation. Data that currently resides in independent systems can be associated with other data sources to deliver outstanding information for the benefit of all.

A Sustainability Information Hub could provide a platform to bring this information together in a meaningful way. Graphic representation of data such as power usage and water usage could help organisations plan in a manner to reduce cost of projects and improve overall service. Sharing of information on project timelines could allow organisations to reduce redundant activities and establish mutually beneficial schedules that are much more cost effective for all.

The open data approach would also allow information to be used for consulting research purposes with the outcome of this being beneficial for local businesses and even improved healthcare. This could potentially strengthen the relationships between the business community and higher education. As this information grows in the hub, it could effectively be used to stimulate desired economic development with coordination being lead by local organisations.

A key component of this open data is ability for participants to input information to the system. This critical attribute enables the important feedback necessary to make this a living system. The inclusion of data from mobile devices would be very advantageous. Local schools could leverage their ongoing focus on sustainability by contributing information from their ongoing efforts that could be shared with others. Advancing tools like mobile applications and QR codes would also enhance the collection and sharing of data. As fast broadband becomes more available, the pace of collecting, analysing and acting on information within this hub will certainly accelerate. Advanced projects like a Tropical Data Hub could be a participant in the system and lead Townsville to international recognition for the ability and willingness to share data in an open environment. The adoption of open data in a Sustainability Information Hub provides unlimited opportunities for the city and community of Townsville.

CopperString Clean Energy Corridor

A major part of the Climate Change picture is transformation of energy sources from fossil fuel to renewable forms of energy. The work on the CopperString clean energy corridor plays an important part in responding to the climate change crisis. It provides a vehicle for positive action by allowing North Queensland renewable energy development along the 800km Townsville to Mt Isa route. It also enables various renewable sources of energy to be integrated into the Australian National Energy Market. Moreover, because of one end's proximity to Townsville, the corridor provides impetus for an energy production capability that is necessary for Australia's energy future. For Mt Isa, it provides transformation of an energy source for mining that insulates it from a fossil fuel cost cycle. The impact of this project can be widely understood via the gathering and dissemination of information on renewable energy – in the "Sustainability Information Hub". It may be foundational for the rapid development of North Queensland region under a strategic energy repositioning.

Citysolar programme and Energy Sense Community

To combat peak power issues and excessive consumption of energy, various local programmes have been developed. These programmes are often jointly aimed at both energy conservation and peak energy reduction[10]. The Townsville Citysolar programme on Magnetic Island (adjacent to Townsville) is one such programme. As part of the $94 million Solar City project of the Australian Government, it has been very successful in reducing year-on-year consumption and peak load on the island, successfully deferring the need for an additional undersea cable. Townsville City Council and Ergon Energy have worked together to increase consumer awareness of peak power and excessive use impacts, and influenced suitable behaviours for consumption. The Townsville Residential Energy Demand (TRED) Community Based Social Marketing programme is one of the most comprehensive studies into energy reduction yet to be undertaken in Australia, and the knowledge gathered within the programme would be enhanced when effectively distributed through the Sustainability Hub.

A programme to further explore the capabilities in demand reduction and peak load shifting is being explored by Ergon. They have entitled it the Ergon "Energy Sense Community" and is an extensive suite of pilots to explore effective measures with residential communities and commercial/industrial clients within the Townsville area. The Energy Sense Community Programme envisions the energy-smart community of 2020 through three streams:

1. "Smart Net 2020" – The electricity distribution grid of the medium-term future;
2. "Smart Res 2020" – The residential community of the medium-term future;
3. "Smart Biz 2020" – The commercial and industrial energy user of the medium-term future.

The programme is being planned with the support of Townsville City Council and further demonstrates the cooperative and collaborative capacity of Townsville. It has the capacity to feed information into a Sustainability Hub, enabling the measurement and validation of various approaches and technologies, and provides an opportunity to inform Australia and the world of effective measures to manage this peak demand phenomenon.

Townsville Council is engaged with industry specialists to foster knowledge and capability that reduces overall energy demand, a decisive part of the mix of strategies to insulate themselves for the impact of peak oil, peak power growth and increasing energy consumption.

Effective energy reduction methods were demonstrated in a number of building projects that were witnessed by the IBM Smarter Cities Challenge team:

- Painting home and building roof a white colour
- Using trees and shrubs for shading
- Replacing traditional hot water systems with solar hot water systems
- Optimising Building Management Systems
- Swapping to LED lights from incandescent or even from compact fluorescent lights.

Each of these initiatives will have different outcomes based on building types, current consumption patterns and investment/replacement cycles. Providing this knowledge in the "Sustainability Information Hub", and social systems knowledge transfer provides another avenue for community engagement in informing the wider community of the benefits.

District Cooling Programme

A programme with James Cook University (JCU) has been successful in reducing the peak energy demand of the university and producing significant overall energy efficiency improvements. This programme chills water overnight, and then delivers it to the University campus during the day, avoiding the use of electricity based standalone air-conditioning systems. The technology, although well known overseas has been rarely used in Australia to reduce peak demand and improve energy efficiency. Its use in Townsville is not only significant to Australia in general, but provides excellent information for the use of this technology in a tropical (predominately cooling) environment. St Anthony's College in Townsville has also leveraged central cooling technology through a central chiller/ energy storage project that will progressively extend from a central sports facility to many of their buildings on the Deeragun campus.

The success has spawned another joint Ergon-Townsville City Council project to explore the feasibility of a district cooling solution in the city CBD. This project not only extends the use of an effective technology to combat peak demand growth and its economic consequences, it engages a whole community in energy conservation and efficiency focus that fosters Townsville Council's community engagement.

