Water Scarcity and Water Footprinting: Long-Term Economic Growth and Climate Justice

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Behaviour & Priorities

Country

Clan

Family

Me
IMPACT
What can Scotland Realistically Do?

1 in 1,336

Population of World at 6:00 20th April 2012

7,035,635,186

Population of Scotland at 6:00 20th April 2012

5,264,770
What can Scotland Realistically Do?

1 in 1,336

How can / Where does Scotland

‘Stand Out’ in a Crowd?

What is the Scale of Global Water Issues?
Water for Life,
Sanitation for Health & Dignity
Kills more than 4,100 children every day

Half the developing world suffering from diseases due to poor water and sanitation

Half the hospital beds in the world filled with people suffering water related diseases
Access to drinking water through household connection in rural areas is as low as 5% in sub-Saharan Africa.

Does it need to be?
Water & Sanitation Facts

over 2.5 billion remain without improved sanitation. 1.8 billion of them live in Asia. The lowest coverage is sub-Saharan Africa - 31% use improved sanitation.
MDG 7

Target 10: By 2015, halve the proportion of people without sustainable access to safe drinking water and basic sanitation.

Progress

World on track to meet the drinking water target (locally major gaps exist)

But we will miss the MDG sanitation target by over 700 million people.

And Africa is off-track to meet both the drinking water and sanitation targets
Access to Water

More than 90% of the global population will use improved drinking water sources by 2015.

87% of the global population in 2006 used an improved source of drinking water, up from 77% in 1990 – 1.6 billion people gained access, 884 million still lack access.

Over 50% of the world’s population has access to piped water at their home.

Accelerated progress needed in sub-Saharan Africa, home to more than a third of those using unimproved drinking water sources.
Between 1990 and 2006, proportion with improved sanitation increased by 12% - 1.1 billion gained access

But: 2.4 billion lack access to a basic toilet - 1.2 billion practice open defecation

At least 173 million people per year need to begin using improved sanitation facilities to meet the MDG.

Most countries that are not on track are in sub-Saharan Africa and Southern Asia -1.8 billion in Asia alone!
A Cost Effective Investment

• Returns of between £1.50 and £17 from 50 pence invested in water and sanitation

• Achieving MDG targets will cost £5 billion annually, but will deliver benefits of around £42 billion

Hitting the targets will also save many lives
Virtual Water Concept

Positive (Red = importer of virtual water)

Negative (blue = exporter of virtual water)
Water Footprint Concept

Green is a small water footprint
Red is a large water footprint
**Water Footprint Concept**

**Water requirement equivalent of main food products**

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>UNIT</th>
<th>EQUIVALENT WATER (liters per unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>cattle</td>
<td>head</td>
<td>4,000,000</td>
</tr>
<tr>
<td>sheep and goats</td>
<td>head</td>
<td>500,000</td>
</tr>
<tr>
<td>fresh beef</td>
<td>kg</td>
<td>15,000</td>
</tr>
<tr>
<td>fresh poultry</td>
<td>kg</td>
<td>6,000</td>
</tr>
<tr>
<td>cereals</td>
<td>kg</td>
<td>1,500</td>
</tr>
<tr>
<td>citrus fruits</td>
<td>kg</td>
<td>1,000</td>
</tr>
</tbody>
</table>


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**Source:** FAO, 1997. Published in the *UN World Water Development Report*. 

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**Notes:**

- The table above provides a breakdown of the water requirements for various food products, measured in liters per unit. 
- Cattle have the highest water requirement at 4,000,000 liters per head, while citrus fruits require the least at 1,000 liters per kg. 
- Understanding these water requirements is crucial for sustainable agriculture and water management.
Economic Water Scarcity

Climate Justice?

Note: indicates countries that will import more than 10% of their cereal consumption in 2025.

Legend:
- Physical water scarcity
- Economic water scarcity
- Little or no water scarcity
- Not estimated
What can Scotland Realistically Do?

1 in 1,336

‘Win – Win’

Economic Models to Develop?
Industry to Attract to Scotland?

