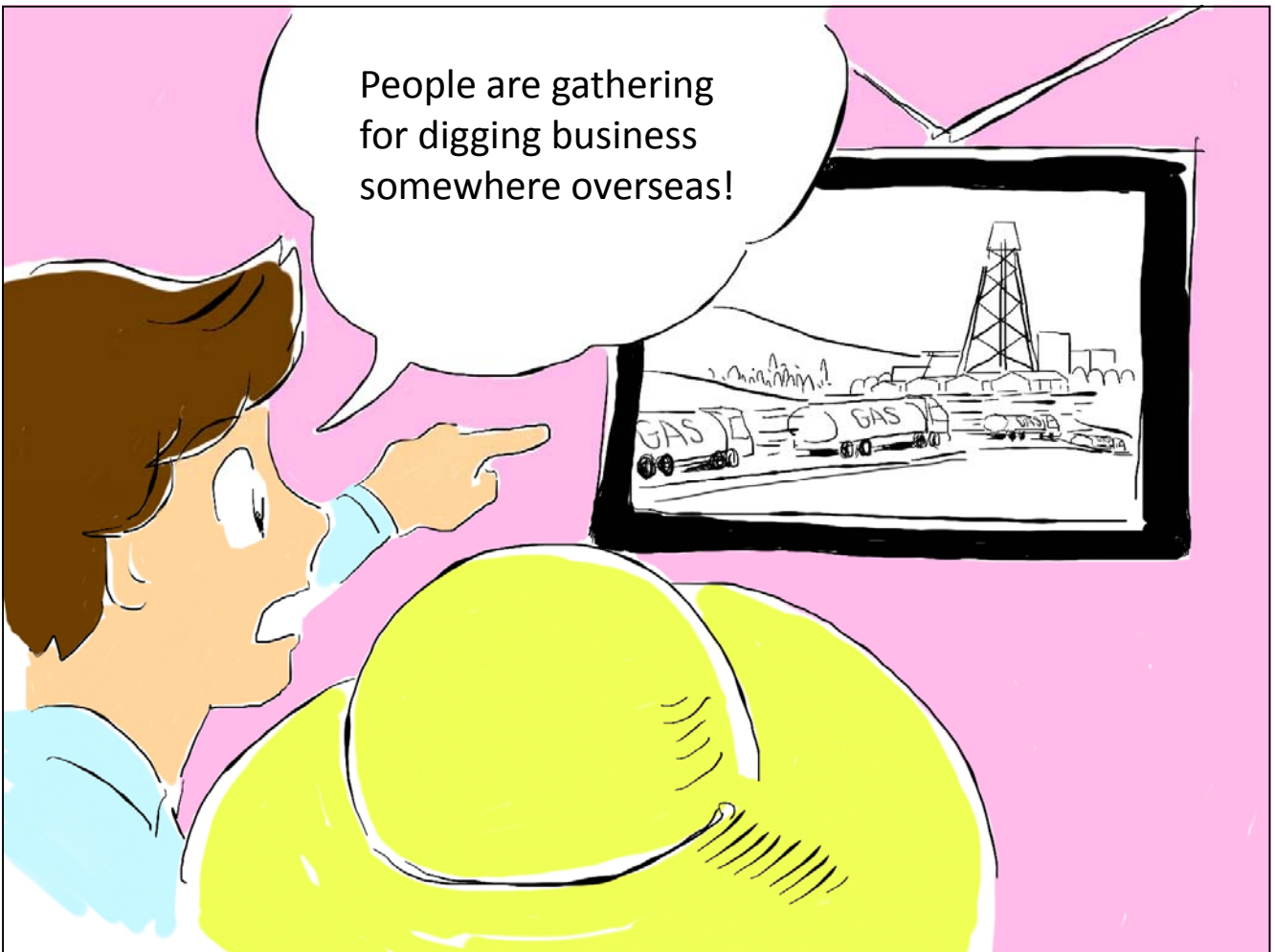
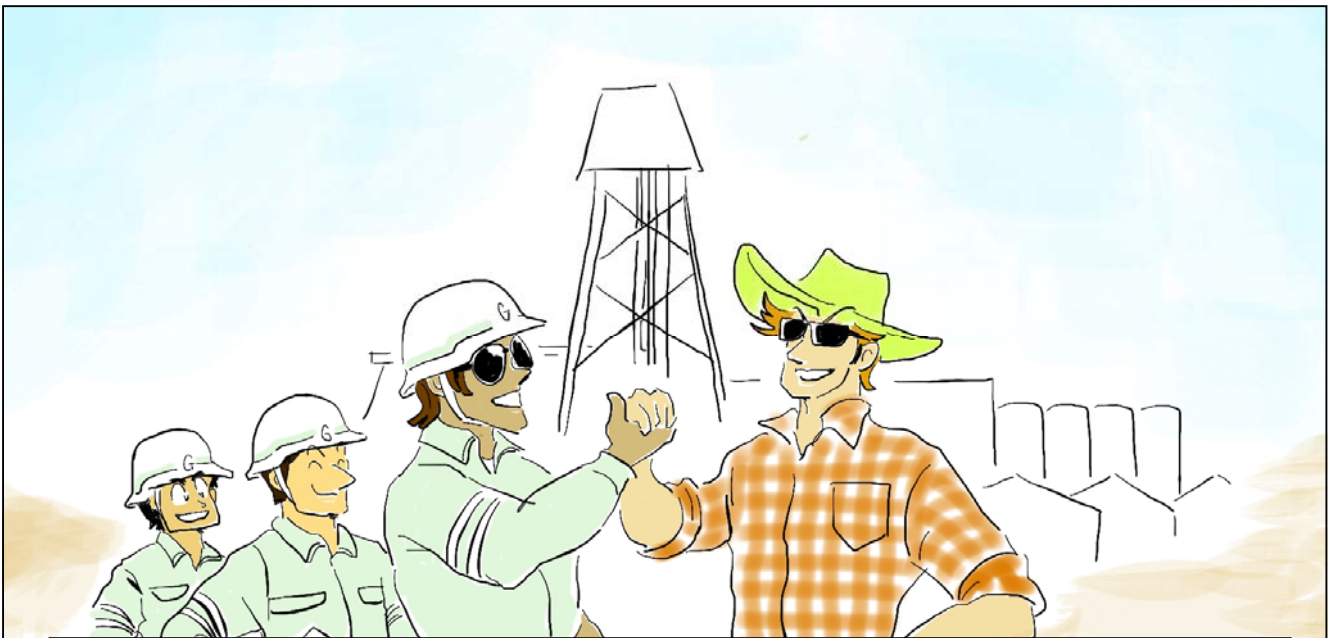


