Well defined system of water credits to incentivise reduction in water usage

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Abstract

In recent years, water scarcity has become an increasingly pressing issue in India, as climate change and population growth put greater pressure on limited water resources. One potential solution to this problem is the use of water credits, a market-based mechanism that incentivizes households and communities to reduce their water consumption. In this system, households and communities are given a certain daily limit of water usage. Anu usage above the daily limit will be priced at a high premium. If they use less water than their allotted amount, they accrue water credits and they can sell their excess water credits on the market to those who can pay off their excess usage using water credits, earning money in the process. This creates a financial incentive for households and communities to reduce their water consumption, as they can save money by using less water and earn money by selling their excess credits.

To operationalize the system an orchestration would be required between the municipality, government, smart city organizations and policy makers. A daily threshold usage limit has to be established which is fair across demographics and geographies. A differential pricing scale has to be established that will penalize usage above threshold. Industry 4.0 technologies would be put in use to measure the water usage through smart meters. A Blockchain based water credits maintenance system will be developed and finally an online exchange for trading of credits will be setup.

The effectiveness of this system will depend on a variety of factors, including the design of the credit system, the willingness of households and communities to participate, the willingness of the government to introduce differential pricing and the overall water availability in the region.

Problem statement

The amount of water overused by households and communities in India varies depending on the region, but in many areas, water overuse is a significant problem.

In terms of specific figures, a study conducted by the Centre for Science and Environment (CSE) found that the average Indian urban resident uses approximately 135 liters of water per day, which is well above the recommended 70 liters per day set by the World Health Organization (WHO) for basic household needs. Similarly, a study by the World Bank found that in the state of Rajasthan, which is one of the most water-stressed states in India, the average rural resident uses approximately 110 liters of water per day, which is significantly higher than the national average of 40-50 liters per day for rural areas.

Community based social marketing water conservation campaigns have been effective [1,2] but can be limited to a small geographical area and for a limited period after which a relapse [3,4] will happen.

Similarly providing real time feedback through smart meters [5]has been effective to alert the consumer on their usage pattern but do not provide any incentive.

When a monetary incentive is added to a CSBM, the longevity of the program is more as argued by Thorgerson et al.

Therefore if the existing CSBM campaigns are combined with real time data capture and a monetary incentive, the effectivity of the program will be very high.

This method will increase the motivation for the people to reduce their daily water consumption which is much more than the conventional schemes.

Current Literature review

Community-Based Social Marketing (CBSM) has been used to promote water conservation by relying on social norms to drive behavior change. Studies have found that CBSM campaigns can be effective in reducing water usage, particularly when combined with other strategies such as education and outreach campaigns. However, CBSM has some limitations in promoting long-term behavior change and reaching all members of a community [6].

To overcome some of the limitations of CBSM, researchers and policymakers have explored the use of smart meters for water conservation. Smart meters can provide real-time information about water usage and can help consumers to identify areas where they can reduce their water usage. Studies have found that smart metering can lead to significant reductions in water consumption, particularly when combined with feedback and education campaigns. For example, a study in California found that smart metering reduced water consumption by 5-10% [7].

Another strategy that has been explored to increase the effectiveness of water conservation efforts is the use of monetary incentives. For example, water utilities may offer rebates or financial incentives to households that reduce their water consumption. This approach has been found to be effective in promoting water conservation, particularly when combined with other strategies, such as education and outreach campaigns. For instance, a study conducted in California found that financial incentives led to a reduction in water usage of 15-20% [8].

Water credits are a type of market-based mechanism that allows households or communities to earn credits for reducing their water consumption below a certain threshold. These credits can then be sold or traded to other households or businesses that exceed their water usage limits. Studies have found that water credits can be an effective approach for promoting water conservation, particularly in areas with limited water resources. For example, a pilot program in Australia found that water credits led to a 9% reduction in water usage [9].

While these approaches have shown promise in promoting water conservation, there are still some gaps in our understanding of how to best promote behavior change. For example, there

is currently no trading system in place for water credits, which limits their potential impact. Additionally, while smart meters and monetary incentives have been effective in promoting behavior change, there is still a need for further research on how to best integrate these approaches with CBSM and other behavior change strategies.