There is no doubt the effectiveness of many of these initiatives and programmes. However, despite the innovation and success of these programmes, the ability to compare approaches and understand the economic impacts is hampered by wider dissemination of result data and access to programme results information; again the "Sustainability Information Hub" may provide an answer.

Nurture Partnerships to Build Healthcare and Business Apps

Healthcare is on a dangerous course. The expense of healthcare as a percentage of gross domestic product (GDP) is projected to double in a generation. The financial burden and issues surrounding quality of care are positioned to have a serious impact on the sustainability of every community. Townsville GP Network understands and has been acting to change the delivery model for better health services for the community.

They have already delivered a number of programmes targeted at changing the current delivery model using eHealth, including electronic referrals and electronic discharge summaries. As an extension to their eHealth initiatives there is a planned Diabetes Home Monitoring Programme, which will assess how access to fast broadband can assist health outcomes for Type 2 Diabetes patients. With the advancement of fast broadband, there are additional opportunities to improve healthcare while minimising the financial obligations and Townsville GP Network is certainly well positioned to work with the Townsville community to achieve this.

From the interviews, there are organisations and businesses that are eager to develop applications on fast broadband and potentially improve healthcare. James Cook University is looking for partnerships with industry and government to identify areas of opportunity where students could develop real world solutions.

Organisations such the North Queensland Small Business Development Centre could be instrumental in matching students with interested businesses. A cooperative environment could be established where educational organisations, local businesses, fast broadband and healthcare organisations could work together to not only improve healthcare, but also establish a business incubator environment.

Local businesses could certainly tackle this opportunity individually. However, the power of an interconnected community could launch Townsville beyond providing improved healthcare locally. With the alignment and communication of a local sustainability hub, Townsville could be a true leader in the development and delivery of electronic healthcare solutions in Queensland and the nation.

Such an implementation would be beneficial in numerous areas. Local businesses would have tremendous opportunities for success. Students would gain real world experience, contribute to much needed solutions and be positioned for local employment in Townsville after graduation. The North Queensland Small Business Development Centre would be recognised as a leader of successful endeavours while positioning for additional opportunities with the advancement of fast broadband.

Teleworking Model to Deliver Skilled Resources

The development of new business and work models will be supported by access to fast reliable broadband. Teleworking will be facilitated by the broadband introduction, increasing flexibility in location of staff and expanding the supply of skilled labour. While teleworking was not specifically referred to in our discussions with stakeholders, possibly since few experience it to day, we frequently heard concerns about a lack of skilled resources for current roles as well as new business development. This change of business models facilitated by reliable fast broadband can assist with skilled resources by bringing people back into the workforce as well as enabling the use of non-local resources for businesses. The opportunities for Townsville to access resources which were previously not available, as well as better use of physical facilities to manage growth, can benefit both employees and employers – fostering a work model that assists with community development.

Cultivate an Appetite for Local Food Apps

In numerous discussions over the last three weeks, a recurring concern regarding the supply of food and the required transportation was recorded. It was stated that virtually all food supplies are routed through the Brisbane area while much of that supply originates in the Townsville area. This creates a precarious dependency that would potentially threaten the sustainability of the community. We believe there are a few actions that could help improve and diversify the local food supply.

There appears to be a sizeable amount of food supply created in the local area. It would be desirable to establish a means for those supplies to be utilised locally without shipping to a remote location to only have the items shipped back to the point of origin for consumption. An energised Sustainability Information Hub could provide such an alternative.

Many communities have leveraged a local information sharing approach to establish non-traditional food supplies. Websites such as locallygrown.net are used to match local producers with consumers. This simple and effective information sharing provides accurate and timely information to producers so they can deliver locally to consumers or even wholesalers. Information sharing can be a component of a sustainability hub. This approach minimises shipping, lowers costs, reduces external dependencies and improves overall community sustainability.

Recommendation

We recommend that Townsville City Council and DEEDI join together taking the leadership role in the introduction of open data practices to the Townsville city. Based on our study of the high potential for realisation of the value of open data, this objective may be implemented in a first phase within three to 12 months.

5.3. Establish City Sustainability Hub Guidelines

Open Data is a cornerstone of our recommendation for a City Sustainability Hub. Open data holds the potential to some opportunities for economic development, promotion of research, and the acceleration of progress for the extended community. Along with the benefits of open data described earlier, responsibility is required to manage a set of valid, current and appropriate data sets. The City Council has a responsibility to protect the private information of citizens, ensuring that data about the population is redacted to avoid sharing specific data points about individuals as public information.

As well as privacy protection, a set of principles should be adopted to retire, de-duplicate and aggregate data. The Peterborough Smarter City project ran workshops to gather data and created a base data model. Secondary workshops produced more detail and higher quality data that were used to refine the data model and improve their outcome (visualisation), as one example of an approach.

Townsville leadership should not start with a clean sheet of paper. Open data and social business guidelines exist in many forms, and have the advantage of several years of testing and tuning. Sources and examples from other organisations are included in the bibliography.

Recommendation

We recommend that Townsville City Council, DEEDI and Ergon Energy join together taking the leadership role in development of data management, usage and privacy protection guidelines. Based on our study, this objective may be implemented within three to six months.

5.4. Establish City Sustainability Hub KPIs

Data analytics and trending are most informative when data are compared and aligned to targets and metrics, or *key performance indicators* (KPIs). Our recommendations include further development and refinement of a core set of KPIs for the purpose of guiding the city of Townsville toward specific sustainability goals. Development of a set of key metrics can support Townsville in aligning its actions to support progress toward its goal of being the leading tropical city in sustainability.

Key performance indicators will help Townsville managers analyse and interpret how well their organisations function on the sustainability front. Communicating them to the community, partners and vendors allows others to assist and align their performance to the needs and priorities of the council.