Scotland’s Publically Owned Scottish Water
Global Exemplar of Sustainable Economic Water Supply
Malawi is the 8th poorest country in the World
Malawi Water Resource Management

Divided into 17 Water Districts

Map to the left shows the Water Districts overlying the Political Districts

Already Sharing Knowledge on Water Safety Plans
Water Demand Projections 2010 – 2035

Impact of Drought becomes severe with projected population growth
Climate Justice?

2035 Medium Growth Drought Conditions

Water Scarcity
Water Sector Contribution to Malawi Energy Demands 2010 - 2030 (World Bank Data)
Malawi Water Resources Plan &
Malawi Energy Resources Plan

80% of the Short Term (188 of 224 MW) new energy capacity will be Hydroelectric.
84% of the Long Term (645 of 770 MW) new energy capacity will be Hydroelectric.
71% of the Medium Term (865 of 1,240 MW) new energy capacity will be Hydroelectric.

NOTE: Wind and Renewable Energy ONLY accounts for 1% of all the new energy needed in Malawi in the next 20 years!
What can Scotland Realistically Do?

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‘Stand Out’ in a Crowd

Sharing Experience HydroElectric Power
Sharing Experience of Rural Community Engagement
Joining up ‘Agriculture / Communities / Water’?

Key: Understand Knowledge Transfer
High Science – Low Technology
The Key to Sustainable Water Resources?

Where is High Technology Most Appropriate and / or most sustainable?

Where can High Science / Knowledge be distilled into an economic denominator that is most appropriate for the infrastructure of the specific society?

How can High Science / Low Technology underpin economic uplift and increased standard of living?
Sanitation

Peri-Urban Environments exist where people have moved into undeveloped areas, there is no ‘tax base’ for providing Water, Sanitation and Waste infrastructure and the lack of planned development produces a ‘social standoff’ (no political will to provide infrastructure to those not legally entitled).
The ‘GULPER’

Simple and Cheap bit of kit to empty what we all leave behind....
Calculated and measured shear strength of ‘Sludge’ determined in collaboration with Water for People.

Head-Lift calculations for Gulper undertaken for the actual shear strength of the Sludge.
All dimensions are in millimeters.

Threaded steel rod should be connected with the steel rod connections to make up to 3m when necessary.

- Stainless steel butterfly valve
- Stainless steel threaded rod extension
- Stainless steel ring support for butterfly valve and turning wheel
- Stainless steel cutting edge
- PVC

Scale 1:26
Modified Outer with cutting edge

Chunglim Mak
2010-12-28
Aug 2011
Review of Health and Safety, Risk Assessment methodology and operational procedures

LATRINE EMPTYING RISK ASSESSMENT FORM

Persons who undertake risk assessments must have a level of competence commensurate with the significance of the risks they are assessing. It is the responsibility of each latrine emptying supervisor to ensure that all operators are adequately trained in the techniques of risk assessment.

Prior to the commencement of latrine emptying operations, a suitable and sufficient assessment of risks should be made and where necessary, effective measures taken to control these risks.

Individuals working under this risk assessment have a general responsibility to ensure they follow the control measures stipulated to safeguard the health and safety of themselves and others.

SECTION 1

1.1 OPERATION / ACTIVITY

Complete the relevant details of the activity being assessed.

Name:

Location(s) of work:

Brief description:

1.2 PERSON RESPONSIBLE FOR MANAGING THIS WORK

Name:

Position:

Signature:

Date:

Department:

1.3 PERSON CONDUCTING THIS ASSESSMENT

Name:

Signature:

Name:

Signature:

Date risk assessment undertaken:

1.4 ASSESSMENT REVIEW HISTORY

This assessment should be reviewed immediately if there is any reason to suspect that the original assessment is no longer valid. Otherwise, the assessment should be reviewed annually. The responsible person must ensure that this is done.

Review 1 Review 2 Review 3 Review 4

Date conducted:

Conducted by:

Issued by: Safety Services – Nov 2020
In Blantyre it was found that on average, a full latrine is able to fill up four 200 litre drums, and on average, the latrine pit emptier is able to fill eight 200 litre drums per day. Therefore, a household will have to pay MK10,000 (4 x MK2,500) for their filled up latrine to be completely emptied. This is equivalent to about £41.

