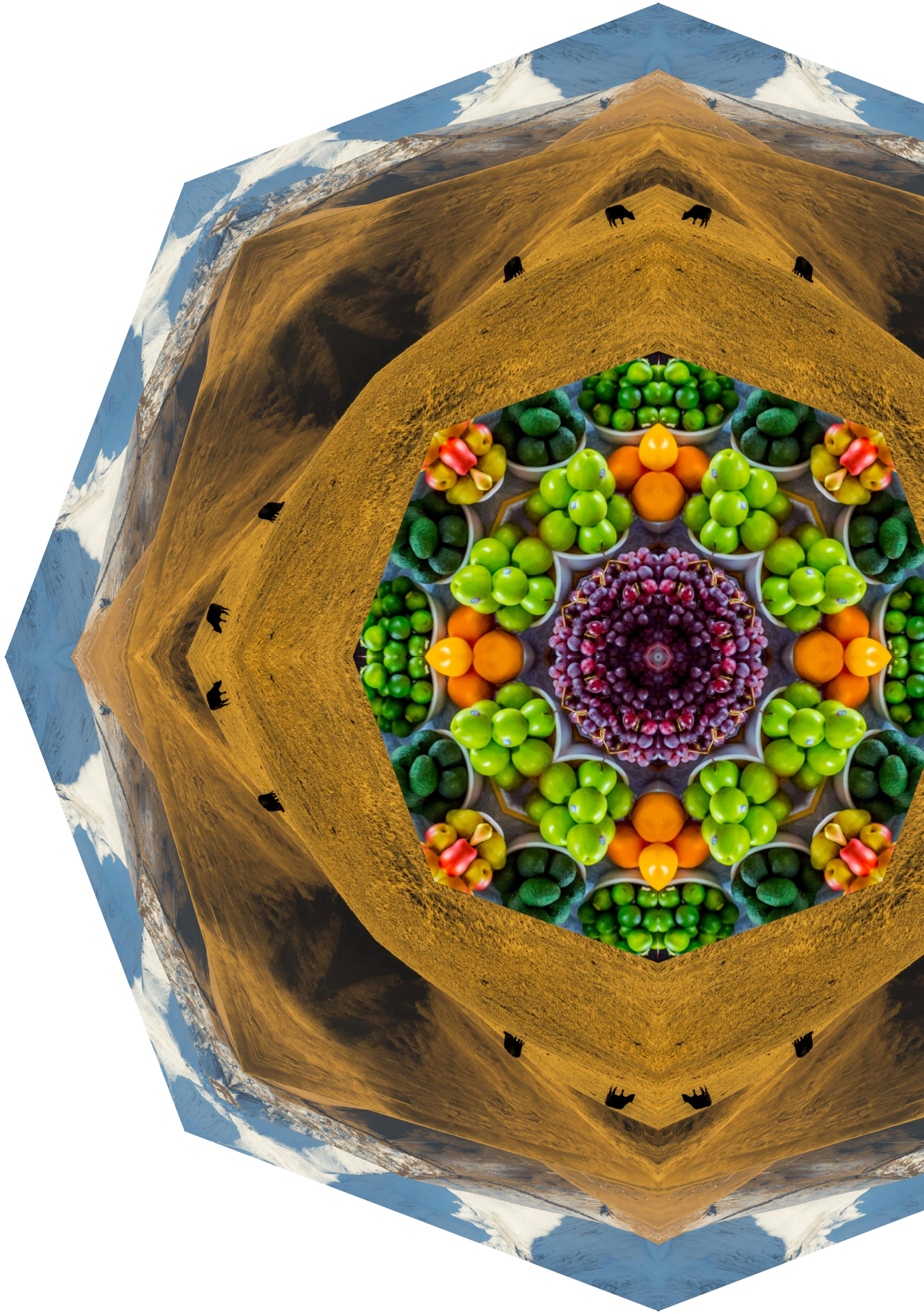
EBRD FINTECC

European Bank for Reconstruction and Development

Food and Agriculture Organization of the United Nations



ACCELERATING ADOPTION OF CLIMATE TECHNOLOGIES IN THE AGRIFOOD SECTOR

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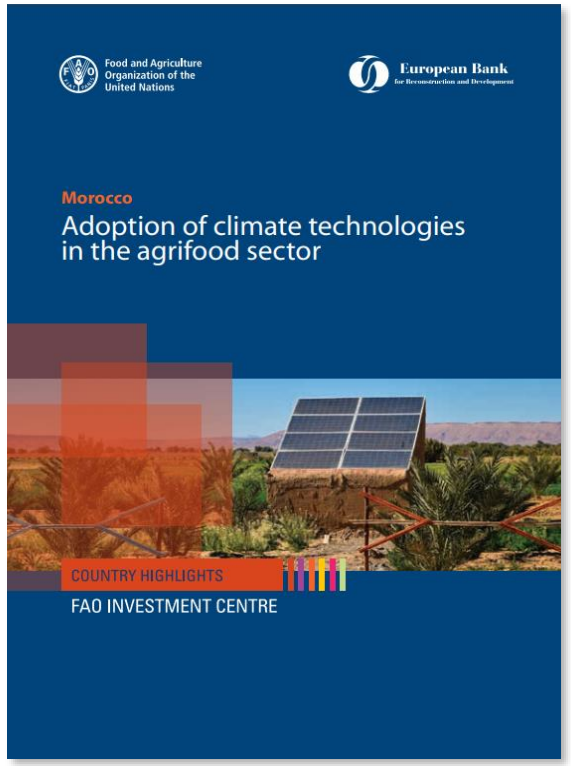
01
METHODOLOGY

- Background
- The 5 steps
- Objectives and criteria
- Assigning scores
- Key results

Background

FAO-EBRD collaboration on FINTECC

- First phase (2015-16):
  - Development of initial methodology study
  - Involvement of the International Energy Agency (IEA)
  - First pilot study in **Morocco**
- Second phase (2017-18):
  - Revising the methodology
  - Studies in **Kazakhstan** and **Kyrgyz Republic**



The 5 Steps

ANALYSIS OF EMISSIONS AND VULNERABILITIES	TECHNOLOGIES EVALUATED AND SCORED	LIST OF PRIORITISED TECHNOLOGIES
1 Mapping GHG emissions and adaptation priorities	2 Assessing technical and financial feasibility 3 Evaluating economy-wide impacts and sustainability 4 Evaluating support policies and barriers	5 Ranking and conclusions

Contribute to GHG emissions reduction and to increased adaptation to climate change in the agrifood sector