In conclusion, promoting water conservation through CBSM, smart meters, monetary incentives, and water credits can be effective in reducing water usage. However, there is still a need for further research and policy development to fully realize their potential impact.

The idea

A well-defined system of water credits will incentivise the reduction of water usage. These water credits can have a commercial value that will also ultimately pay off the saving consumer. There will be a transparent water credit trading platform that will create a new monetization for water saved.

Suggested water credits:

In this model, a cap can be set on water usage per unit time. This cap can be modified as per the geographical regions and other parameters. So, a more water stressed community can set a lower water cap per day.

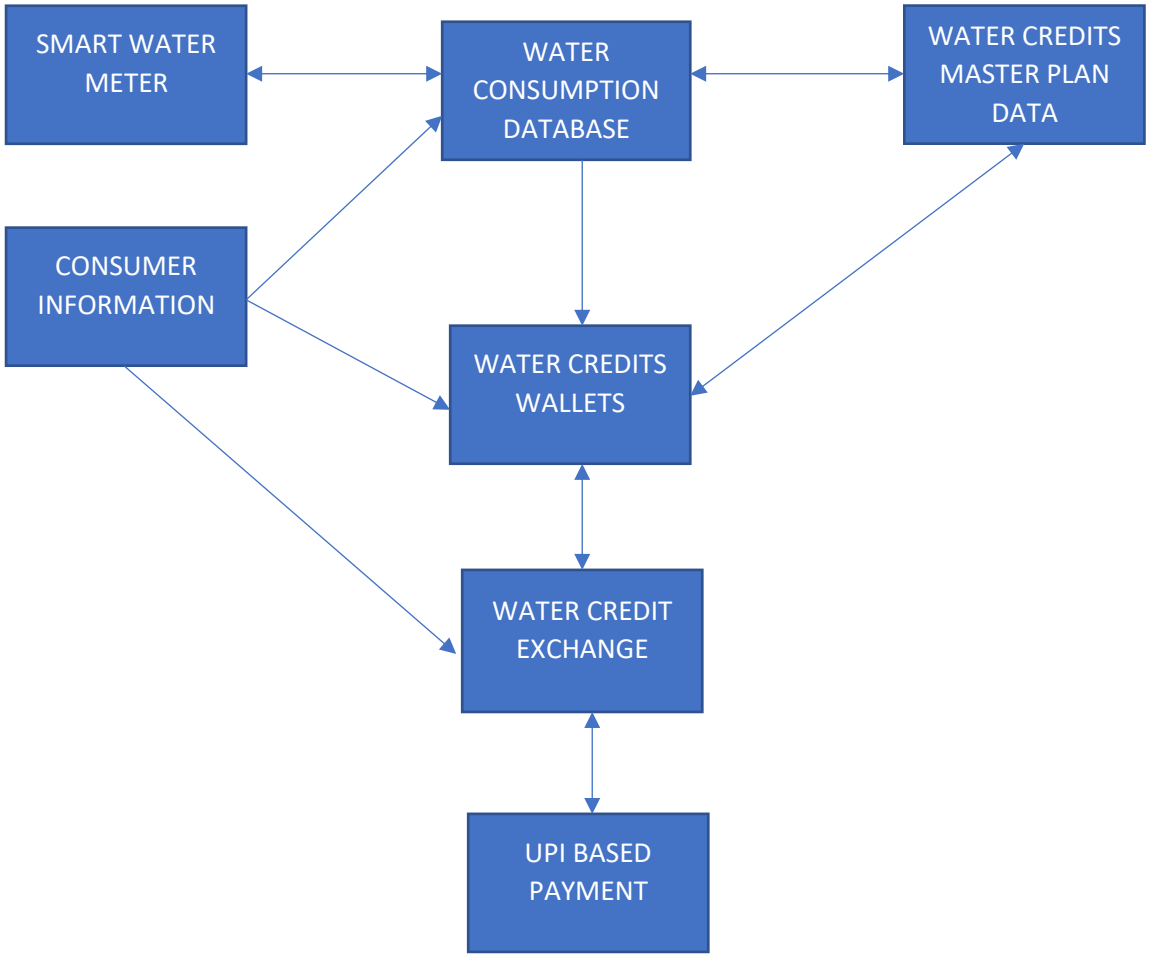

Figure 1. Schematic diagram of Water Credit System

Components:

- A daily per capita water usage threshold for households. A threshold for commercial purposes based on type of industry.