The year 20XX, in a farm in Japan





“The Shale Revolution”

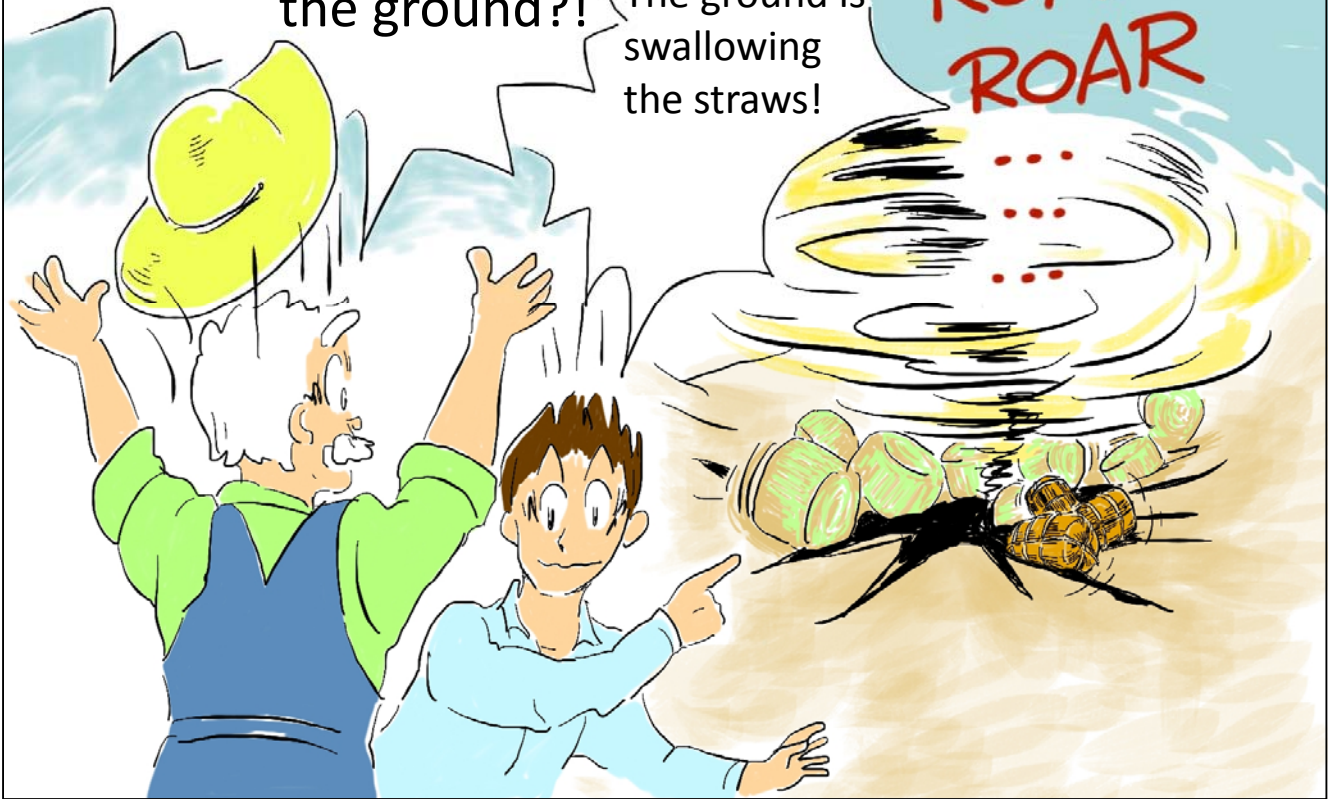
In countries like the USA, where efficient recoveries of nontraditional natural resources in shale layers had been unrealistic, an epoch-making approach of digging enabled to recover