

Community biogas and clean cooking solutions for food processing in rural Ghana



Presented by:

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Director

- Institute for Sustainable Energy and Environmental Solutions (I-SEES)
- College of Tropical Agriculture - KITA - Executive Board Member
- Global Ecovillage Network Ghana - Vice President
- Biogas Association of Ghana, (Executive Member)
- Ghana Alliance for Clean Cookstoves (GHACCO) - Executive Member
- Ecosystem Based Food Security Assembly - Energy Focal Point
- Youth Volunteers for the Environment - YVE Ghana - Exec. Member
- African Youth Initiative on Climate Change - Ghana Member



Brief Introduction of the Institute

- ▶ The Institute for Sustainable Energy and Environmental Solutions (I-SEES) is
- ▶ research, training and development oriented institution based in Ghana

Mission:

- ▶ **identify** (through research),
- ▶ **promotes** (awareness creation and training) and
- ▶ **deploys** (market deployment) of
- ▶ **innovative solutions and technologies in**
- ▶ **Renewable energy, climate change, environment, water and sanitation for improving the livelihoods of households and small enterprises in Ghana and Africa.**
- ▶ Website www.iseesghana.org

Thematic Areas of Operation

Renewable Energy
& Energy
Efficiency

Natural Resources
- Forestry,
Fisheries and
Agriculture -
REDD+,

Environment -
Climate Change and
Biodiversity
Conservation

WASH - Water,
Sanitation and
Hygiene

Objectives we strive to achieve

- ▶ **Reducing energy expenditure** for vulnerable communities through increasing access to efficient energy solutions
- ▶ **Reducing exposure to air pollution from traditional heating and lighting** by Improving the health and livelihoods of vulnerable women through **promotion of climate smart technologies** - promoting clean Cookstoves and solar lighting solutions
- ▶ **Empowering young people with entrepreneurial skills and innovative ideas** to reach their potential through training and business incubation
- ▶ **Enhancing biodiversity conservation and sustainable utilization of natural resources** of vulnerable communities through participatory approaches
- ▶ **Improving Sanitation and Hygiene through sustainable waste to energy technologies**, recycling and reuse for improved health and environment of households and communities
- ▶ **Contributing to food security and poverty reduction through conservation agriculture** in attainment of the sustainable development goals and climate change mitigation

How we do it

Training

- Technical, Vocational and Entrepise-based skills training (seminars, short courses, academic courses, workshops)

Research and Policy Advocacy

- Evidence based research for policy advocacy and market intelligence advisory

Consultancy

- Professional Advisory Services, research, market study, feasibility analysis,

Community Development

- Outreach, awareness, education and behavioral change communication, livelihood empowerment

Technology Deployment & Marketing

- Market Development of innovative products and technologies through inclusive business models

Business Development

- Support for SMEs, business incubation, financial management, marketing, records, Bss plan dev't

Center for
Renewable
Energy and
Energy
Efficiency

Center for
Biodiversity
Conservation
Agroforestry
and Natural
Resources

Center for
Water
Resources
and
Sanitation

TECHNOLOGY DEPLOYMENT & MARKETING UNIT



Solar Lighting



Solar Home System



Solar Home Lighting



Energy Saving Led Bulbs



Solar Home Lighting



Prime Cook Stoves & Fuels



Water Filters



**Tree Planting, Afforestation
& Improved Charcoal Kilns**



Affordable Solar Lanterns



**Improved Household
Charcoal Cook Stoves**



**Cook stoves for food processing
(Gari roasting & Fish smoking)**



**Oil Expellers
Coconut oil, Palm kernel & Groundnut**



Solar Water Pumping



Biogas (waste to energy)



Institutional Cook Stoves

Activities: Training, Consultancy, Research, Community Development & Technology Deployment

Sectors: Renewable Energy, Climate Change, Environment, Natural Resources, Water Sanitation And Hygiene (WASH)

Locations: Accra - Madina Estates, Near UPS, Rawlings Circle
Kumasi - Domeabra-apromase, Near Knust, Off Oduom Junction

