Chapter 39
A Paradigm Shift: Empowering Farmers to Eliminate the Waste in the Form of Fresh Water and Energy Through the Implementation of 4R+T

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ABSTRACT

The growing population in Turkey as well as in the rest of world is focusing their attention on the availability of main resources for now and for future generations. As the clock ticks by, this focus is intensifying at an exponential rate. Depleting resources, dependency on fossil fuels, high costs of energy, water quality, food cultivation and food safety present themselves as expected issues of our generation. Waste in the form of electricity and fresh water in agricultural practices can be reduced by using Reduction, Recovery, Reuse, Recycle and efficient Technologies in order to come to a sustainable management of waste starting with small-scale farming implementations. This generation must act to implement these changes, and they must act now.

INTRODUCTION

The growing necessity of adequate waste management measures is an important area of sustainability. Waste management of not only solid and liquid wastes but also the wastes in the form of electricity, water and soil (through erosion) which complement the multidisciplinary approach of (4R+T) 4 R's consisting of Reduction, Reuse, Recycling, and Recovery with (T) the efficient Technologies in the rural development and agricultural practices.

The growing population and increasing demand of food bring more emphasis on the agricultural production and dairy industry. The current irrigation practices urgently need a shift from the massive flood irrigation in thousands of hectares to more environmental friendly, sustainable irrigation methods such as drip irrigation with renewable energy powered pumping systems. This shift in the irrigation method

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would meet with the waste management pyramid at the Source Reduction & Reuse which is the most preferred action as a result; save the natural resources, conserve energy both water and electricity, save money for consumers and for governments as well as making farming more profitable.

Economically, the agricultural areas in Turkey are around 8.5 million hectares in total of which 69% is currently irrigated by all types of irrigation methods, although generally flood irrigation is the primary method. The development of the infrastructure of the remaining 31% in the coming years will not only increase the agricultural yield and create new jobs but will however put pressure on both the water resources and electrical infrastructures.

Because of the unreliability of the resource due to the effects of the climate change it is even more prudent to manage our resources more carefully.

This is where the importance of Technology wrapped around in the 4R's comes into play and creates the ability to make major shifts in farming methodologies against conventional practices.

Reduction in the consumption of water and the energy to provide this resource is the focus of this chapter.

BACKGROUND

The population of Turkey is estimated to be 100 million in 2030 by TUIK (Currently 75 million - Turkish Administration for Statistics). Turkey with its current water resources and changing water demand needs to sustain its water resources at least at current usage levels to be able to meet the demand in 2030 with 100 million people.

State Hydraulic Works (DSI) states the current yearly usable water quantity per capita is 1.519 m^3 approximately. With the growth rates provided by Turkish Statistic Administration (TUIK), only by conserving the water sources as they are at the moment, the usable water quantity per capita will decrease to 1.120 m^3 per year, which is very close to the definition of 'water poor' being less than 1.000m^3. This creates another pressure and importance at the same time for sustainable water and resultant energy management practices.

With the growing world population toward 2050, there is a challenge to produce 50% more food up to 2030 and to double the production by 2050. The conditions will make the world achieve these targets by using less water due to the growing industrialization, urbanization and climate change. Water efficiency, water management, especially in agriculture, being the major water user, reaching about 70% of the fresh water withdrawals and over 40% of OECD countries' total water withdrawals (OECD, 2010).

In Turkey, 75% of the total water consumption comes from the irrigation sector. As a result of a fast growing industrialization with the growing rate of population the availability of water per capita is decreasing. Most of the investments realized were on the irrigation infrastructure by transferring the water natural resources to the fields. Large capital investments are necessary in order to expand the irrigated area which results in difficulties in the allocation of the capital investment while putting pressure on the consumptive use of water resources (Cakmak, 2010).

The Turkish Government transferred the irrigation schemes to water user organizations and is one of the world leaders. However, the water price in these organizations is still based on operation and maintenance costs, and is charged per hectare depending on the crop. It does not include the Economic and Opportunity costs associated (Cakmak, 2010).