A KPI usually consists of a directive, indicator, time frame, benchmark and target. For example, a directive could "decrease water useage by 10%" for the Water department. "From an average 1,300 litre per household to 1,170 litre per household" could be the indicator. "By the end of the fiscal year" typically represents a reasonable target. "Alignment with similar size and environment towns" represents a general benchmark (picking a town to benchmark to is important). Another element typically describes how frequently the organisation reports the data; for example, monthly, quarterly or annually.

By examining performance levels, managers can see where to develop improvement strategies and can call on the public for participation and suggestions. Marketing alignment and estimated saving can be part of the communication programme.

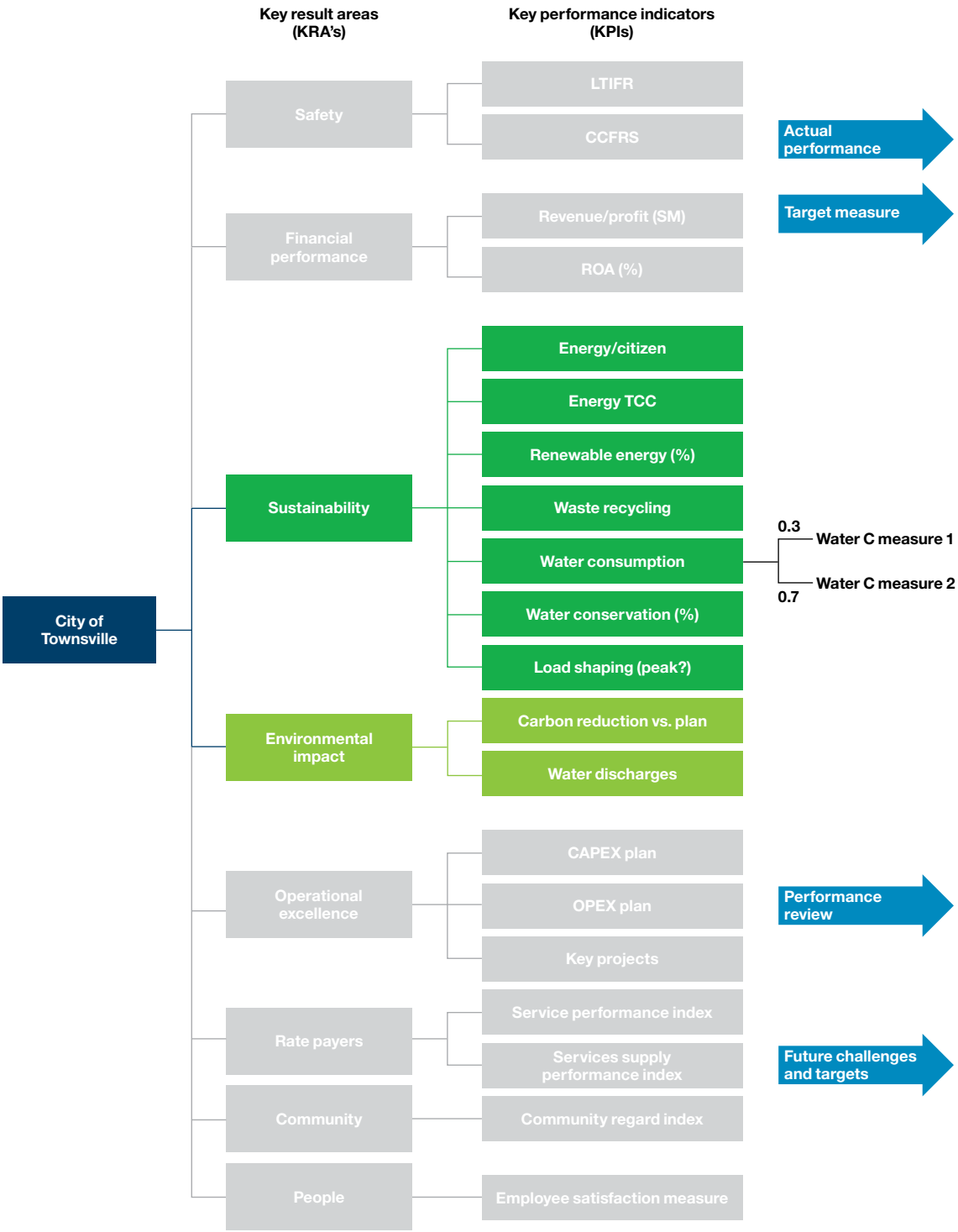

Key result areas (KRA's)
Key performance indicators (KPIs)
City of Townsville
Safety
LTIFR
CCFRS
Actual performance
Financial performance
Revenue/profit (SM)
ROA (%)
Target measure
Sustainability
Energy/citizen
Energy TCC
Renewable energy (%)
Waste recycling
Water consumption
Water conservation (%)
Load shaping (peak?)
0.3
Water C measure 1
Water C measure 2
0.7
Environmental impact
Carbon reduction vs. plan
Water discharges
Operational excellence
CAPEX plan
OPEX plan
Key projects
Performance review
Rate payers
Service performance index
Services supply performance index
Future challenges and targets
Community
Community regard index
People
Employee satisfaction measure

Figure 10

KPIs typically aggregate from lower level measures and end in Key Performance Areas that are in this case broad categories of sustainability and environmental performance. They can be prioritised against other measures such as growth, financial performance, standing debt. An example of a KPI system is shown right. The example is indicative only of a system that needs to be established rather than the absolute measures.

One starting point may be the top line measures used in Australian Sustainability Index. This index measures 15 different indicators across three broad areas: Environmental Performance; Quality of Life; and Resilience; it establishes the baseline and benchmarks against others for improvement. International indices, such as those found on City Forward may be appropriate. The key is establishing the measures that fit the vision of Townsville and picking benchmarks to strive to in a predetermined period.