As for the pit emptier, even though they will earn 2,500MK per drum, the operating cost per drum is 1,305MK. Therefore, the total operating income per drum is 1,195MK, and hence the total average operating income per latrine is 4,780MK. This is equivalent to about £20 per latrine.

The total equipment costs with Staff, operation and maintenance costs 396,300MK per annum, equivalent to about £1639. Therefore, the latrine emptier will have to empty at least 83 latrines to begin to work at an operational profit.

<table>
<thead>
<tr>
<th>Equipments</th>
<th>Unit</th>
<th>Cost per drum (MK)</th>
<th>Total Cost (MK)</th>
<th>Duration per yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 litre Drum</td>
<td>2</td>
<td>2500</td>
<td>5000</td>
<td>1</td>
</tr>
<tr>
<td>50 litre Drum</td>
<td>2</td>
<td>3500</td>
<td>7000</td>
<td>1</td>
</tr>
<tr>
<td>200 litre Drum</td>
<td>10</td>
<td>10800</td>
<td>108000</td>
<td>1</td>
</tr>
<tr>
<td>Uniform</td>
<td>12</td>
<td>8000</td>
<td>96000</td>
<td>1</td>
</tr>
<tr>
<td>Gum Boots</td>
<td>3</td>
<td>3000</td>
<td>9000</td>
<td>1</td>
</tr>
<tr>
<td>Goggles</td>
<td>4</td>
<td>3000</td>
<td>12000</td>
<td>2</td>
</tr>
<tr>
<td>Heavy-Duty Gloves</td>
<td>8</td>
<td>3600</td>
<td>28800</td>
<td>0.5</td>
</tr>
<tr>
<td>Respirator</td>
<td>3</td>
<td>3500</td>
<td>10500</td>
<td>0.5</td>
</tr>
<tr>
<td>Gulper</td>
<td>1</td>
<td></td>
<td>120000</td>
<td>1</td>
</tr>
</tbody>
</table>
1) Construction of new Designed Gulper and testing of the new Method statement against cost/benefit analysis
2) Current Development of meso-scale ‘Sludge’ biogas projects in Malawi to increase the ‘value’ of the sludge and develop a profit from the sludge (note co-using biomass from permaculture)
3) Development of a ‘Solar’ drying of biogas residual sludge for use as a fertiliser
4) Full LCA of the ‘Business Cycle’ of Latrine Emptying

Note: Thank you to Bill and Melinda Gates Foundation for funding this Research (through Water for People in Malawi)
Solution
Siemens Water Technologies supplied a system consisted of 48" diameter steel vessels containing 43 cu. ft of Siemens GFH® granular ferric hydroxide media.

Results
Siemens has the flexibility to provide both short term and long term, permanent installations for arsenic treatment. The short lead times and service options that Siemens offered enabled this customer to meet the new regulation within the allotted timeframe and avoid the need for violation communication to its customers. Further, Siemens ability to provide both the temporary and permanent system simplified the process for this customer since they did not have to work with multiple suppliers.
Arsenic co-precipitated with Iron Oxides
Aeration, aeration, aeration
Change Redox State from Anaerobic to Aerobic

*Same Chemistry in the Well?*

- Water from the aquifer is lifted and aerated through spray nozzle for introducing oxygen.

- The oxygen impregnated water is re-circulated back to the aquifer.

**Advantages**

- No Sludge and No use of Chemicals.

- Simple technology that can be handled by local technicians.
Approach stabilised in 1 month and As content in the area came down below WHO norms of 0.01 mg/L.
Aim of this talk was to open a debate and spark innovative thinking around distilling Science and High-Tech / High-Energy Engineering Solutions for Water Resources Problems to a local Economic Denominator.

Scotland’s Innovation and the ‘Hydro-Nation’ can capture new ideas for Community Engagement / Behaviour Change, Economics, Technology and through ‘Know-How / Shows-How’ share the experiences with others.
Behaviour & Priorities

- Me
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