the resources like shale gas. The technology dramatically influences not only the energy supply-and-demand structures but also the social structures of the areas.



Unbelievable!
A huge crack in
the ground?!

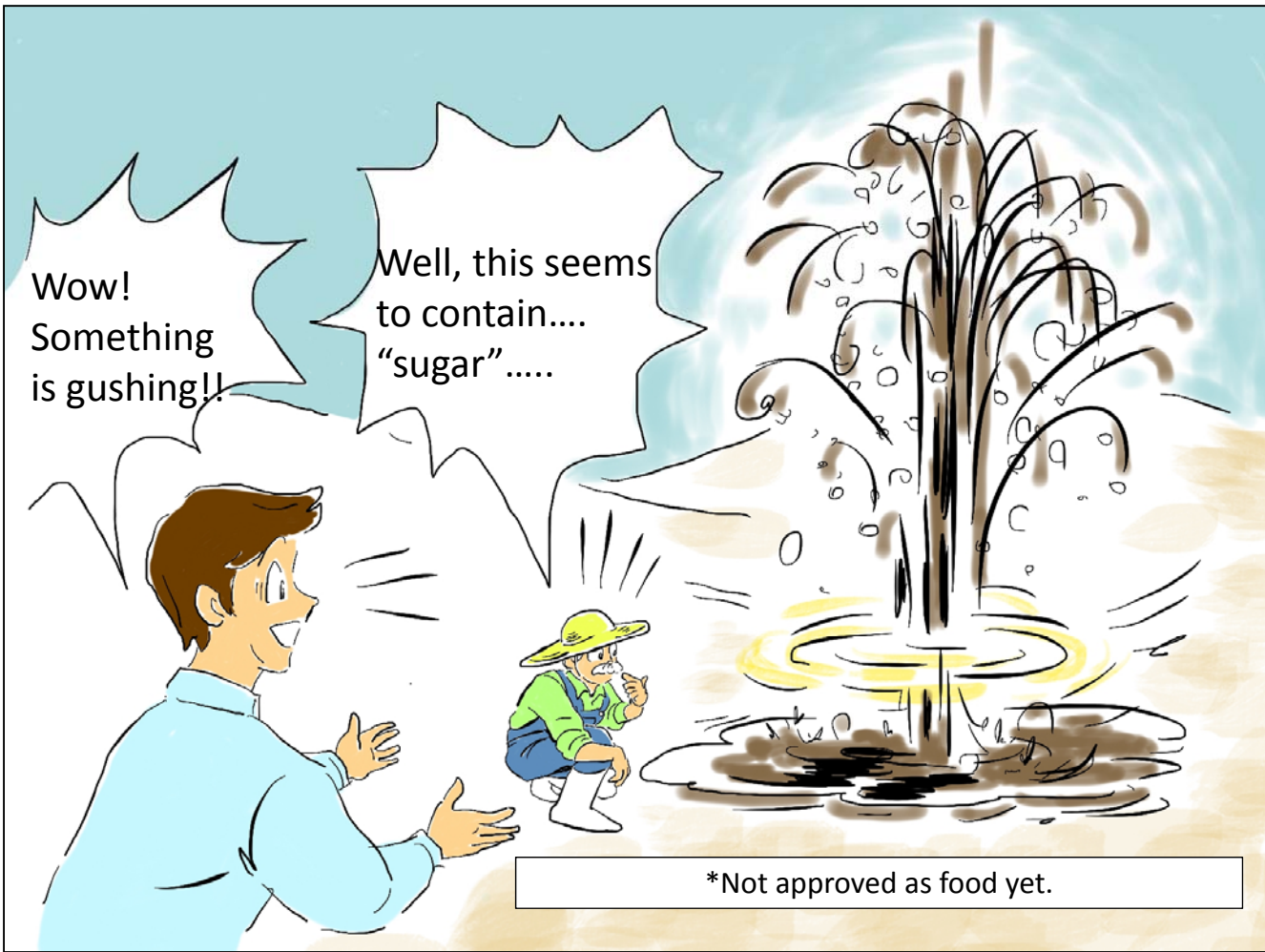
The ground is
swallowing
the straws!