Another measure of sustainability is the Australian Conservation Foundations's 2010 Index which ranks Townsville fourth of the 20 largest Australian cities.

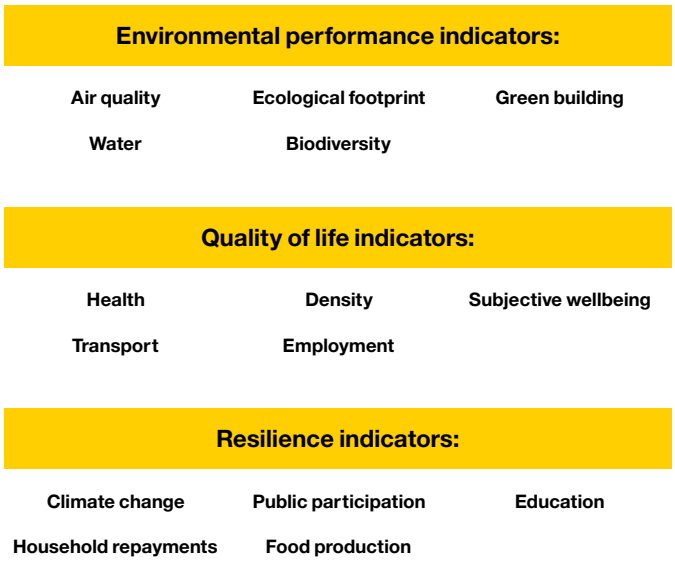


Figure 11

Townsville has the opportunity as it moves ahead to select this or other measures and to identify their underlying KPIs for adoption as Townsville's own. It is highly recommended to seek support and buy-in from key stakeholders and the community so that the KPIs serve as true guideposts for plans of action and validation for course correction as and when needed to maintain momentum and measure forward progress toward the goal of becoming the leading tropical city in sustainability. (More detail is shown in Appendix D.)

Recommendation

We recommend that Townsville City Council assume the leadership role in the development of a set of Sustainability KPIs. Due to TCC's strength in engagement of the community, it is likely that the solid practice of a community workshop may serve well in involving interested parties in this activity. Based on our study of the progress already achieved in this area, this objective may be implemented in a first phase within one to three months.

5.5. Select a project for piloting open data and open apps

Starting with a defined project that is small in size can be an ideal step to starting a city-wide approach to open data and achieving a City Sustainability Hub. Taking the first steps with a small group of stakeholders who are focused on a successful feasibility pilot can breathe life into the data, and more rapidly show success and attract additional stakeholder participation and funding approvals.

Townsville has several interesting projects already in motion from which to select, or the hub leadership might choose one similar to the scenarios outlined earlier. Information-sharing initiatives that we learned of during the Smarter Cities Challenge include the Ergon-Townsville plan for sharing of long-range plans, the Copperstring Initiative, the feasibility study for central cooling in the central business district (CBD), and the proposed collection of data and analysis for the Tropical Sustainability Hub described by Dr. Ian Atkinson of James Cook University.

The pilot should not preclude nor preface all the other recommendations. Concurrent to the pilot should be the creation of guidelines, KPIs, and digital communications plans for all projects. The pilot should be used as a testing lab for those steps toward sustainability.

Recommendation

We recommend that Townsville City Council, Ergon Energy and James Cook University join together taking the leadership role in developing, scoping and launching a pilot open data sharing project. Based on our study of the readiness of the City and the advanced nature of discussions already under way toward this objective, we believe this objective may be implemented in a first phase within 12 to 18 months.

5.6. Weave Together Physical and Digital Learnscapes

The introduction of broadband connectivity for educational facilities, primary, secondary and tertiary, will enable them to develop and collaborate on innovative and flexible educational services and resources to extend online learning services to homes, schools and workplaces. The schools and JCU in Townsville are already using ICT and connectivity for learning within their programmes. Access to fast reliable broadband will advance their capabilities to extend these programmes. Other areas that will improve include online training and learning, using teleconferencing and interactive programmes that cannot be supported by existing broadband services.

Public access to wifi and facilities to access fast broadband through cafes and community facilities such as libraries will open up the fast broadband to a wider section of the community in particular for public use. The Aitkenvale Library has already started to provide internet access through council provided PC's which they are getting strong public access.

As this work on learnscapes progresses, the conservative approach to digital communication will be challenged. The team observed that there was an opportunity to build upon the social collaboration that occurred on Twitter, in citizen discussion and in libraries following Cyclone Yasi. However, this momentum has largely been lost. Like most organisations and governments, fears over the negative prevent the growth of the positive value of social collaboration. (The same reactions often led to management declarations against other techno-social change – the internet, the cell phone, the personal computer – all consumer hits that moved quickly into business tools.)

Therefore, an important success factor for open data and digital learnscapes will be the engagement and flexibility of city council, council directors, utility executives, and business leaders (the schools and universities seem well ahead in their thinking). Ever mindful of privacy and security, the sustainability hub can lead the way in appropriate digital collaboration and the advantages it will bring, including the education and support of management.

Recommendation

We would recommend the Townsville City Council continue to drive the community learning through the Integrated Sustainability Services department, the Libraries, and the Communications department, taking advantage of support and funding from the State, Ergon, JCC, and community businesses. Moving to a more digital communication approach will not only draw support from new constituents but also allow the leveraging of new apps and data for learning.

5.7. City Sustainability Hub Recap

The City Sustainability Hub operates hand in hand with other structured data capture systems, such as Infrastructure Management Systems in the government and utilities. As a platform, it exposes data from structured internal systems to the outside world, maintaining privacy and security whilst aggregating a host of digital data services.