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ISEES PART OF AN ACCREDITED COLLEGE OF TROPICAL AGRICULTURE



Focused on

- Renewable Energy and Energy Efficiency,
- Climate Smart Solutions,
- Environmental Conservation, biodiversity and Natural Resources Development
- Water, Sanitation and Hygiene



Focused on

- Agriculture and Food Security
- Competency based training of youth in Technical Vocational Agriculture to Diploma Level
- Extension Services to farmers on conservation agriculture and improved farming practices

ISEES is prominent in with various national networks in Ghana

- ▶ Ghana Alliance for Clean Cookstoves - GHACCO - to drive adoption of clean Cookstoves and fuels in Ghana www.ghacco.org
- ▶ Biogas Association of Ghana - to promote biogas technologies as solution for sanitation and waste management and energy and agric. www.biogasassociationgh.org
- ▶ Ecosystem Based Food Security Assembly - Enhancing ecologically sustainable approaches to food security and renewable energy and environmental sustainability www.ebafosa.org
- ▶ Ecovillage Network Ghana- Ensuring sustainable community development through wholistic and participatory approaches involving socio-economic, ecological and worldview models towards climate change adaptation - www.ecovillage.org
- ▶ Permaculture Network Ghana - promoting ecologically sustainable practices towards forest conservation, food and energy security and strengthening vulnerable communities www.permacultureghana.wordpress.com
- ▶ Youth Volunteers for the Environment - YVE Ghana - building capacity of youth through innovative volunteerism to be involved in green economy, environment and climate policy decision making and sustainable development www.jve-international.org - school clubs education on energy and environment among others.

Partners



Activity supported by the
Canada Fund for Local Initiatives
Activité réalisée avec l'appui du
Fonds canadien d'initiatives locales



REAG
Renewable Energy
Association of Ghana



PERMACULTURE
NETWORK GHANA



Energy is required in majority of food processing activities in rural Africa for process heating

- ▶ **Boiling** - Palm Oil Processing, Palm Kernel Oil Processing, Mushroom Sterilization, Shea Butter Processing, Pito (Beer) Brewing,
- ▶ **Roasting** - Cassava "Gari" Processing, Groundnut roasting, Shea nuts roasting
- ▶ **Drying** - Gari, Fish, Mushroom, Fruit Drying, Leaves drying, Vegetables, fish drying, Corn
- ▶ **Smoking** - Fish



Rural Food Processing are largely Women dominated Enterprises



Over-dependence on firewood contributes to deforestation, Air Pollution, and Climate Change through use of inefficient cookstove technologies



Effluent from Agro-processing centers are usually disposed off inefficiently causing environmental nuisance but are potential bio-energy source



Effluent from Cassava (Gari) Processing, shea butter and Palm oil disposed into

Biogas Technologies can be a feasible bio-waste to energy solution for rural agro-industries



» Fixed Dome



Anaerobic Baffled Reactor (ABR)



» Floating Drum



Puxin Digesters



Typical Examples of Community Based Biogas Digesters for Food Processing

Bole Community Biogas Plant for Shea Waste Processing in Northern Ghana

Installed by - CRIG, Biogas Engineering Limited



- 50m³ fixed dome biogas installed, capable of generating 12m³ of biogas daily.
- Shea butter processing effluent used as feedstock for the digester
- Biogas used as fuel in roasting shea kernels
- Biogas is also used to power the shea kernel grinding mill
- Women processors are now able to roast their shea kernels and boil their shea using gas from the biogas that provides clean energy

BIOGAS INTERVENTION: INDOOR ACTIVITIES WITH RENEWABLE ENERGY FROM THE PROCESS WASTE RESULTS IN QUALITY OIL/BUTTER FOR EXPORTS



PROJECT IMPACT ON CLIMATE CHANGE

The LC has a *50 m³ biogas digester attached, which is capable of generating about 15 - 30 m³ of biogas daily:

- ▶ 1 m³ biogas = 5.56 kg wood (Sasse L., 1988)
- ▶ 15 - 30 m³ biogas = 83.4 - 166.8 kg wood/d
- ▶ Potential fuel wood savings/a = 30.4 - 60.8 metric tons
- ▶ Estimated annual vegetation productivity for the savanna in Ghana = 6 - 12 metric tons of wood/ha (Duke J. A., 1987).
- ▶ Potential vegetation that could be saved annually by replacing firewood with biogas in all-year-round processing of shea butter at the LC = 5.1 - 10.1 ha respectively.
- ▶ Hence communities adopting the technology implies that the fragile savanna vegetation could be saved annually through the proposed project.

GLOBAL WARMING/CLIMATE CHANGE MITIGATION



TRADITIONAL METHOD:
**CUTTING DOWN TREES FOR
FIREWOOD**



BIOGAS EFFLUENT INTERVENTION:

**SEEDLINGS GROWN WITH EFFLUENT FROM
BIO-DIGESTERS TO PROMOTE AFFORESTATION
(FIRE WOOD SUBSTITUTION + TREE
GROWING)**

Safi Sana Community Biogas Plant for Electricity Generation in Ashaiman Community - Processes Food waste and other bio-waste from Local Market



- Digester capacity - 2500 m³
- 100 kW biogas generator to generate electricity
- Faecal matter, slaughter waste and organic waste from the market is sourced for feeding
- The treated plant effluent used as bio fertiliser for growing seedlings
- PPA with ECG for offtake of electricity generated



Biogas Market Potential and Demand

- Huge numbers of small agro-processing enterprises - Palm oil producing industries, shea butter processing industries etc. for the deployment of biogas systems in Ghana



Benefits of Biogas for agro-industries

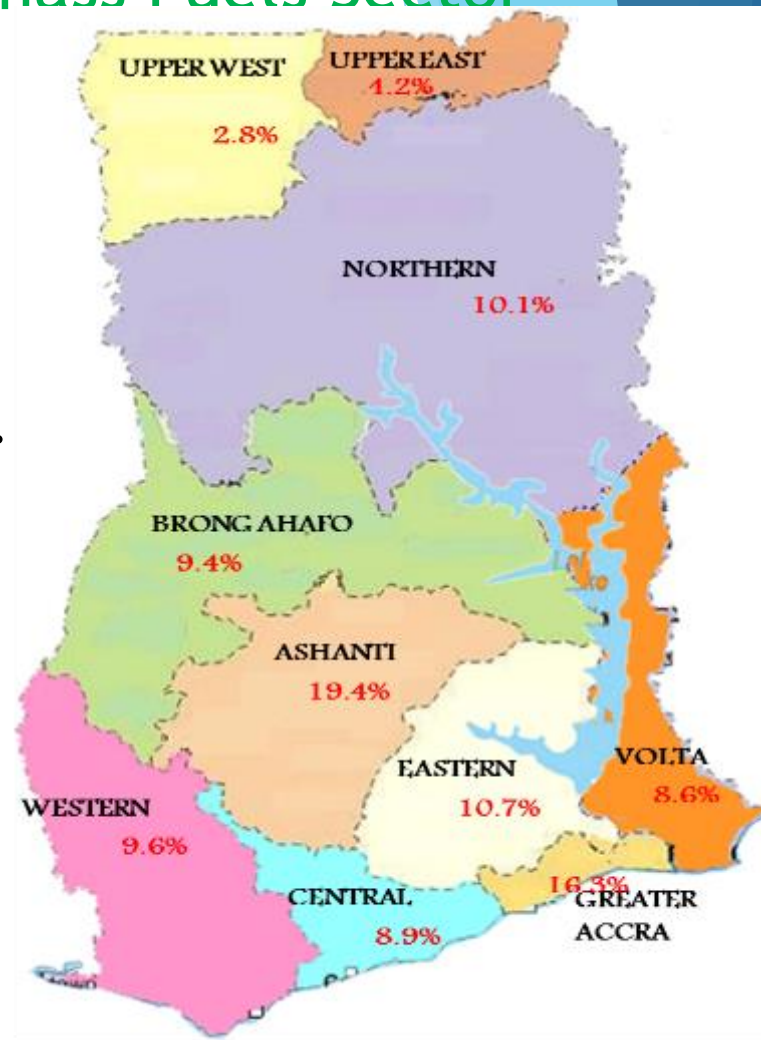
- ▶ Provide technology to treat waste/slurry from various processing materials before released into the environment
- ▶ Provides Biogas for heating in place of firewood thereby reducing deforestation
- ▶ Improves health of women/community through reduced air pollution
- ▶ Reduces poverty by reducing expenditure on fuelwood by women groups
- ▶ Provides alternative energy for lighting as well as fertilizer for replanting trees or food crops