Identify drivers to support adoption

Identify technologies with significant potential

Objectives and criteria

used for the core of the technologies assessment (Steps 2, 3 and 4)

	STEP 2	STEP 3	STEP 4
OBJECTIVES	**TECHNICAL AND FINANCIAL** To identify the most technically efficient and supported technology and to maximise the returns to individual investors.	**ECONOMIC AND ENVIRONMENTAL** To maximise net economic benefits	**INSTITUTIONAL** To pursue technologies with the lowest reform threshold
CRITERIA	Performance compared to best practice Maturity of technical support services Current technology adoption rate Trends in gap between uptake and potential Financial returns	Potential to reduce annual GHG emissions Contribution to adaptation Mitigation cost Negative externalities Positive externalities	Policy reform requirements

Implementing the methodology

Facilitating public-private dialogue for technology adoption

- Local team set up in collaboration with international experts
  - Usually Ministry with environment/agriculture mandate
- List of technologies can be expanded as needed
- Using the same analytical principles can be done as a quick assessment or an in-depth study (from Kyrgyz Republic to Ireland)
- Mitigation vs Adaptation
- Incorporating land use issues

Assigning scores to criteria

Technical and financial assessment (Step 2)

STEP	CRITERIA	SCORING	HIGHLIGHTS
2 TECHNICAL & FINANCIAL	Performance compared to best practice	4	Farmers mainly use the te
	Maturity of technical support services	3	Technology….
	Current adoption rate	14%	Potential areas ….
	Trends in gap between uptake and potential	3	Area installed ….
	Financial returns	22%	-NPV -IRR -Payback period

Absolute score
QUALITATIVE
(Likert scale: 1 very low to 5 very high)

Relative score
(normalized across technologies: 0 to 100)

Absolute score
QUANTITATIVE
(estimated financial IRR)

Relative score
(normalized across technologies: 0 to 100)

Assigning scores to criteria

Technical and financial assessment (Step 2)

Score examples

STEP	CRITERIA	SCORING	ABSOLUTE SCORE explained
2 TECHNICAL & FINANCIAL	Performance compared to best practice	4	**Qualitative:** Likert scale 1 – very low to 5 – very high
	Maturity of technical support services	3	**Qualitative:** Likert scale 1 – very low to 5 – very high
	Current adoption rate	14%	**Quantitative**: estimated current adoption rate in % of technical potential
	Trends in gap between uptake and potential	3	**Qualitative:** Likert scale 1 – very low to 5 – very high
	Financial returns	22%	**Quantitative**: estimated internal rate of return (IRR) from financial models using market prices

Absolute scores
QUANTITATIVE or
QUALITATIVE

Assigning scores to criteria

Economic and institutional assessment (Step 3 and 4)

STEP	CRITERIA	SCORING	ABSOLUTE SCORE explained
ECONOMIC & ENVIRONMENTAL	Potential to reduce annual GHG emissions	4 $KtCO_2eq$	**Quantitative**: estimated absolute amount of emissions in CO_2 equivalent that could be reduced at full estimated technical adoption
	Contribution to adaptation	4	**Qualitative:** Likert scale 1 – very low to 5 – very high
	Mitigation cost	-545 USD/tCO_2eq	**Quantitative**: estimated USD per ton of CO_2 equivalent emissions where USD is based on estimated NPV of adoption
	Negative externalities	3	**Qualitative:** Likert scale 1 – very low to 5 – very high
	Positive externalities	4	**Qualitative:** Likert scale 1 – very low to 5 – very high
INSTITUTIONAL	Policy reform requirements	2	**Qualitative:** Likert scale 1 – very low to 5 – very high

Results obtained from the process

Policy dialogue and investment opportunities

- Focused policy dialogue and knowledge exchange
  - Debate on GHG emissions from the sector and priorities
  - Which technologies have greatest potential for GHG reduction
  - What type of support is needed => themes for policy reform
- Tool for donors and IFIs strategic work at country level
- INDCs
- Analysis can help inform financial products development