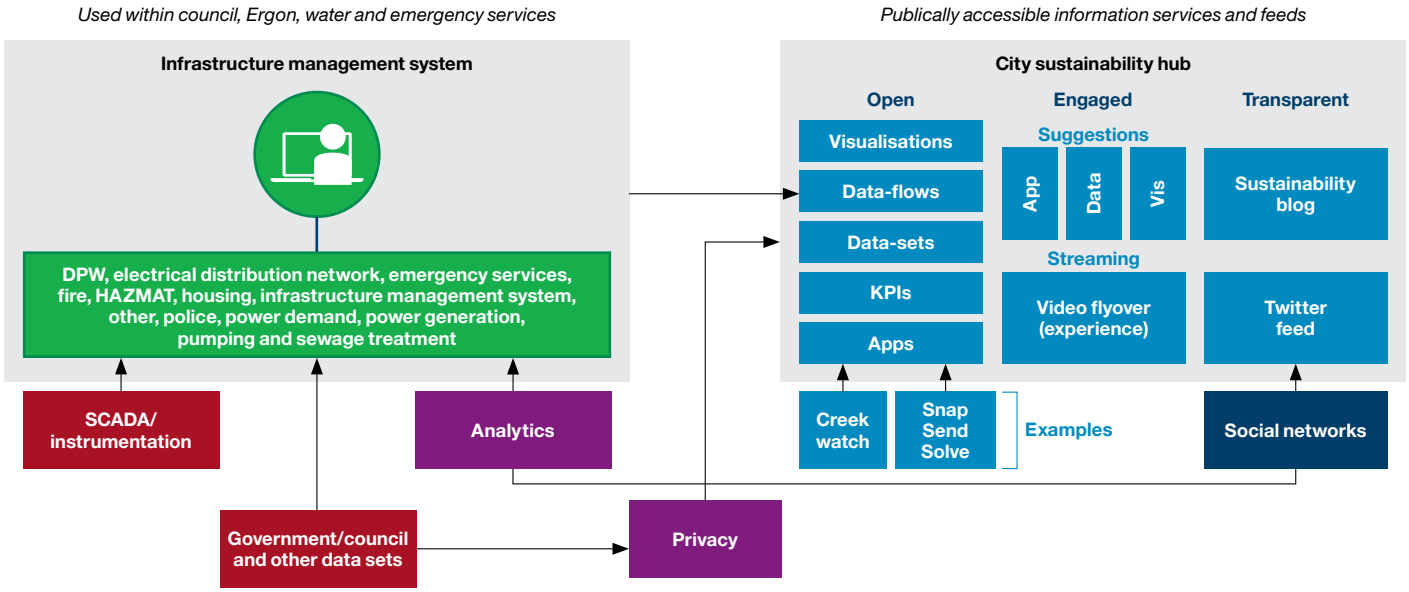


Figure 12

As an access point, the hub's target is wide: visitors, residents, and businesses in formal and informal communities. Its role in innovation is made possible by easy access, high bandwidth connectivity (via fast broadband), open standards and an overall data model that focuses on the town and community. As an aggregation point it is not a massive accumulator, it allows access to what is already in place or will be put in place. Business and community insights are gained by providing information that is not typically available today. It fosters a knowledge-based society giving an edge to those who mine and explore information.

Contributions may be through channels that exist today (social systems like Twitter and Facebook; applications like Snap, Send, Solve) as well as open new non-traditional channels focused heavily on the sustainability thrust of the council.

Ergon is investigating the concept of a unified platform to supply business managers, planners and operational managers improved insights into their energy networks and surrounding systems. This type of system can be referred to as an Infrastructure Management System, which allows complementary operational data, planning data and abnormal event management data (such as extreme weather events) to co-exist. Feeds are not duplicated to these systems but rather are mapped to each other (see above diagram) – enriching real-time and static data sets (whilst managing privacy and security needs). The use of indexed information by businesses and the community at large will typically foster the identification of community issues and correlations.

Sustainability encompasses resiliency, an important issue in tropical regions where extreme weather events occur on a yearly cycle. The Sustainability platform could make use of social data fed into social analytics software as well – assisting Ergon and Townsville council in richer ways than their manual processing of social media that was carried out during Yasi.

6. Conclusion

The City of Townsville is a perfect setting for understanding, testing, and living the goal of sustainability without sacrificing quality of life. The city's location and climate will challenge the use of energy and water, access to digital communications, and protection of an environmental heritage worth preserving. Other cities, large and small, can benefit from the lessons Townsville's leaders are learning.

While Townsville may have a few unique challenges, the models that they are already testing (solar energy, white roofs, shared cooling, peak demand management) have value across the planet, uniting government, citizens, utilities, educaton, and business. As other communities have found, the human side of sustainability – perception, funding, policies, and the affect on an individual's purse – drive decisions far more than long-term views.

Townsville has leaders with vision, and the next steps are to bring more of the vision to reality before the actions of conservation and renewable resource fall behind the growth in consumption and the fluctuations of the economy.

We believe the acceleration of the vision requires significant improvements of the speed and use of digital communications, the adoption of serious open data principles, and the extension of their informal teamwork to a living, breathing hub of sustainability focus across all constituents. The eagerness to reach out to best practices and global support will not only benefit Townsville, but Townsville's lessons and successes will be a model for a smarter planet.

