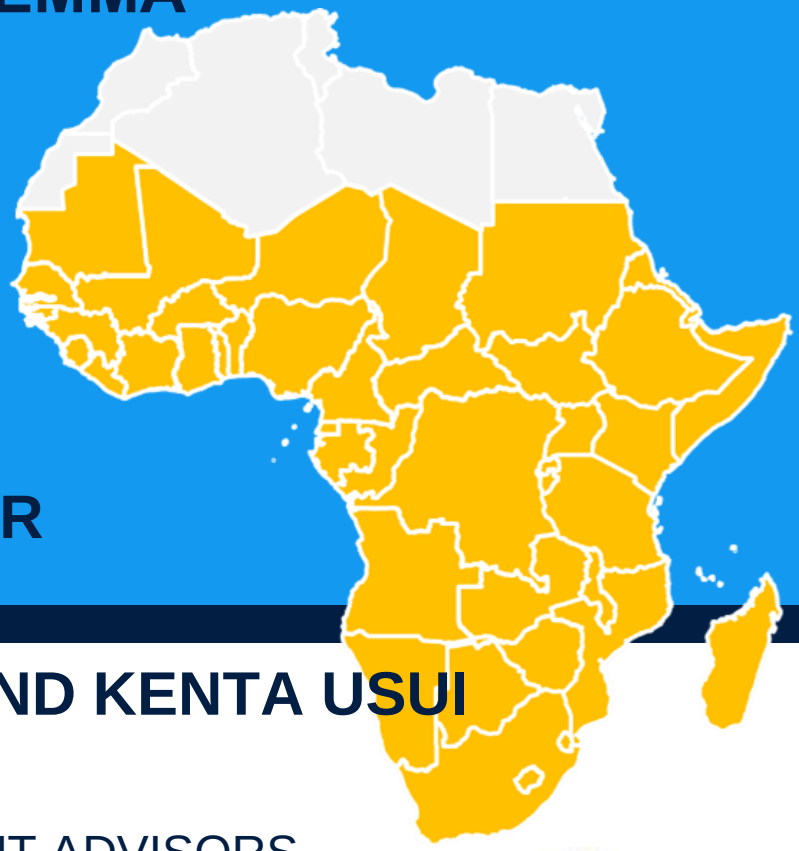
SCALABLE BUSINESS MODELS FOR ALTERNATIVE BIOMASS FUELS AND STOVES IN AFRICA: BEYOND THE CHICKEN-AND-EGG DILEMMA



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ESMAP
Energy Sector Management Assistance Program

Ci-Dev
CARBON INITIATIVE FOR DEVELOPMENT

Introduction: Alternative Biomass Fuels and Stoves

What are alternative biomass fuels?

Why are we interested in them and their use?

Are Fuels-or-Stoves like Chickens-or-Eggs?

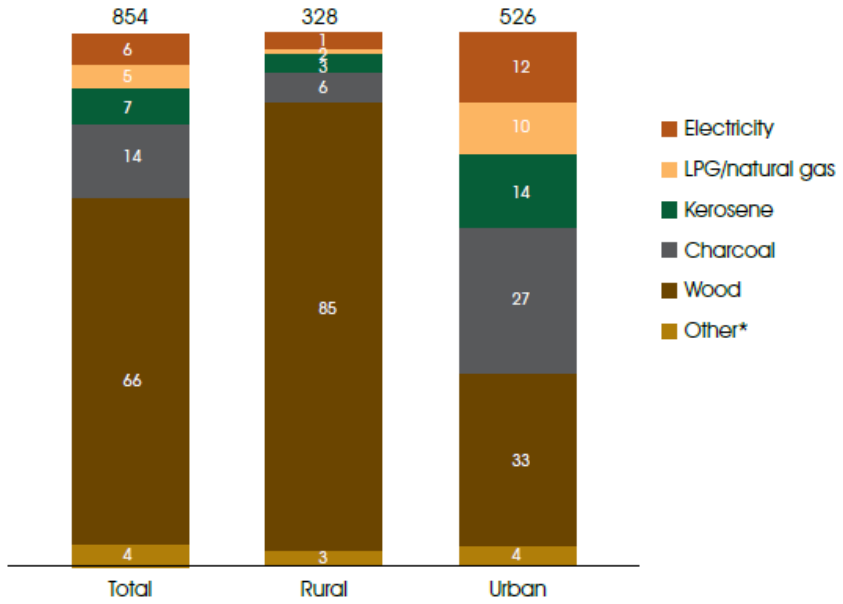
Which Business Models have been Tried?