STEPS

Mapping GHG emissions and adaptation priorities

Assessing technical and financial feasibility

Evaluating economy-wide impacts and sustainability

Evaluating support policies and barriers

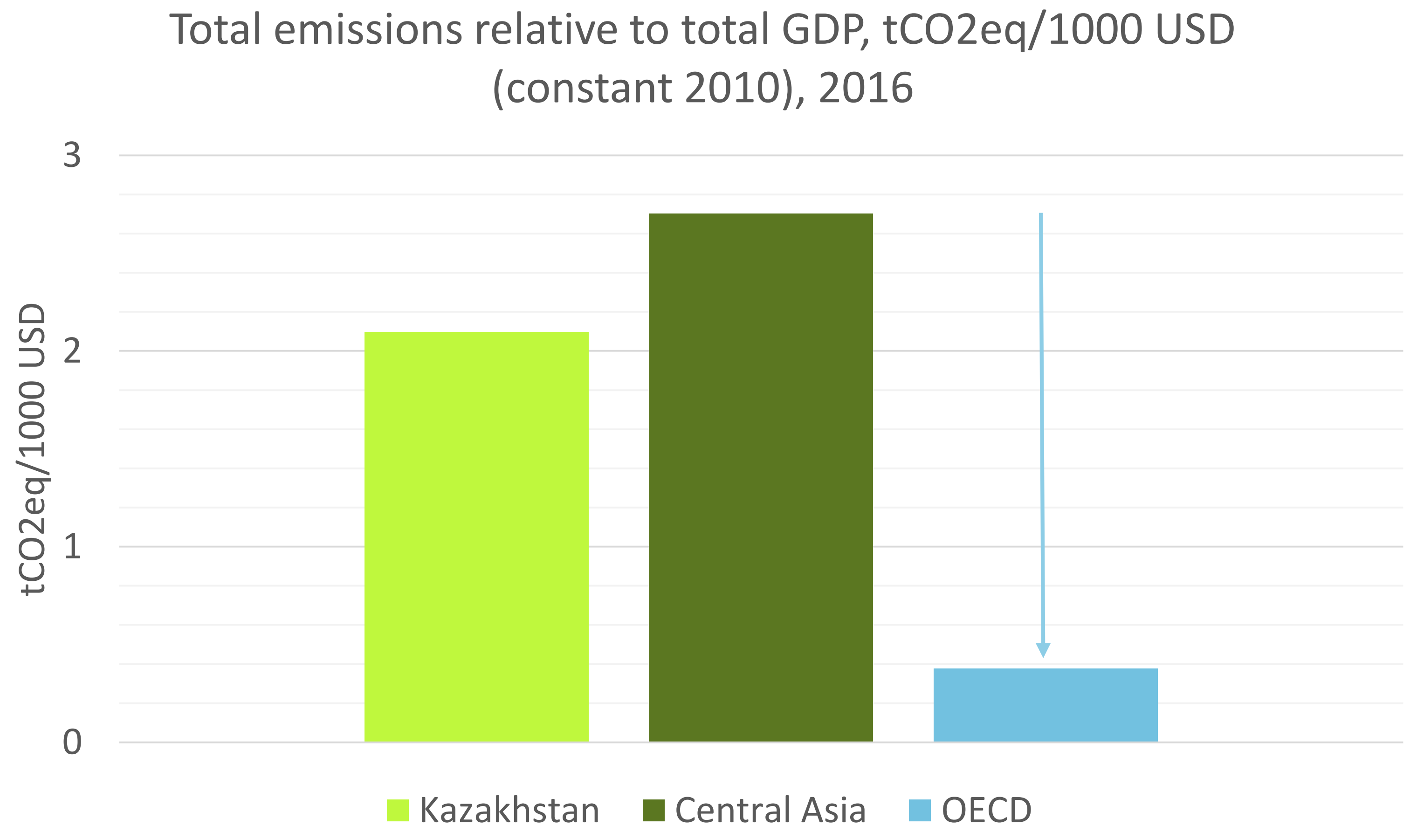