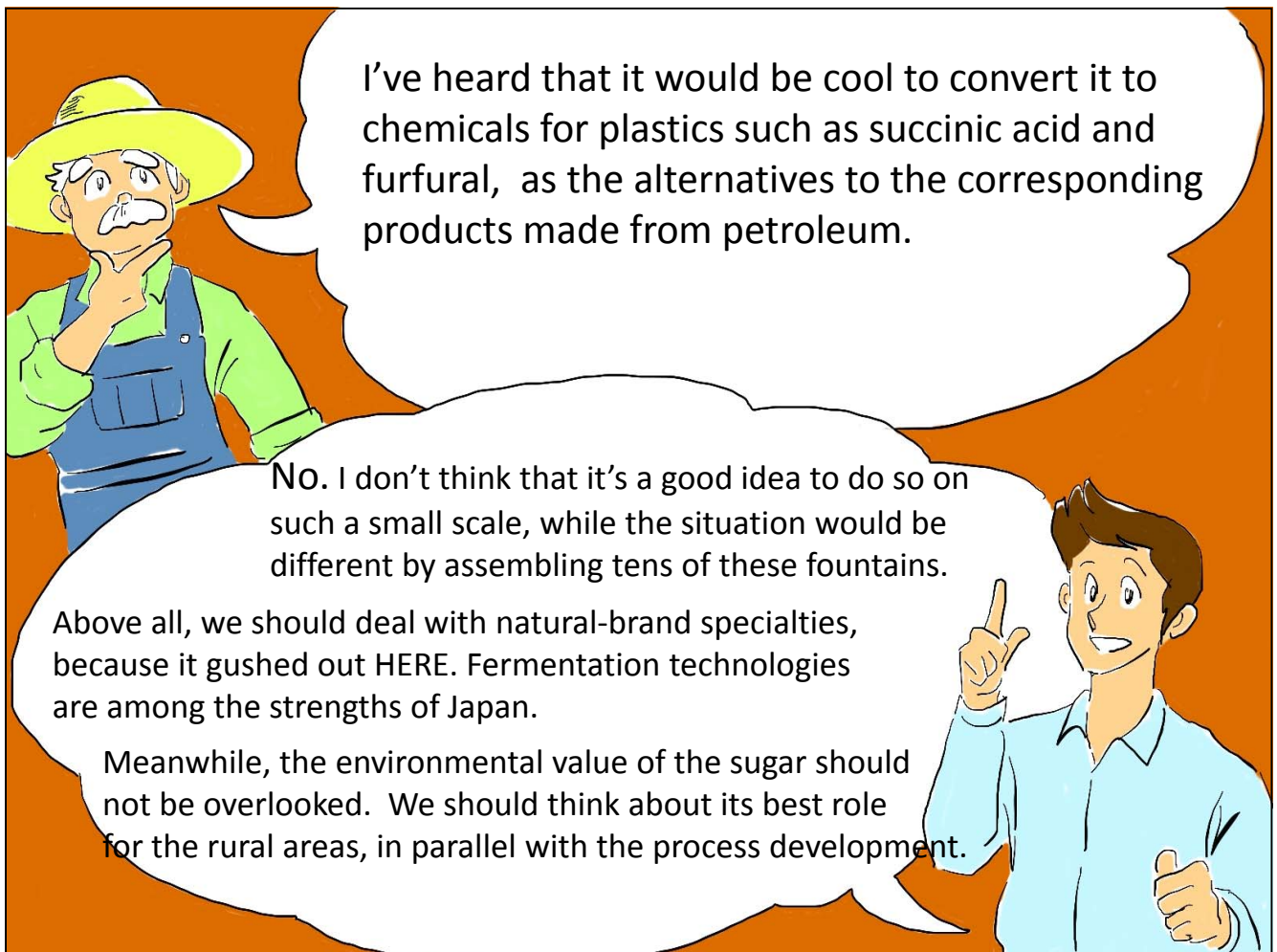
ROAR
ROAR



... A SUDDEN STOP









Concept of the 2nd generation fermentation industry

The 1st generation (traditional in the area)

Sake (rice wine), Miso, Soy sauce, Vinegar, Natto (fermented soybeans), Shochu (distilled spirits), Wine, Pickles, Yogurt, Cheese etc.

Spices, perfumes

Industrial enzymes

Microbial ingredients for agriculture

Microbial biomass

Pigments, dyes

Algae for fuel

New!

The 2nd generation (strategic for the area)

fibers

Rural specialties

Feed

Chemicals for rural industries

Ethanol for fuel

(For generation of unique rural industries)


(For rural energy security)

How about starting with making products like docosahexaenoic acid (DHA)?