What steps are needed moving forward?

What are alternative biomass fuels?

"Alternative"—not commonly used at present

Figure 2.1. Fuel Types Used for Household Cooking in Sub-Saharan Africa



* Solid fuels, including dung, crop waste, and coal, plus a tiny (less than 0.1 percent) biofuel component.

Sources: Fuel-use database drawn on WHO 2016a and various other statistics presented in World Bank, 2014 and Kammila, et al. 2015.

ie., not wood or charcoal

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What are alternative biomass fuels?(2)

Biomass: Made of biological material

Ethanol (either in denatured or gel form)

Briquettes (either carbonized or non-carbonized)

Pellets (compressed biomass)

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Why are we interested in Alternative Biomass Fuels?

- **Biomass fuels can be sustainable…if well managed**

  Waste products (sawdust, bagasse, crop residues, etc.) or by-products
- **Biomass fuels can be inexpensive with low-cost feedstocks**

  Consistently cheaper to use than unsubsidized LPG or kerosenes
- **Biomass fuels can, if used in clean-burning stoves, reduce pollutant exposure significantly**

  Stove becomes specialized to ensure performance, mis-matching fuels and stoves yields unsatisfactory results with respect to “cleanliness”
- **Biomass fuels can reduce overall systemic GHG emissions**

  CO_2 balances are tricky, but any efficiency gain or use of waste shows up favorably

Limitations of Wood and Charcoal Stoves

Understanding of “Clean” requires some explanation

- International Workshop Agreement (IWA) specifies five dimensions of rating stoves:

  Emissions (CO and PM2.5); Indoor Emissions; Efficiency of Fuel Use; and Safety

  For each dimension, Five tiers are specified (Tier O; Tier 1; Tier 2; Tier 3; and Tier 4) from worst to best

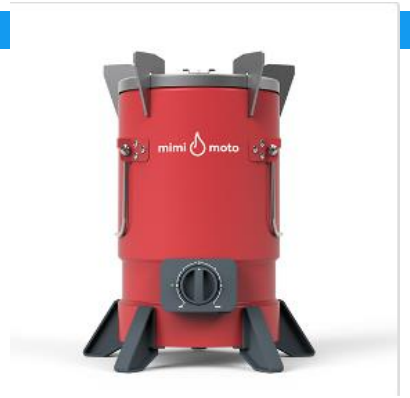
- **For Baseline Stoves and Best-in-Class Baseline Fuel Stoves:**

Stove	High Power Indoor CO Tier Rating	High Power Indoor $PM_{2.5}$ Rating	Efficiency Rating
Three stove fire & Fuelwood	0	0	0
Kenya Ceramic Jiko & Charcoal	0	0	2
Super-saver Wood GL (Envirofit)	4	1	2
Burn Jiko-koa & Charcoal	1	3	4

Opportunities for Non-Traditional (ie., alternative) Stoves and Fuels

Examples of Ratings of Alternative Biomass Fuels and Stoves

Stove	High Power Indoor CO Tier Rating	High Power Indoor $PM_{2.5}$ Rating	Efficiency Rating
Mimi-moto & pellets	4	4	4
Moto-safi & ethanol	-	-	4
KIKE Green Cook KD1 & gel ethanol	4	4	3



Truly "Clean" Means Alternative Fuels and Specialized Stoves

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So how do we move toward “Clean Cooking” In Sub-Saharan Africa?

To engage in “Clean Cooking”, market needs a supply of both alternative fuels and more sophisticated stoves

- Eighty percent of households in Africa cook with wood or charcoal
- Most cooking devices are either pre-historic in nature (ie., 3-stone-fire) OR
- 19th century technology—”charcoal bucket”

Which comes first? Stove or Fuel?