Ranking and conclusions

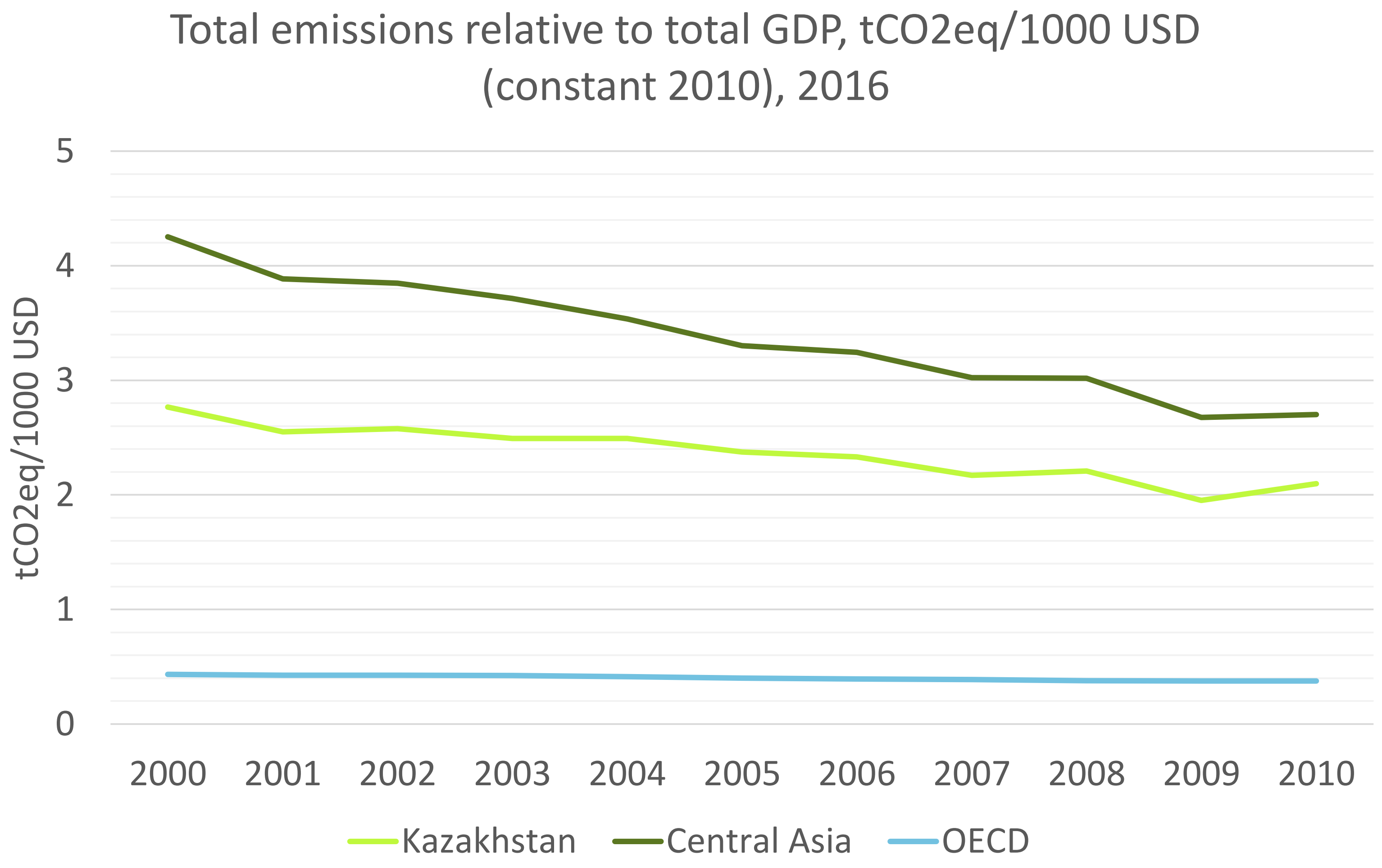
02
EXAMPLE OF APPLICATION TO KAZAKHSTAN

- Analytical details
- Final ranking of technologies
- Investment opportunities

Total emissions relative to total GDP