Sounds great! Feeding that to animals would add extra value to the products.

DHA production by microorganisms:

For example, T. Yaguchi, *et al.*, Production of high yields of docosahexaenoic acid by *Schizochytrium* sp. strain SR21, *JAOCS*, 74, 1431-1434 (1997).



But can we
secure feedstock?


Of course!

As long as we keep on growing rice,
we get tons of straw every autumn.

In short, it will work well as long as
our agriculture keeps steadfast.

What other
“reserve materials”
do we have to make it
work throughout
the year?

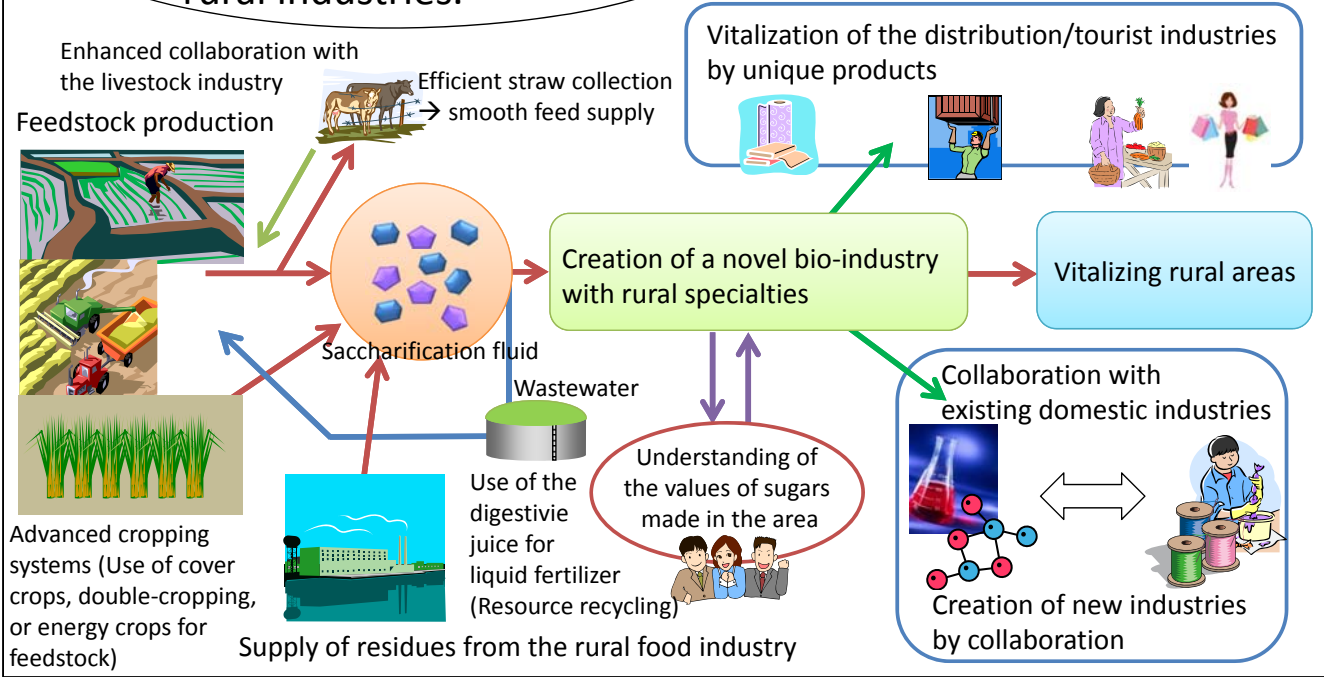
Energy crops: *Erianthus spp.*
and *Miscanthus spp.*, are being
developed, which can be harvested
10 times more than rice straw.
Additionally, we should also manage
well with residual materials in
the food industry.