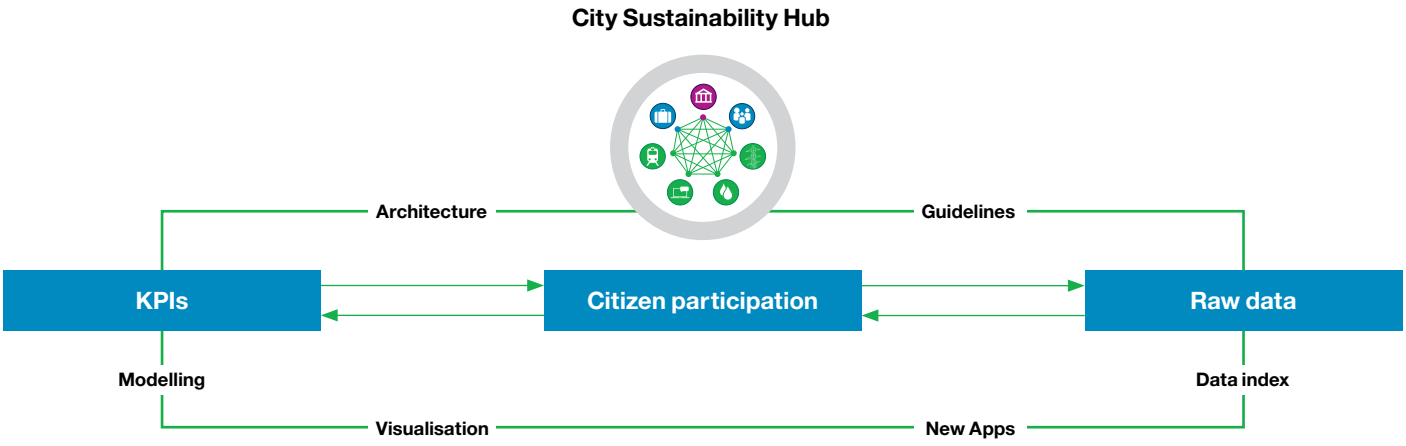


Figure 13


disconnected
Sea Temple

7. Appendix

A. Acknowledgements

- **Cr Les Tyrell:** Mayor – Townsville City Council
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- **Cr Suzanne Blom:** Councillor – Townsville City Council
- **Cr Ray Gartrell:** Councillor – Townsville City Council
- **Cr Brian Hewitt:** Councillor – Townsville City Council
- **Cr Jenny Hill:** Councillor – Townsville City Council
- **Cr Jenny Lane:** Councillor – Townsville City Council
- **Cr Dale Last:** Councillor – Townsville City Council
- **Cr Natalie Marr:** Councillor – Townsville City Council
- **Cr Tony Parsons:** Councillor – Townsville City Council
- **Cr Trevor Roberts:** Councillor – Townsville City Council
- **Cr Vern Veitch:** Councillor – Townsville City Council
- **Greg Bruce:** Townsville City Council
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- **Jason Meldrum:** Townsville City Council
- **Dylan Furnell:** Townsville City Council
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- **Charles Blake:** Townsville City Council
- **Adam Bury:** Townsville City Council
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- **Anthony Wilson:** Townsville City Council
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- **Brian Ashfield:** Townsville City Council
- **Christina Pery:** Townsville City Council
- **Colin Phillips:** Townsville City Council
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- **Charlie Hargroves:** The Natural Edge Project
- **Cheryl Desha:** The Natural Edge Project
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This long list gives some indication of the involvement of the residents of Townsville and the State of Queensville in the journey toward sustainability.

Sincerely,
Glen Garner, Annette Hicks, Chris Holmes, Lisa Johnston, Boxley Llewellyn, Jennifer Okimoto.

B. Team Profile

The IBM Team (Left to Right) with Councillor Les Tyrell OAM, Mayor of Townsville (seated Centre)

Boxley Llewellyn is Director of Growth Initiatives for the global Banking and Financial Markets Sector team, driving new technology solutions for large clients and growth markets.

Annette Hicks is the Healthcare Business Executive for ANZ. Annette has worked in Health both as a Clinician and in Technology solutions delivery. She has worked with a wide spectrum of public and private health customers across ANZ.

Chris Holmes is the Solution Sales Manager for IBM's Public Sector, focusing on technology and business solutions for government clients.

Jennifer Okimoto is an Associate Partner in IBM's Global Business Services as a strategy consultant focusing on social business.

Glen Garner is a Managing Consultant in the Australia & New Zealand Energy & Utilities team, helping customers solve problems with energy and water, helping make our electric grids smarter and more resilient, and working on smarter cities and their challenges.

Lisa Johnston is Director, Information Management Marketing for IBM Software Group and holds worldwide marketing responsibility for IBM's information management software portfolio. Her global team drives innovative marketing campaigns and communications.

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D. More on IBM's social communications journey

Leadership Decisions

The IBM journey into social technologies required leaders to ask questions and promote a level of risk taking. For example, there was a deliberate move from closed collaboration and knowledge management systems toward open ones. For many years, information was closed to a specific team or department and others were provided access because they had a "need to know."

Nearly a decade ago, leaders within IBM challenged the conventional wisdom and asked, "what if instead of all information is closed unless there is a need to know, we make all information and knowledge open to the company and only restrict it if there was a clear business reason to restrict it?" This change did not come easily, but over time it is more common within IBM to have open knowledge sharing repositories and databases than closed, as well as cross-organisational collaboration platforms.

You can see this same type of risk taking with the way that IBM embraced blogging and each subsequent social media trend[11]. You can also see this with how we learned from our culture of "jamming" and opened up our Innovation Jams to customers, business partners, family members and friends.[12]

Guidelines

IBM has updated its guidelines for web use twice since 2005 as technologies evolve and questions arise from the community of IBMers who use social technologies. Early on we made a decision that IBMers who interact on our social spaces should be themselves and that they should post and comment on IBM internal spaces openly and authenticated as an IBMer. This means we do not allow anonymous postings or comments within our corporate intranet and we encourage employees to demonstrate trust and personal responsibility on external sites.