High country emissions relative to GDP, below regional levels and in net decline

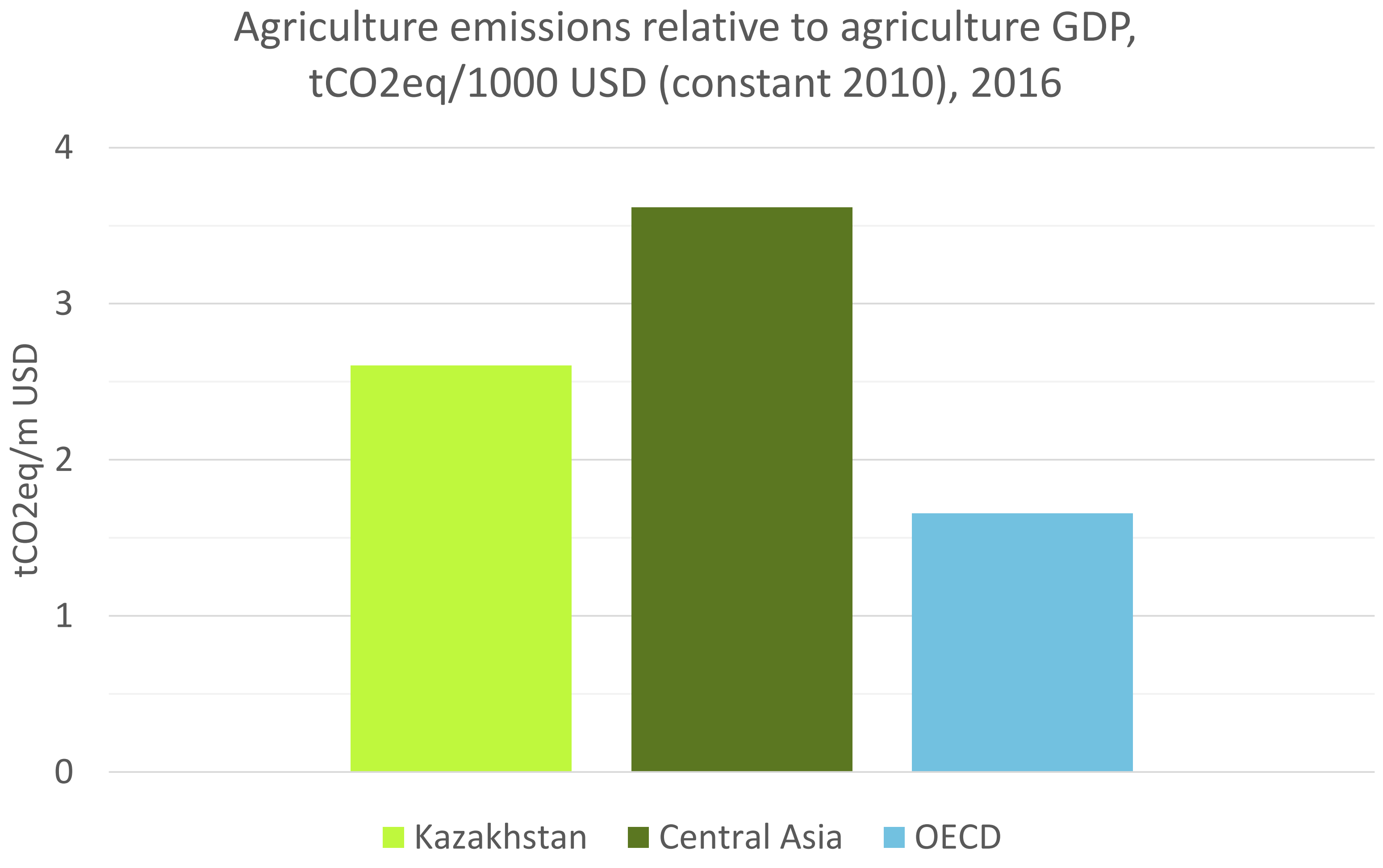


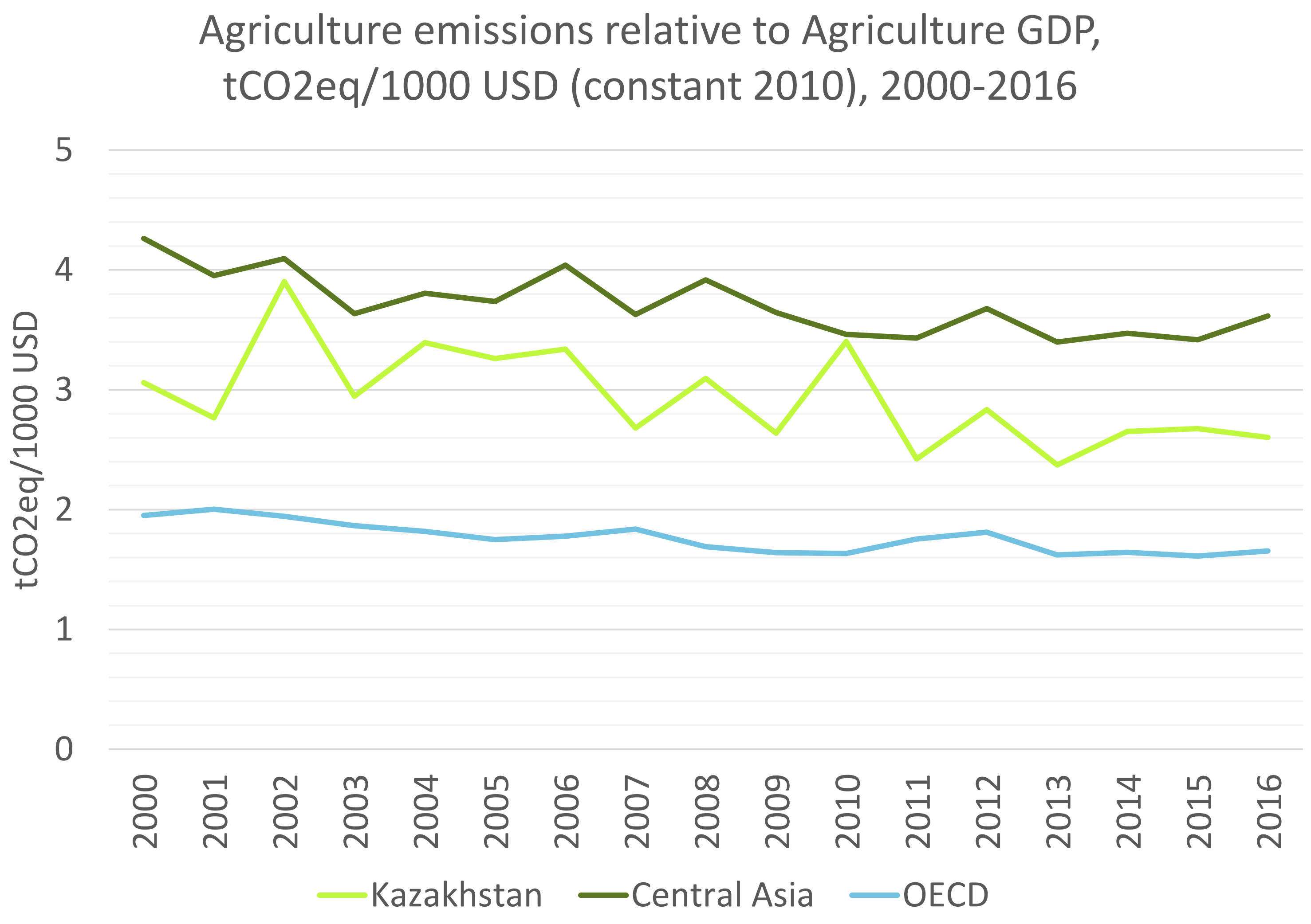


Source: FAOSTAT and World Bank

Agriculture emissions relative to agriculture GDP