**Climate Smart Improved Cookstoves
Technologies also provides direct benefits
to food processors**

State of Cookstove & Biomass Fuels Sector

- 70% reduction of forest cover largely via unsustainable woodfuel collection and Charcoal Burning.
- 84% households use solid fuels.
- 21% impacted by Indoor Air Pollution.
- 17,000 deaths every year with 50% being children (WHO - 2017)
- 30% low awareness of health, economic, and environmental impacts.
- LPG penetration rate is 26% lower than expected target of 50% to be achieved by 2020.
- Media campaign/ education on sector issues very minimal



(Land Area: 238.5 km²)

Shifting from Traditional Cookstoves To Improved Cookstove Technologies.

Traditional Stoves



Improved Stoves and Fuels



Advanced Super Clean Stoves and Fuels



ISEES visits women groups to educate them on benefits of switching to improved household and institutional stoves and provides financing scheme to help drive adoption



In the Fish Smoking Industry - ISEES is partnering with SNV and CFLI to improve local technology and deploy cookstoves



Barrel Traditional oven	Chorkor Oven	Morrison Oven
Efficiency; Baseline	Efficiency; Baseline	Efficiency; 37% over chorkor
BaP 15; PAH4 72	BaP 22; PAH4 84	BaP 30; PAH4 110
Where EU limit is BaP2; PAH 12		

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Current Improved stoves for healthier Fish smoking - low PAH levels being deployed in Ghana. ISEES is training technicians to build and deploy the stoves and ISEES



Improved Quality of smoked fish from New Stove technology for a healthy population

Fish smoked from
Existing Chorkor Oven

Quality of fish smoked from Ahotor
Oven with low PAH levels for export
and healthy local market.



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Canada

Approaches used and lessons learnt



Research & Baseline



Pilot new concept



Stakeholder involvement &
Knowledge Sharing



Technology Development



Periodic monitoring

In the Gari Processing Industry, Traditional Inefficient stoves consumes lots of firewood and brings heat and smoke to women involved