Managing risk has also included constant communication and education of our employees about our social computing guidelines. It has included encouraging IBMers to share success stories and lessons learned from their actions inside the IBM firewall and on the Internet. It has included monitoring individual posts and behaviour with the right to delete inappropriate content. Guidelines have included a social media audit to assess risks and opportunities from IBMers who are engaging on the Internet with friends, colleagues, customers and business partners.

Guidelines and practices at IBM have included targeted learning and co-mentoring programmes to help employees, managers and leaders feel comfortable with these new technologies, understand how they apply to their jobs and organisations, and to provide skills development and active coaching on how to use the new technologies. It has included developing new ways to analyse the data and information being created by our people to better understand and optimise recommendations, actions, behaviours and patterns.

E. Further discussion on KPIs

KPIs should start relatively simple and have at least the broad groupings at the higher levels of measure mapped across the range of categories that is desired. Initial calculations or even estimations can lead to later accurate instrumented readings. Relationship between the readings are established so that one measure may populate a number of KPIs or aggregation of KPIs arrive at a higher order KPI or KPA (Key Performance Area).

Below is an example only but shows how, for instance, car kms and consumption (km/litre) would drive Townsville efficiencies in its own fuel use.

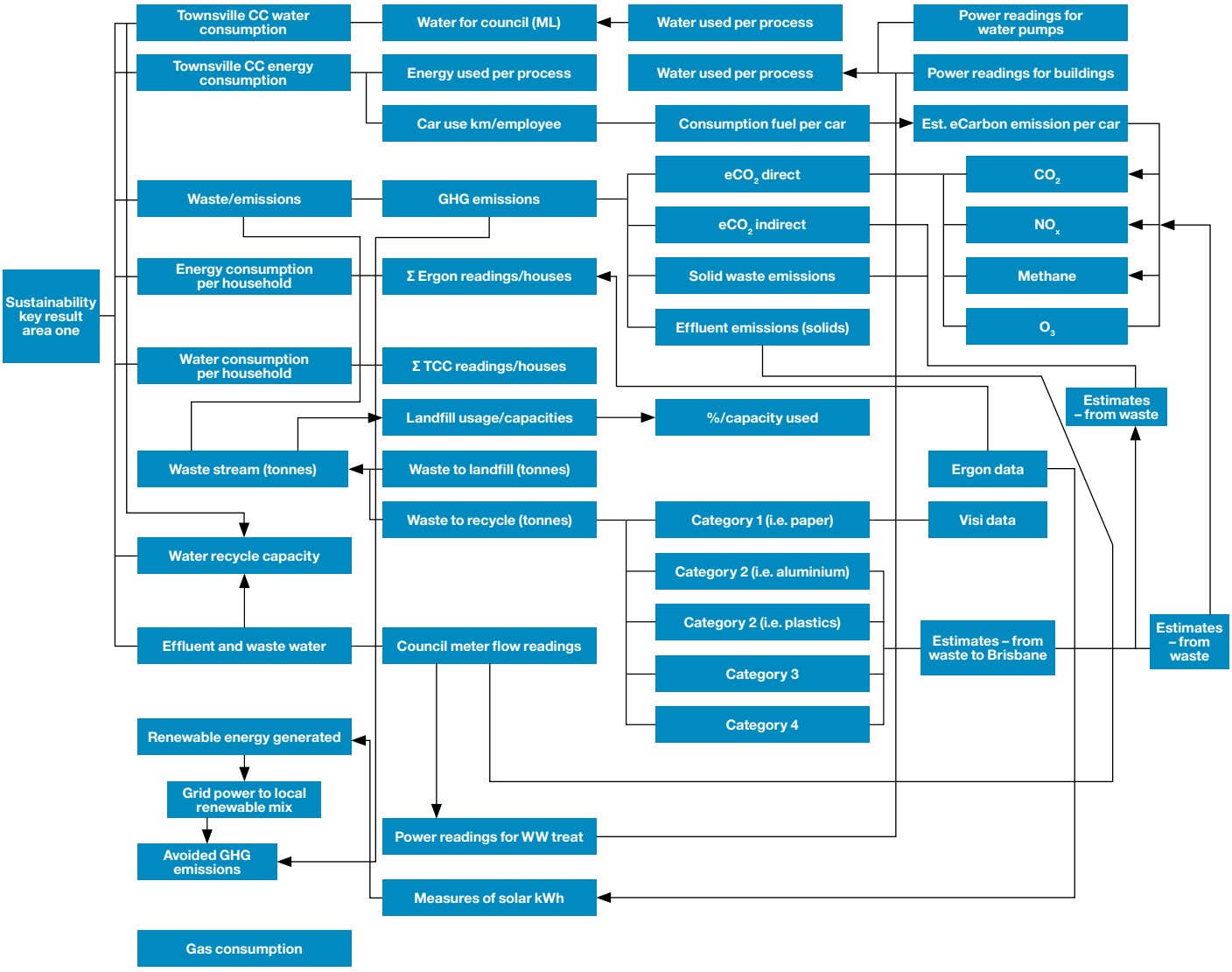
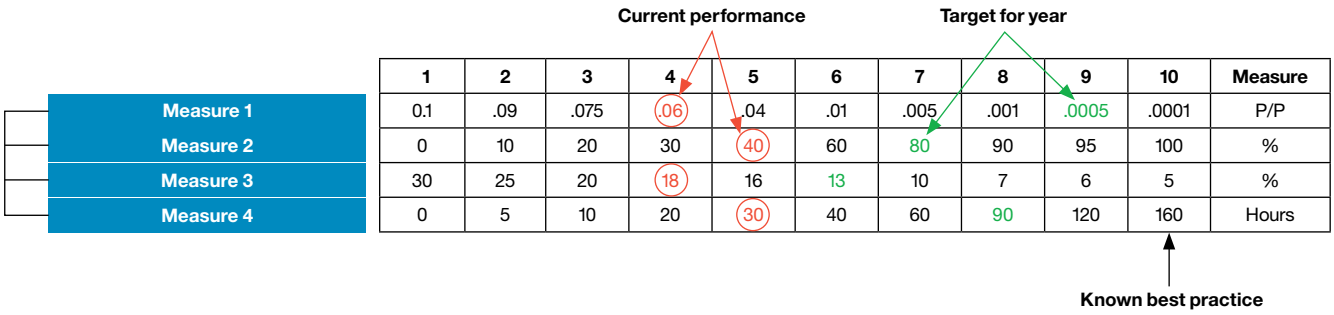