Agricultural GHG intensity value lower than region

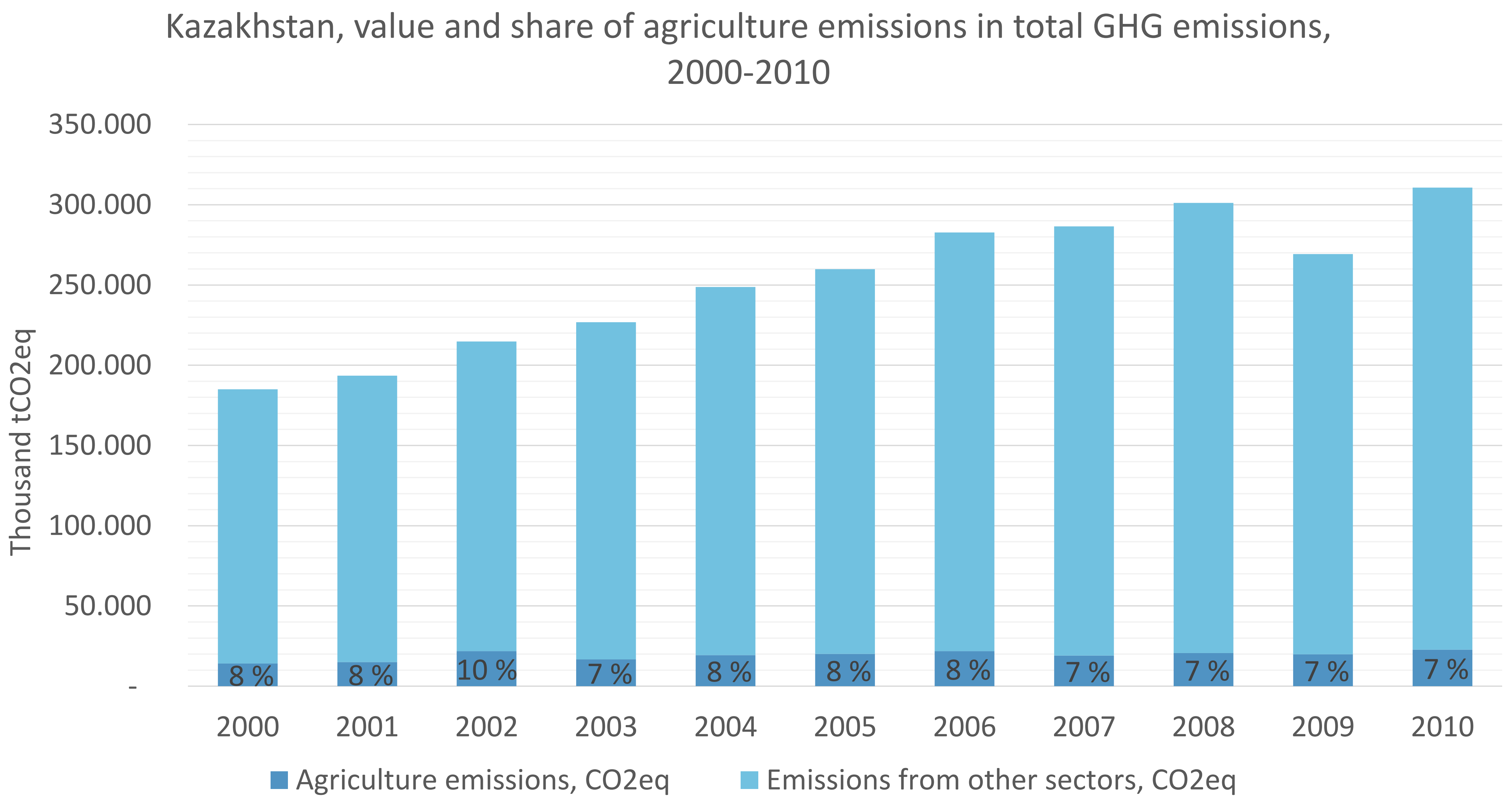


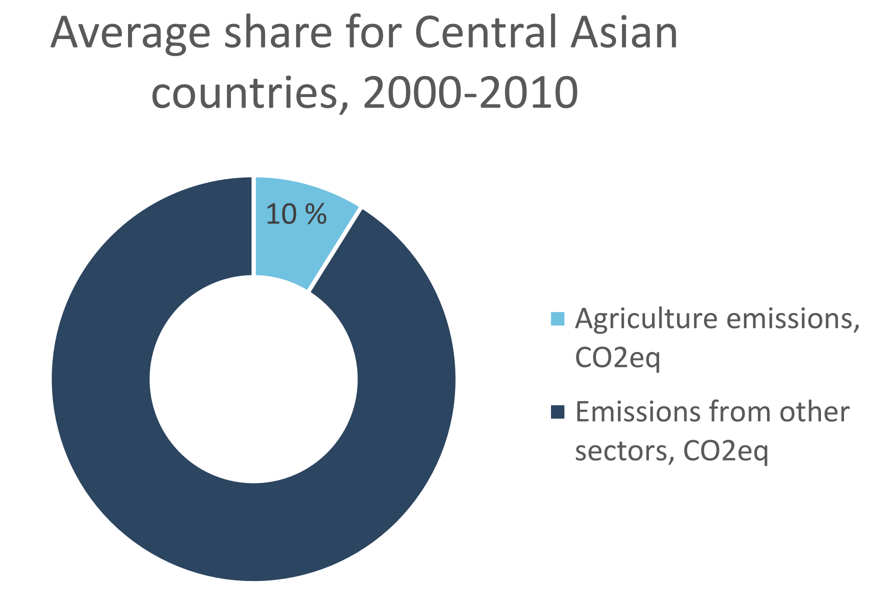


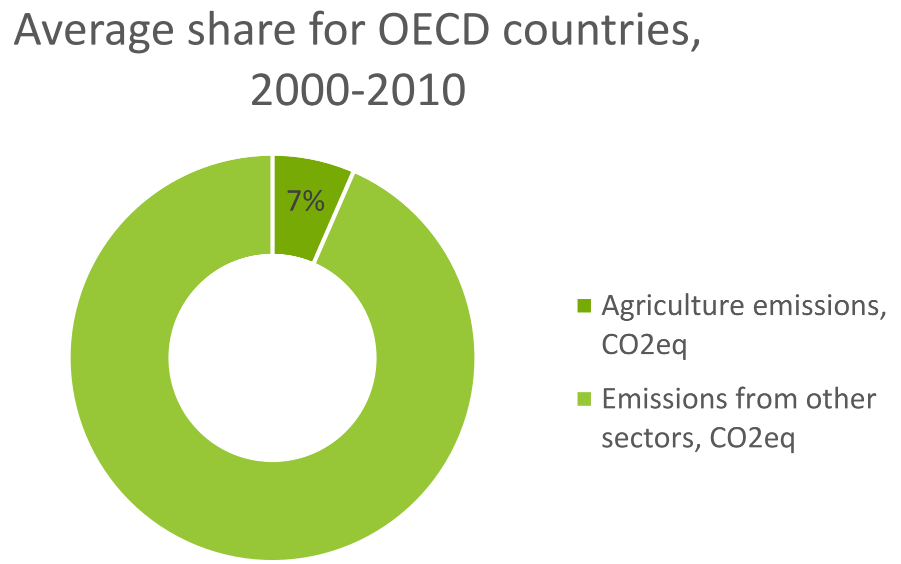
Source: FAOSTAT and World Bank

Value and share of agriculture emissions