Designing a daily water usage threshold for water credits requires consideration of several factors, such as the water consumption patterns of households, the availability of water resources in the region, and the overall goal of the program. Here are some steps that can be taken to design a daily water usage threshold for water credits:

Determine the water usage patterns of households: Conduct surveys or collect data on the average daily water usage of households in the target area. This will help in determining an appropriate threshold that incentivizes households to reduce their water usage without causing undue burden.

Consider the availability of water resources: Evaluate the availability of water resources in the region and determine the level of conservation needed to ensure sustainable usage. A threshold that is too high may not result in sufficient water savings, while a threshold that is too low may lead to unnecessary water restrictions.

Set a realistic and achievable goal: Determine the desired level of water savings and set a realistic goal for the reduction in water usage. This goal can be used to set the threshold for water credits.

Determine the value of water credits: Decide on the value of water credits that will be provided to households that meet the threshold. This value can be based on the cost of water in the region, the cost of water conservation measures, and other relevant factors.

Communicate the program effectively: Ensure that households are aware of the water credit program, its benefits, and the threshold required to earn credits. Provide education and outreach programs to encourage households to reduce their water usage and earn credits.

It is important to note that designing an effective daily water usage threshold for water credits requires a careful consideration of all relevant factors and a thorough understanding of the water usage patterns in the target area. The threshold should be designed to achieve the desired level of water savings while ensuring that households are not unfairly burdened.

- Differential pricing, where above the threshold usage is charged a higher tariff.

In addition to promoting water conservation, differential pricing can also help to make trading in water credits more effective. By setting a higher rate for water usage above the threshold, households that consume more water than they need can be incentivized to purchase water credits from households that have reduced their water usage below the threshold. This can create a market for water credits and provide households with a financial incentive to conserve water.

- Smart meters that can record real time consumption and transfer the information to data storage.
- A water wallet platform that holds the water credits for a user.

An online wallet can be a useful tool for households to store and manage their water credits. The use of online wallets for water credits can provide households with a secure and convenient way to keep track of their credits and to easily transfer credits to other households or to use them to pay for water bills. Today the technology is available to make it blockchain enabled.

There are already several online platforms that offer water credits and digital wallets for managing them. For example, the Bangalore Water Supply and Sewerage Board (BWSSB) in India has launched an online platform called "MyBWSSB" that allows customers to track their water usage, pay bills, and purchase water credits (MyBWSSB, n.d.). Similarly, the city of Cape Town in South Africa has developed an online platform called "City Water Map" that allows households to monitor their water usage and to trade water credits with other households (City of Cape Town, n.d.).

The use of online wallets for water credits can also help to increase transparency and accountability in the water trading system. Digital records of water credit transactions can provide a clear and auditable trail of how credits are being used and transferred between households. This can help to prevent fraud and ensure that the trading system is operating fairly.

- A trading platform that will have buyers of water credits interacting with the sellers of water credits.

Transparent Marketplace: A transparent marketplace where households can buy and sell water credits with each other. The marketplace should be easily accessible and allow for quick and easy transactions.

- Integration to payment systems that enable transfer of money.

A secure payment gateway to facilitate online transactions between households. This will ensure that payments are processed safely and securely.

<u>Testing:</u>

Shirpur Warwade in Maharashtra has 100% smart meters. There are 13500 consumers. Though it is not a pre requisite as consumers will be driven to install smart meters when they realize that water credits can ultimately pay for the meters.

Lets say a threshold of 75 liters per day is set per capita. Based on authenticated adhaar addresses, the number of residents in a household are taken onto account and a total household limit is established and maintained in the database for that smart meter.

For every litre less than the threshold consumed per day, the household is awarded so many liters of water credits. This will be reset every day.

At the end of the billing cycle, the number of credits collected during the month will be used to either offset any over usage by the same household, or trade.