**ISEES and SNV with GIZ is promoting Improved Rectangular GARI
ROASTING Stoves with no smoke and quality gari**

Chrisaach Stove **Morrison Stove**



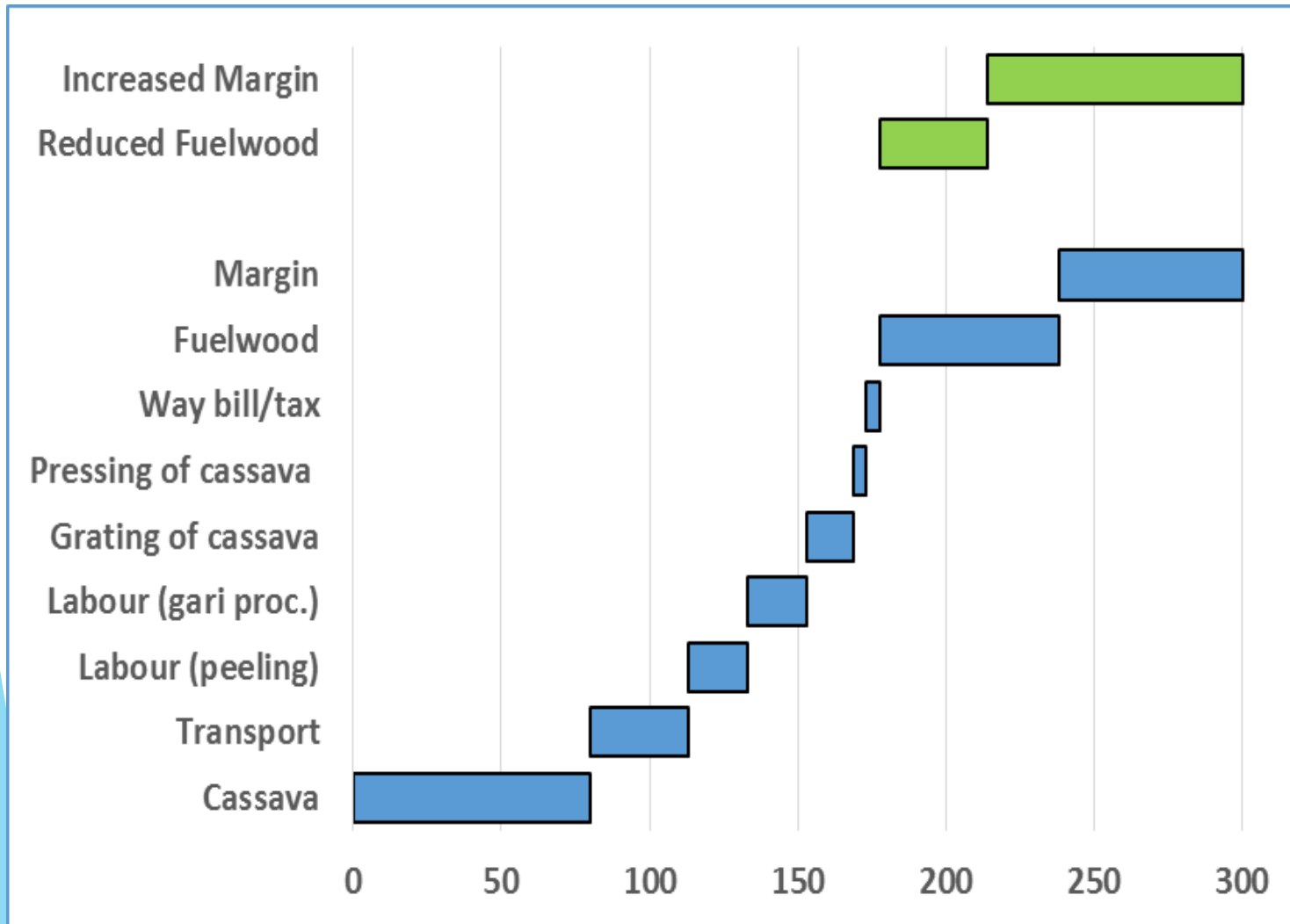
Improved stoves for palm kernel oil processing - using palm fibre - constructed with support from ECREEE



ISEES works with communities to use woodlot plantations and agro-forestry to provide sustainable source of fuel for processors