Small share of total emissions and approximately stable

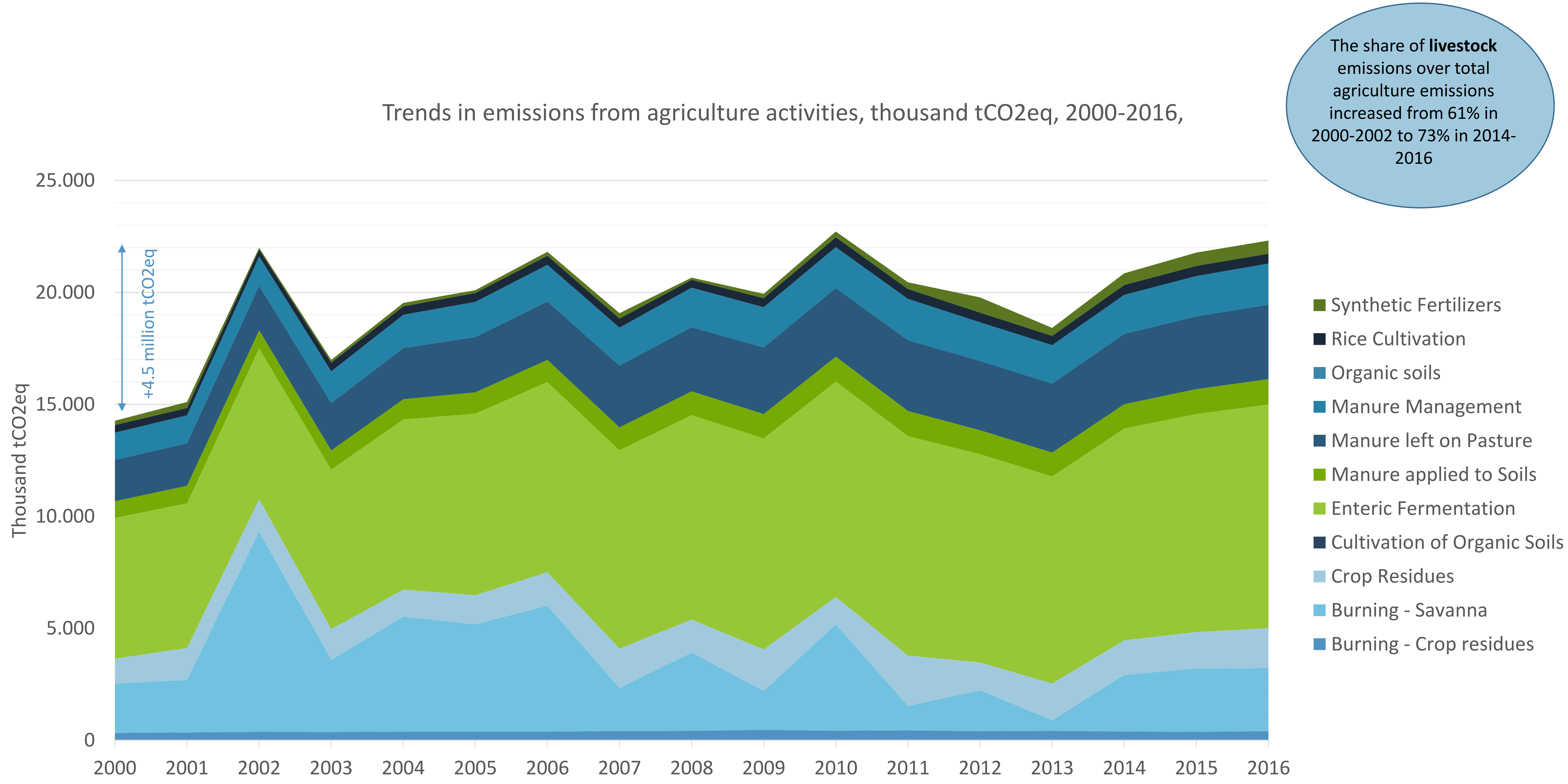






Source: FAOSTAT and EDGAR

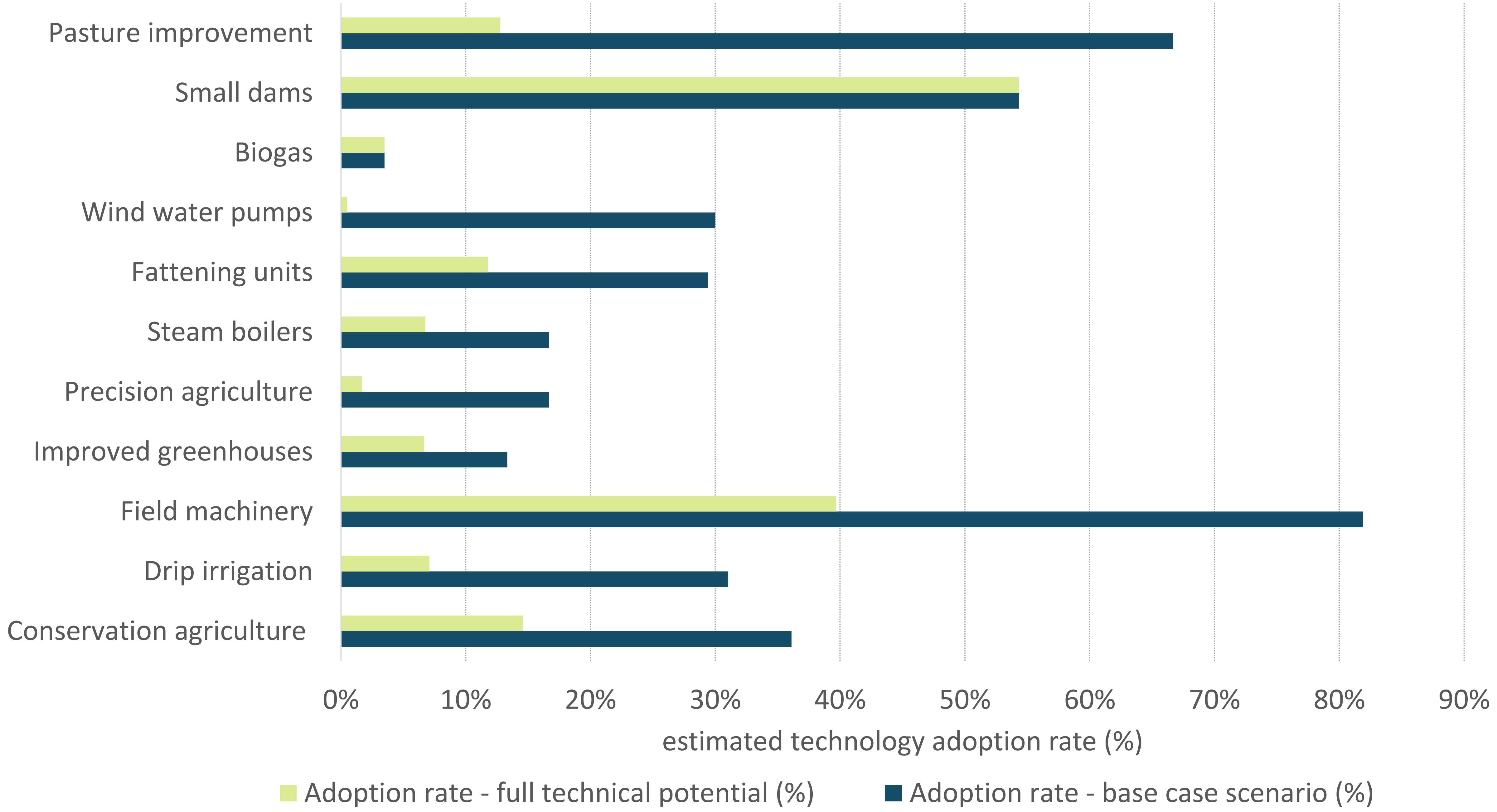
Key emitting agriculture activities in Kazakhstan