- **If we focus on alternative biomass fuels….**
  - There are no stoves to utilize these fuels properly leading to zero gains and possibly worse efficiency and emissions
- **If we focus on advanced stoves…**
  - We are asking poorer people to buy stoves which they cannot reliably obtain the fuel for…

Alternative Biomass Fuels faces its own “Chicken or Egg” Dilemma

What are the range of African Companies Working in this Space?

Roughly 80 firms, give or take

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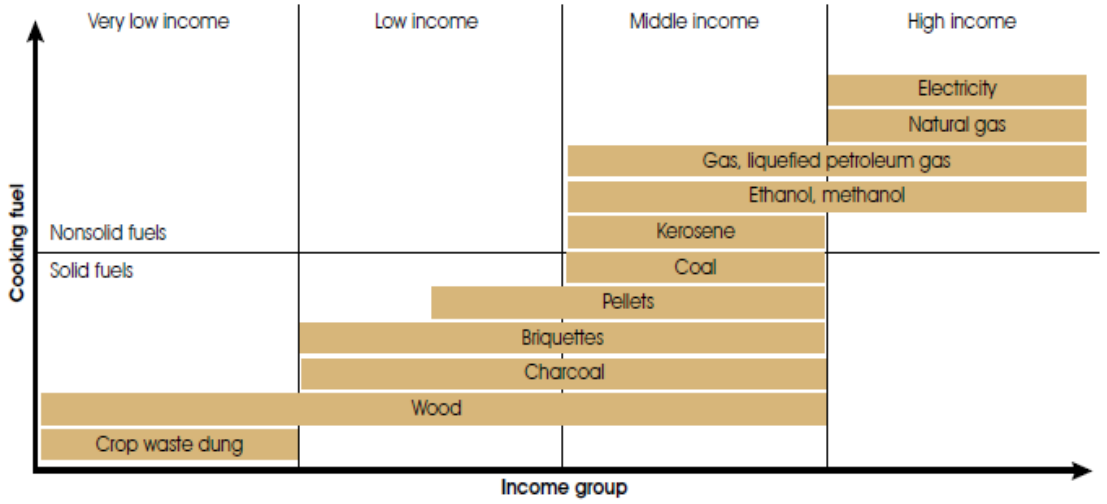
Consumer Use/Demand side Challenges--Egg

Concerns for Demand Side

- Most HH's pay neither for fuel nor for stove…the higher stove cost, smaller the targeted market (Zero cost is baseline)
- Does stove work with all cooking patterns or staples?
- To achieve market share, fuel supply must be reliably produced or else stove stack backs up
- Limited Availability of raw materials means Limited Market Share

Alternative Biomass Fuel use by Income Category

Figure 2.2. Relationship Between Income and Type of Energy Consumed for Cooking



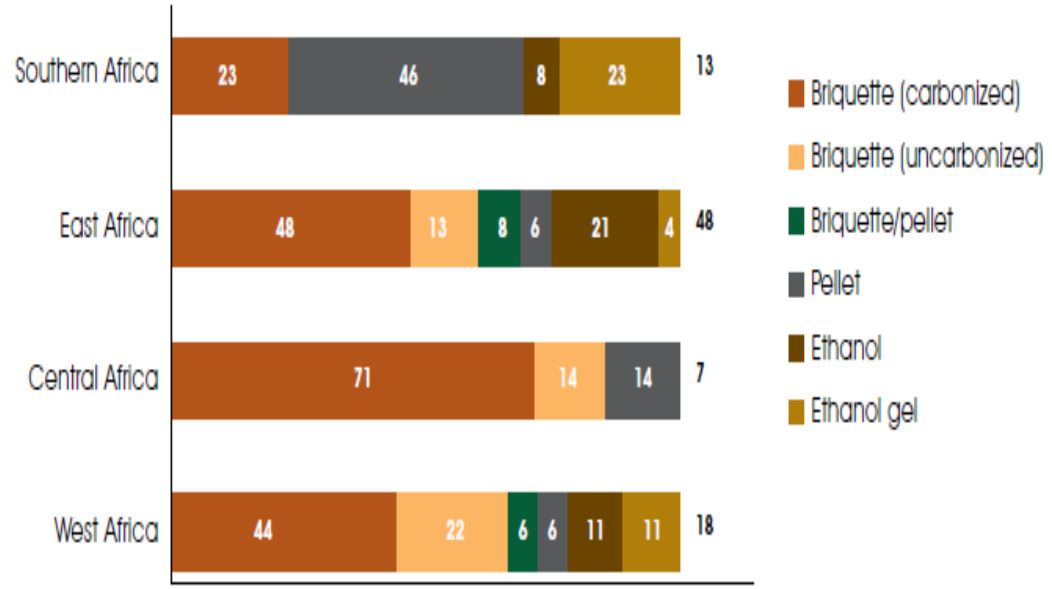
Source: Adapted from WHO 2016a.