Lets assume there is another consumer that has a monthly over usage over the threshold by 100 liters. So either they have to pay the high differential tariff for the 100 liters, or buy water credits to offset the over usage.

The high differential tariff will create a market and price discovery for the water credits.

The required IT systems and integrations would need to be built for this experimentation.

The overall time line and plan of activities would be like this:

Phase 1: Planning and Preparations (Week 1-2)

Identify and engage key stakeholders, including local government, water utilities, and technology partners.

Establish project goals, objectives, and timelines.

Develop a detailed project plan, including scope, budget, and resource requirements.

Conduct a site survey to determine the technical requirements and feasibility of deploying smart water meters and implementing the water credit trading platform.

Conduct a site survey to determine the technical requirements.

Identify and procure the necessary hardware and software components, digital wallets, payment gateways, and compliance monitoring tools.

Identify and procure the necessary hardware and software components, including smart water meters, digital wallets, payment gateways, and compliance monitoring tools.

Phase 2: Installation and Configuration (Week 3-4)

Integrate smart water meters with the digital wallet and payment gateway systems.

Conduct a pilot test to ensure that all components are functioning correctly.

Phase 3: Testing and Validation (Week 5-10)

Conduct an initial test of the water credit trading platform with a limited number of households.

Monitor system performance and make necessary adjustments to the platform and technical components.

Expand testing to include a larger number of households and conduct user acceptance testing.

Validate the system's performance against key performance indicators, including water usage reduction, credit trading volumes, and compliance monitoring.

Phase 4: Deployment and Rollout (Week 11-12)

Develop and implement a communications and outreach strategy to promote the water credit trading platform to households.

Rollout the platform to all 13,500 households, including training and support for users.

Monitor system performance and provide ongoing support to users.

At the end of the three-month testing period, the project team should conduct a thorough evaluation of the water credit trading platform's performance, including its impact on water usage reduction, credit trading volumes, and compliance monitoring. The project team should also identify any areas for improvement and make recommendations for future enhancements to the platform.

Conclusion

In conclusion, the use of water credits presents a promising approach to incentivize households and communities to reduce their water consumption. By providing water credits for households that use less water than a threshold limit, water credits create a monetary incentive for water conservation that can help reduce overall water consumption.

The success of water credit programs in various parts of the world has demonstrated their potential as an effective tool for reducing water usage. Through the use of smart water meters, households can easily track their water usage and receive real-time feedback on their progress towards meeting their water consumption goals. This feedback, coupled with the potential for financial rewards in the form of water credits, can motivate households to adopt water-saving behaviors and reduce their overall water usage.

Furthermore, the monetization of water savings through the use of water credits also presents an opportunity for the redistribution of wealth based on water usage. By rewarding households that use less water with water credits, the program can provide an economic incentive for those with high water usage to reduce their consumption and promote greater equity in water access. This can be particularly important in areas where water is scarce or where access to water is a source of conflict or inequality.

The use of a water credit trading platform can further enhance the effectiveness of water credit programs. By allowing households to trade water credits, the platform can create a market for water savings that incentivizes households to conserve water and monetizes the value of water conservation. This can also create opportunities for businesses and other entities to participate in the market and generate additional revenue streams by purchasing water credits to offset their own water usage.

However, it is important to acknowledge that there are limitations and challenges to the use of water credits as a water conservation strategy. For example, the success of water credit programs may depend on a range of factors, including the availability of technical

infrastructure, the willingness of households to participate, and the overall regulatory and policy environment.

Moreover, while the use of water credits can incentivize water conservation, it is not a substitute for the need for effective water management practices and policies. Efforts to promote sustainable water use must be based on a comprehensive approach that includes water governance, stakeholder engagement, and the development of appropriate policies and regulations.

In conclusion, the use of water credits presents an innovative approach to promoting water conservation and incentivizing households and communities to reduce their water consumption. While there are challenges to their implementation, water credits offer a promising tool for addressing the pressing challenges of water scarcity and promoting greater equity in water access. With the right policies, technical infrastructure, and community engagement, water credits can play a critical role in ensuring sustainable water use for generations to come.

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