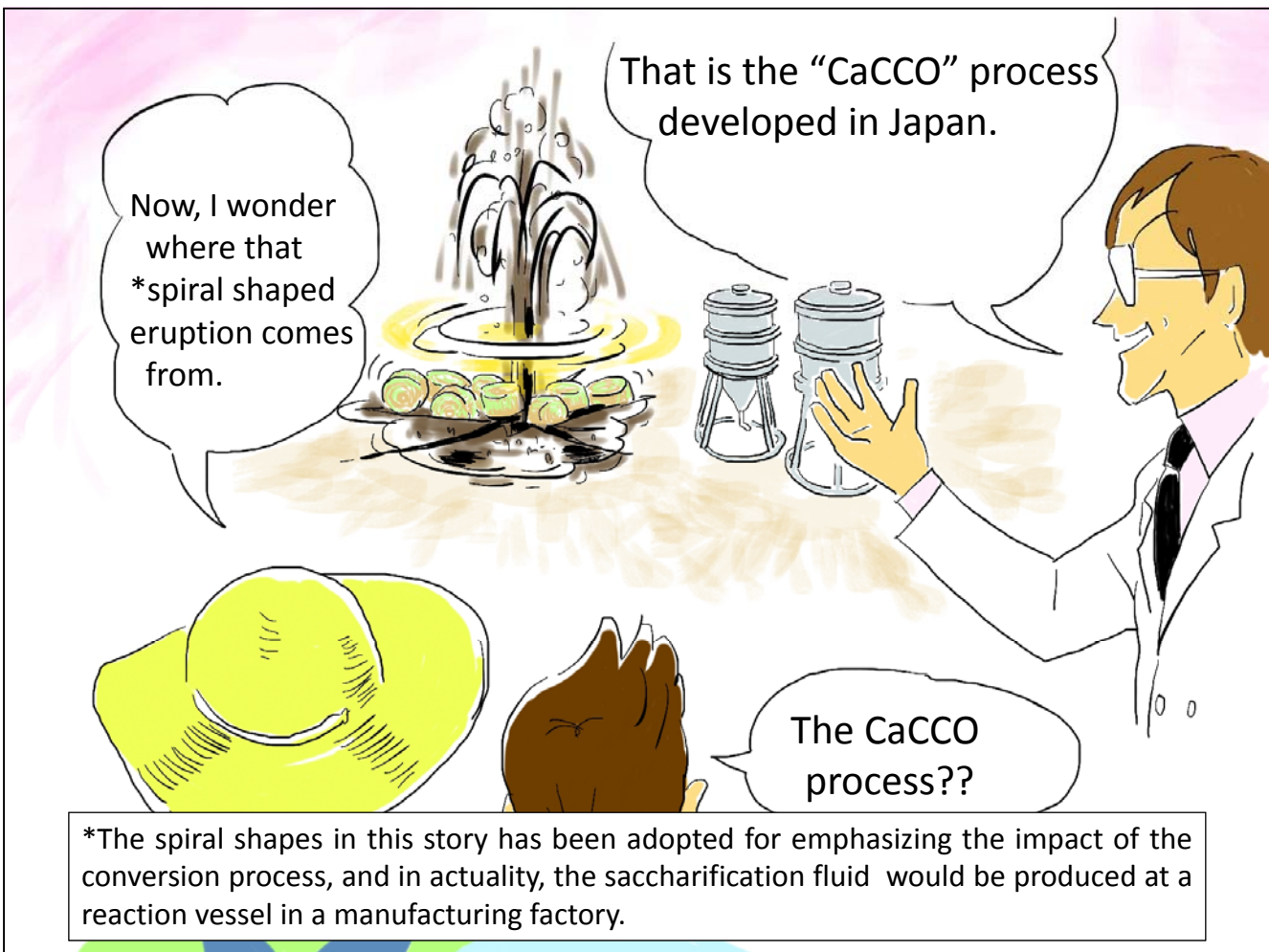
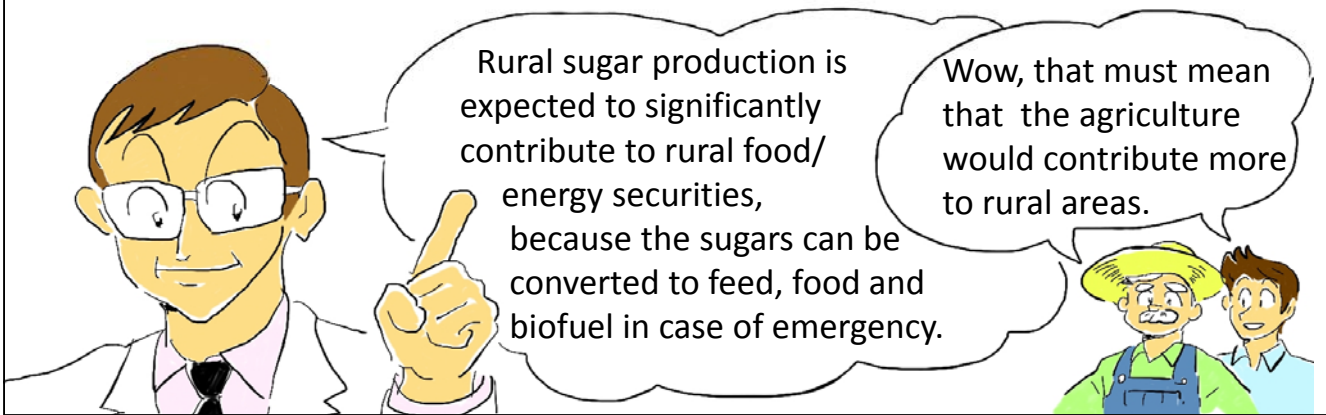