Fuel Production Supply Side--Chicken

Concerns for Supply Side

- Which fuel to produce (briquettes v pellets v ethanol?)
- Which feedstock is available at what price?
- What is target market? Household sector may not be not easy nor most profitable…
- How do you distribute fuels to target market and consumers? Beyond production site…

Figure 2.6. Biofuel Manufacturers and Distributors by Fuel Type and Subregion in Sub-Saharan Africa



Sources: Desk research, interviews, and surveys building on the GACC fuels/stoves database http://catalog.cleancookstoves.org/stoves.

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What are baseline levels of Alternative Biomass Fuel Production in Africa?

Ethanol:

- Global Production in 2015 estimated at 97 billion liters
- SSA-wide production: ~ 0.01% for cooking; 0.5 % globally

Biomass Pellets:

- Global Production in 2015 estimated between 27 and 29 million tons
- SSA-wide production: ~ 0.1 % for cooking; 1.5% globally

Biomass Briquettes:

- Global Production of Uncarbonized briquettes: 20 million tonnes per year
- SSA-Wide production: 100,000 tonnes per year or less than 0.5 percent globally
- Global Carbonized Briquettes: maybe 1-2 million tonnes per year
- SSA Carbonized Briquettes: between 70 and 100 thousand tonnes per year (<10% globally)

Market Transformation Solution: Not a choice of chicken or egg, but that of needing both Chicken and Egg

Market Transformation Approach: Removing Barriers to Growth of Enabling Environment, Demand Side, and Supply Side

Enabling Environment Barriers: (bread & butter for WB)

- Policy environment, quality of products (S&L), Finance availability & R&D

Supply-Side Barriers:

- Distribution networks; fuel supply; feedstock supply; availability of high quality stoves; and fuel quality

Demand-Side Barriers:

- Affordability & availability of stoves and fuels; High quality stoves; Consumer awareness; Perceptions of fuel quality & safety; Behavioral changes needed

Successful Business Models: Depends upon market niche

For all businesses (cross-cutting in sectors) Choices to be Made

- **Operational models:**
  - Production focused: Produce own product, can market downstream
  - Distribution focused: May distribute their own and others' products
  - Fully integrated (11% of enterprises)—Inyenyeri both fuel production, distribution and contracted in end-use equipment
  - Partially integrated (51% of enterprises)—Full or partial production and distrubution
  - Equipment led/B2B (e.g. sells presses only; sells stoves only; or handles Pay-Go technology, etc.)
- **Ownership models:**
  - Private v. public and state vs. community-owned, social enterprises, or NGOs, or a hybrid of any of above

Upstream-Focused Model Choices

Production Models

- Centralized v. Decentralized approach: urban v. rural markets (Ethiopian ethanol decentralized for HH market vs. Kenyan ethanol centralized for automotive ethanol)
- Feedstock sourcing: Own feedstock, purchase wastes, produce on site, single supplier, multiple suppliers

Downstream-Focused Model Choices

Distribution Model:

- Trade-off between control and cost
- Use firms' own infrastructure or contract it in, or out
- Sales-agent or salesforce model vs direct distribution, commonly both
- Well-established retail stores (Nakumatt, Shoprite, others)

Cookstove Strategy:

- Is there one or more than one stove giving best results?
- Is stove means to an end (fuel sales) or an end in itself (profit-center)?
- May choose to give away or front-end load stove to hook fuel consumers (LPG Europe Model)

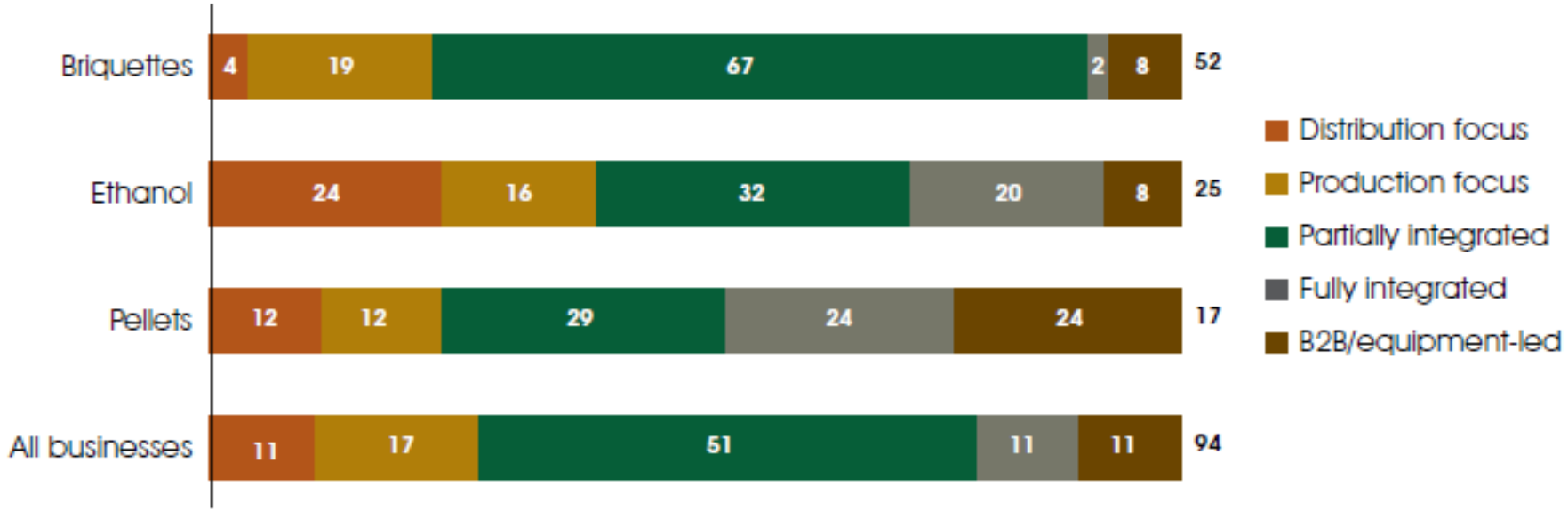
Revenue Sources for Economic Viability

- Is cooking fuel primary focus or secondary line of business?
- What items can be loss-leaders and still keep business afloat?
- Is there a need for internal cross-subsidization to grow one element?

Geography of the Target Market (urban, rural, peri-urban or some combination?)

Survey-based Breakdown of African Alternative Biofuel Business Models

Figure 3.2. Operational Business Model Mix



Note: Database supplemented by nine additional businesses to include more producer, distributor, and B2B companies that reflect the diversity of operational business models but that are not involved deeply enough in biofuel production or distribution to be included in the core database.

Source: Sub-Saharan Africa Biofuel Enterprise Database.

How do we move the field forward?

By picking the winners and investing heavily in them?

- Categorically Not.
- Betting on specific fuel-technology combos not the way to move market forward
- Rather, support market development and transformation

Innovation rules the day—let it proceed

- Of the 90 or 100 enterprises reviewed in this study, at least 10% are no longer in business
- Perhaps more than 10% are new start-ups, but presently at a high-turnover stage of market development
- Current stage of market development relies upon innovation in both the technologies and business models deployed

Support to Market Development and Transformation

1) Enhance Enabling Environment: Promote Better Policies
2) Increase Financing Using Results-Based Financing as Strategic Tool
3) Broaden Access to Finance (A2F)
4) Provide Support to Grow Market
5) Improve Sector Knowledge

All above have to be country & sector specific

1) Enhance Enabling Environment: Promote Better Policies

Taxes and Duties:

- Remove Taxes/Duties on Targeted Fuels (ethanol, pellets or briquettes)
  - VAT is not imposed on traditional fuels
  - Making playing field level for alternative cooking fuels

Subsidies:

- Remove Kerosene Subsidies, replace with tax
- LPG does not need subsidy but why tax an economic good with health benefits?