Benefits of ICS to Women Processors



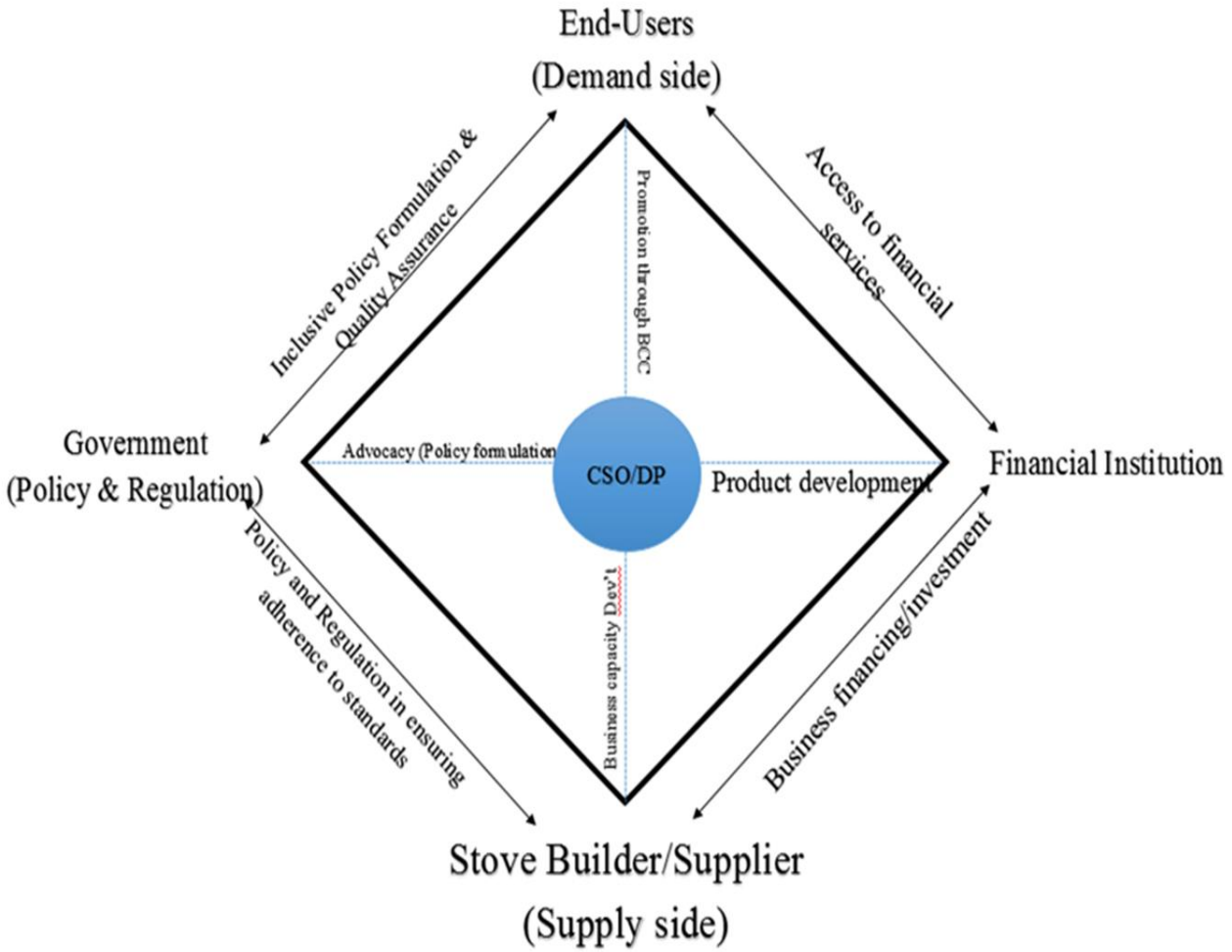
~30%

~20%

Reduced Fuelwood + Increased Margins + Healthier Workplace + Quality Product



Financing and Sustainability Model to Drive Adoption



Key factors for ICS Adoption

- Sustainable Business
- Policy & Regulation
- Promotion

Gasification using palm kernel shells to generate electricity for agro-processing- Installed in an off-grid community Papasi, by Kumasi Institute of Tropical Agriculture, ISEES/ CEESD awith funding from USADF Power Africa



Way Forward

- ▶ ISEES is looking for strong partnerships to deliver renewable energy solutions to local communities - including solar, clean cooking and biogas technologies for climate change mitigation
- ▶ ISEES is also starting a training center in renewable energy and looks for partnerships to develop its training center and also partner with universities to run technical and tertiary as well as short course modules for youth in Ghana and West Africa
- ▶ ISEES is looking for opportunities for project partnerships for our community development initiatives that enhances access to energy services for local communities.
- ▶ Partnerships are also open to the Ghana Alliance for Clean Cookstoves (GHACCO) and the Biogas Association of Ghana

Contact Us

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