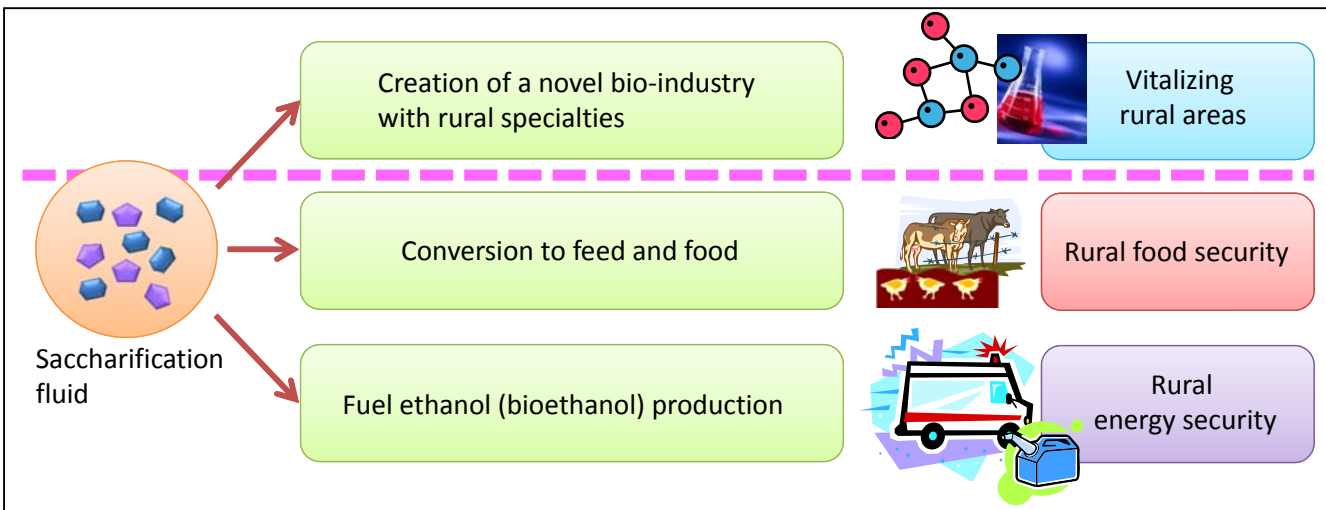