Fuel Quality Standards:

- Ensure alternative fuels (ethanol) meets consistent quality standards
- Ensure stoves are tested and performance efficiency known

Streamline Licensing Restrictions:

- Licenses should not serve as a barrier to entry for new fuel providers/producers

Ensure National Policy Incorporates Alternative Biomass Fuels

- Policy needs to reflect importance of desirable, viable alternative biomass fuels

2) Increase Financing Using Results-Based Financing as Strategic Tool

Financing to Clean Cooking Must Increase

- Estimates from SE4All place the financing requirement at US$4.4 billion
- Until thrust and focus of investment is clearly defined, sector cannot absorb such a windfall

Increasingly, clean cooking initiatives are using Results-Based Financing

- Ci-Dev has shown that channeling funding for results (CO2 reductions) can bring greater investment to bear
- Can be focused at various stages of the market (producers, distributors, consumers, stove sales, stove use, and policy reform)
- Level playing field across all actors able to meet pre-specified qualifications
- Looking at results-based financing for health benefits, for market sales, gender benefits, can be front-end loaded

Results-based Financing has Wide Potential Uses

- Can be used across clean-cooking ecosystem
- Can be used in piloting
- No results, no payment—betting not on one winner, but any winner able to show the desired results

3) Broaden Access to Finance (A2F)

Beyond RBF, Financing is needed throughout value chain

- Commercial financing necessary to grow market
- Work with local lending entities to tailor financing products for biofuel market needs

Producer Financing

- Producers need financing for K-equipment and trade finance
- Raw-material supply
- Front-end risk capital difficult until business is established

Distributor Financing

- Inventory management
- Transport, storage facilities
- Trade finance & marketing

Consumer financing

- Normal consumer loans for purchasing stoves
- Micro-finance sector has demonstrated interest

4) Provide Support to Grow Market

Market Awareness Raising:

- Need to raise awareness among consumers
- Public outreach with valid information “Above the line marketing”
- Linked to regional market roll-outs

Capacity Building Assistance to Producers

- Both stove manufacturers, distributors
- Producers to smooth out supply chain hitches
- Match-making between global and local players

Role for Government, donor or non-government subsidy programs

- For selected “targeted” needy customers, may justify support to benefit

5) Improve Sector Knowledge

Alternative Biofuels for Cooking is New Market Area

- Experience of ethanol for transport (not so favorable outside Brasil) is not entirely applicable
- Markets for Pellets or Briquettes is fairly new
- Technologically, at early stages of learning curve

Further information on fuel-technology combinations is needed

- Energy and environmental (emissions) profiles not well known
- Further advances for stoves and fuel production may accelerate and lower cost of cleaner options

Successful Business Models for Scale remain largely a “work in progress”

- Continued work to monitor progress of growth and new business models emerging
- Awareness of new developments meriting further support and guidance to clients

Conclusions

Clean Cooking Space Surrounding Alternative Biomass Fuels is Dynamic and Growing

- Varies by country and even regions within countries
- No universal solution to challenges applicable everywhere

Role for World Bank and other Development Partners is to Support Market Growth and its Growth

- For some countries, clean cooking may still mean stimulating meaningful stove efficiency improvements
- Other countries may be ready for and need support to alternative biofuels and stoves

World Bank needs to provide opportunistic support—as local circumstances justify—through

1) Enhancing Enabling Environment, especially through well-informed policies
2) Increasing Financing, especially Results-Based Financing as Strategic Tool
3) Broadening Access to Finance (A2F)
4) Providing Support to Grow Market
5) Improving Sector Knowledge and Information

Watching Brief, Opportunistic Interventions

THANK YOU

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