Figure 14

Each of the measures can be assigned a number based on the actual measure and against a benchmark of acceptability (ie 1 may be a poorest measure and 10 a representation of a benchmark performer).



	1	2	3	4	5	6	7	8	9	10	Measure
Measure 1	0.1	.09	.075	.06	.04	.01	.005	.001	.0005	.0001	P/P
Measure 2	0	10	20	30	40	60	80	90	95	100	%
Measure 3	30	25	20	18	16	13	10	7	6	5	%
Measure 4	0	5	10	20	30	40	60	90	120	160	Hours

Figure 15

A "weighting" relates to strategies in the planning cycle (ie power consumption may be assigned a high weighting to achieve emphasis on strategic reductions in desired areas). In this way KPI measures can be used inside the councils to drive desired yearly efficiency and economic gains; and outside the council to demonstrate leadership in efficiency and sustainability.

	Target	Calculation	Weight	Maximum score	Score (1-10)
Measure 1	8 of 10	(1/10 – LTI)	3	30	15
Measure 2	6 of 10 average	10 scale score	1	10	8
Measure 3	>5%, <15%	30/3 + % (> 27% = 10)	2	20	5
Measure 4	40 hours/year	Average hours/4 (40=10)	2	20	15
Totals	0.75			80	45/80 = 0.56

Roll up to next level **Total score = 0.56**

Figure 16

Most measurements systems in Corporations that drive sustainable efficiencies end up driving economic value. KPIs set up in the above way ensure that sustainability is a core strategy of the council, it is aligned with the current year initiatives and drive economic improvement.


Mount Surprise
Georgetown
Einasleigh
Forsayth
Einasleigh
Lynd
Lyndhurst
RY RANGE
GREAT
Burdekin
Cardwell
Herbert
Ingham
Bambaroo
Rollingstone
Clarke River
Clarke
Basalt
Charters Towers
LOLWORTH RANGE
Homestead
Pentland
Flinders
Dutton
Richmond
Hughenden
Prairie
Torrens Creek
Marathon
Stamford
Stawell
Tully
Mount Garnet
Bullock Creek
Ravenshoe
Innisfail


CORAL SEA
BARRIER REEF
MALAY REEF
CHINBROOK ISLAND
T. PARK
GREAT PALM ISLAND
NAT. PARK
MAGNETIC ISLAND
CAPE CLEVELAND
sville
CAPE BOWLING GREEN
Giru
Mount Elliot
1234
Ayr
Home Hill
CAPE UPSTART
Mingela
Bowen
GLOUCESTER ISLAND
Merinda
HOOK ISLAND
WHITSUNDAY ISLAND
CUMBERLAND
NAT. PARKS
LEICHARDT
Mount Abbot
1055
Proserpine
CLARKE RANGE
Collinsville
Repulse Bay
CAPE CONWAY
ISLANDS
BURDEKIN FALLS
Bowen
Bloomsbury
EUNGELLA NATIONAL PARK
Calen
CAPE HILLSBOROUGH
RANGE
Mount Dalrymple
1211
Mackay
Netherdale
Eton

1 Original estimates by Dr Faith Bairol in the "World Energy Outlook – 2008" predicted peak oil in the near future, but he has since revised this the peak oil event as having *occurred* in World Energy Outlook 2010 publication – November 2010.

2 Peak Oil and Australia's National Infrastructure Submission to Infrastructure Australia – October 2008.

3 An example of this was witnessed in 2008 – but demand then reduced with the Global Financial Crisis.

4 Inter-fuel Substitution – Coal to Liquids has been carried out since 1950, and is now undertaken in some countries on a commercial non-subsidised basis.

5 Paul Simshauser – Chief Economist AGL – AGL Applied Economic & Policy Research paper April 2010.

6 Change in aggregate network charges in Sydney and Brisbane – AGL Applied Economic & Policy Research paper April 2010.

7 Much water used in energy production is often recovered later in the cycle for drinking water and is not lost. However, water consumed in energy production (in for instance by evaporation) is lost as a resource.

8 Townville Council estimates of water consumption are 450kL – 500kL per household per year.

9 http://fennerschool.anu.edu.au/people/visitors/brownv.php

10 Peak Power is typically the distribution grid high demand period between 6pm and 9pm.

11 Can blogging boost IBM's revenues and reduce layoffs? The computer giant is about to find out as it prepares to launch a massive corporate blog initiative; Tom Foremski; 13 May 2005; http://www.siliconvalleywatcher.com/mt/archives/2005/05/scoop_can_blogg.php

12 MIT Sloan Management Review; An Inside View of IBM's Innovation Jam; Osvald M. Bjelland and Robert Chapman Wood; 1 October 2008; http://sloanreview.mit.edu/the-magazine/2008-fall/50101/an-inside-view-of-ibms-innovation-jam

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