Experimental field for *Erianthus sp.* (Kyushu Okinawa Agricultural Research Center ,
National Agriculture and Food Research Organization, JAPAN)

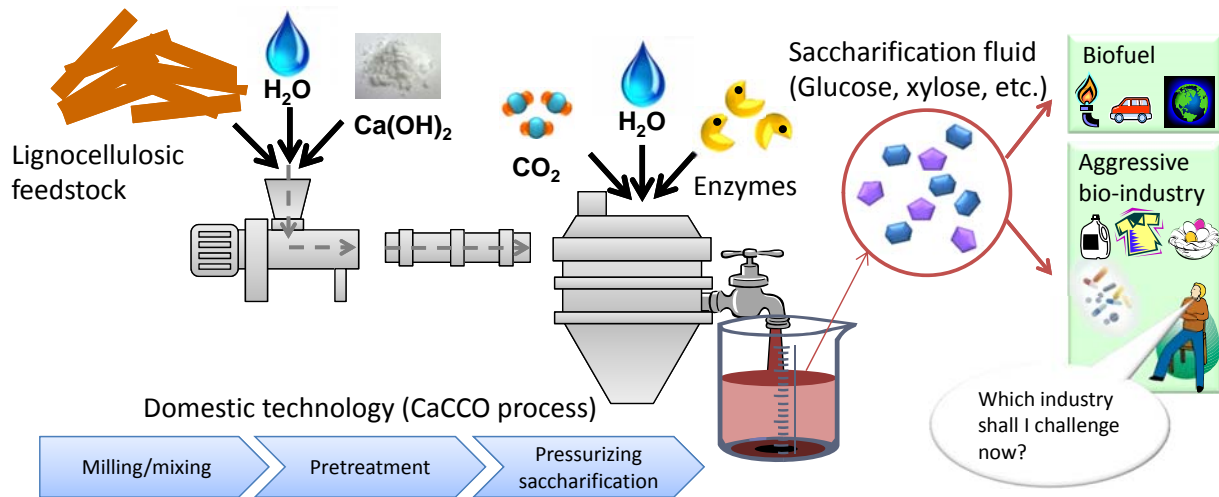
I hope people in the area can get together and cooperate on this project.

Then, rural agriculture could play the central role for activating various rural industries.





The CaCCO (Calcium Capturing by Carbonation) process



The CaCCO process was designed as a simple process for saccharification-fluid recovery for rural areas; accepting a wide range of domestic herbaceous feedstock, saving heat consumption in the pretreatment, and using calcium hydroxide and carbon dioxide, which are not categorized in poisonous- nor hazardous substances. The fundamental figure of the process is about to be fixed.

Do you remember the shale-gas news some years ago? The company seems to be planning to dig a neighboring town. The original one has almost dried up.

Some years later,

It's quite natural. No underground resources last forever.

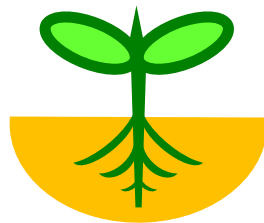




NARO



For the beginning of bio-industry revolution from Japan



Ken Tokuyasu*

Carbohydrate Laboratory, National Food Research Institute,
National Agriculture and Food Research Organization, JAPAN

*The author thanks T, C and J for their great help for preparation of this file.

Sep. 18, 2013 (Commercial use of this file is not permitted.)