Source: FAOSTAT and World Bank

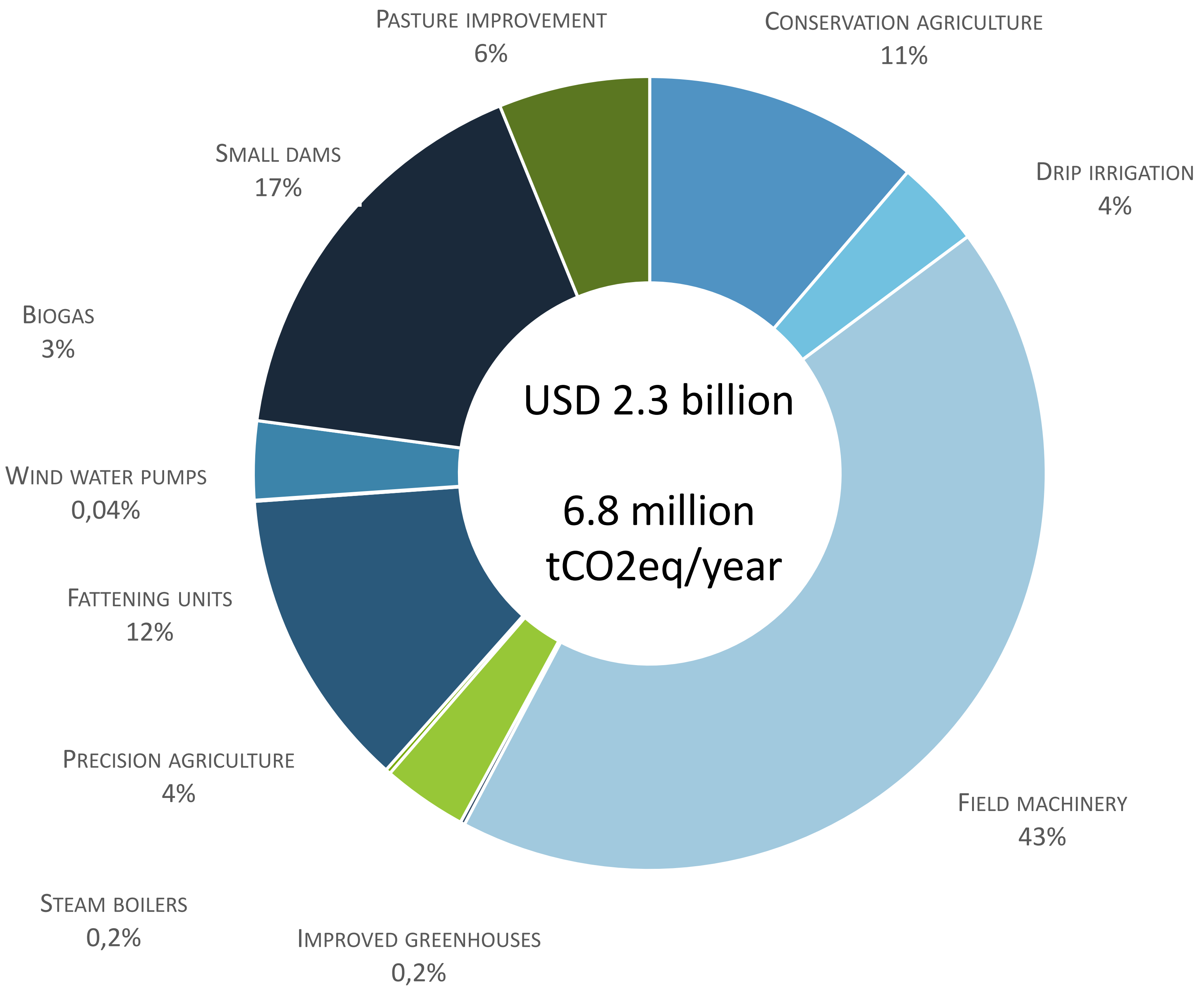
Estimated technology adoption rates

Adoption rates indicate significant potential for technology uptake



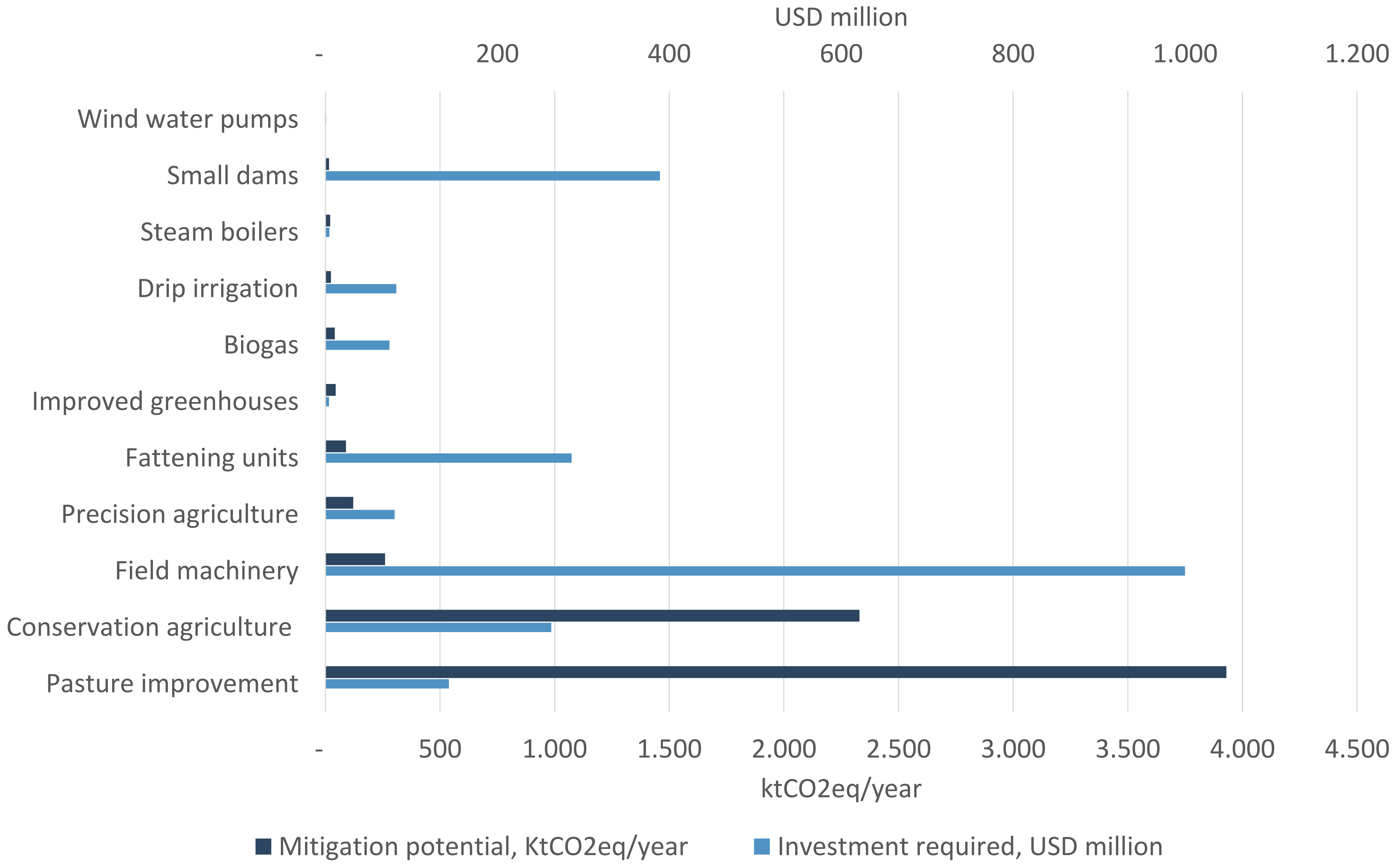
Estimated investment size

USD 2.3 billion in base case scenario of investment needs for full adoption



Estimated investment size and mitigation potential

Major differences across technologies



Source: FAOSTAT and World Bank

Zooming in specific technologies (1)

Conservation agriculture

CURRENT ADOPTION	POTENTIAL ADOPTION	POTENTIAL INVESTMENT	POTENTIAL GHG REDUCTION	POTENTIAL ADAPTATION
36% of estimated potential - 2.6 million ha	7.2 million ha 40% of total cereal, oil and leguminous crops area	USD 263 million	2.3 million tCO2eq/year	USD 250 million

Drip irrigation

CURRENT ADOPTION	POTENTIAL ADOPTION	POTENTIAL INVESTMENT	POTENTIAL GHG REDUCTION	POTENTIAL ADAPTATION
31% of the estimated area (where drip can have mitigation benefits) 9,000 ha	29,000 ha and up to 250,000 ha (inc. adaptation)	USD 83 million	24,000 tons CO2eq/year	USD 112 million

Efficient field Machinery

CURRENT ADOPTION	POTENTIAL ADOPTION	POTENTIAL INVESTMENT	POTENTIAL GHG REDUCTION	POTENTIAL ADAPTATION
16% of the needed fleet	69,000 tractors 25,000 harvesters	USD 1 billion	260,000 tCO2eq/year	USD 63 million

Zooming in specific technologies (2)

Precision agriculture

CURRENT ADOPTION	POTENTIAL ADOPTION	POTENTIAL INVESTMENT	POTENTIAL GHG REDUCTION	POTENTIAL ADAPTATION
17% of estimated potential	Around 45,000 units of systems of parallel driving (9 million ha)	USD 80 million	122,000 tCO2eq/year	USD 10 million

Improved greenhouses

CURRENT ADOPTION	POTENTIAL ADOPTION	POTENTIAL INVESTMENT	POTENTIAL GHG REDUCTION	POTENTIAL ADAPTATION
13% of estimated greenhouse area – 20 ha	Around 150 ha and up to 300 ha including new greenhouses	USD 4 million	45,000 tCO2eq/year	USD 1 million (*)

Technical and financial assessment details (Step 2)

Summary for crop farming technologies

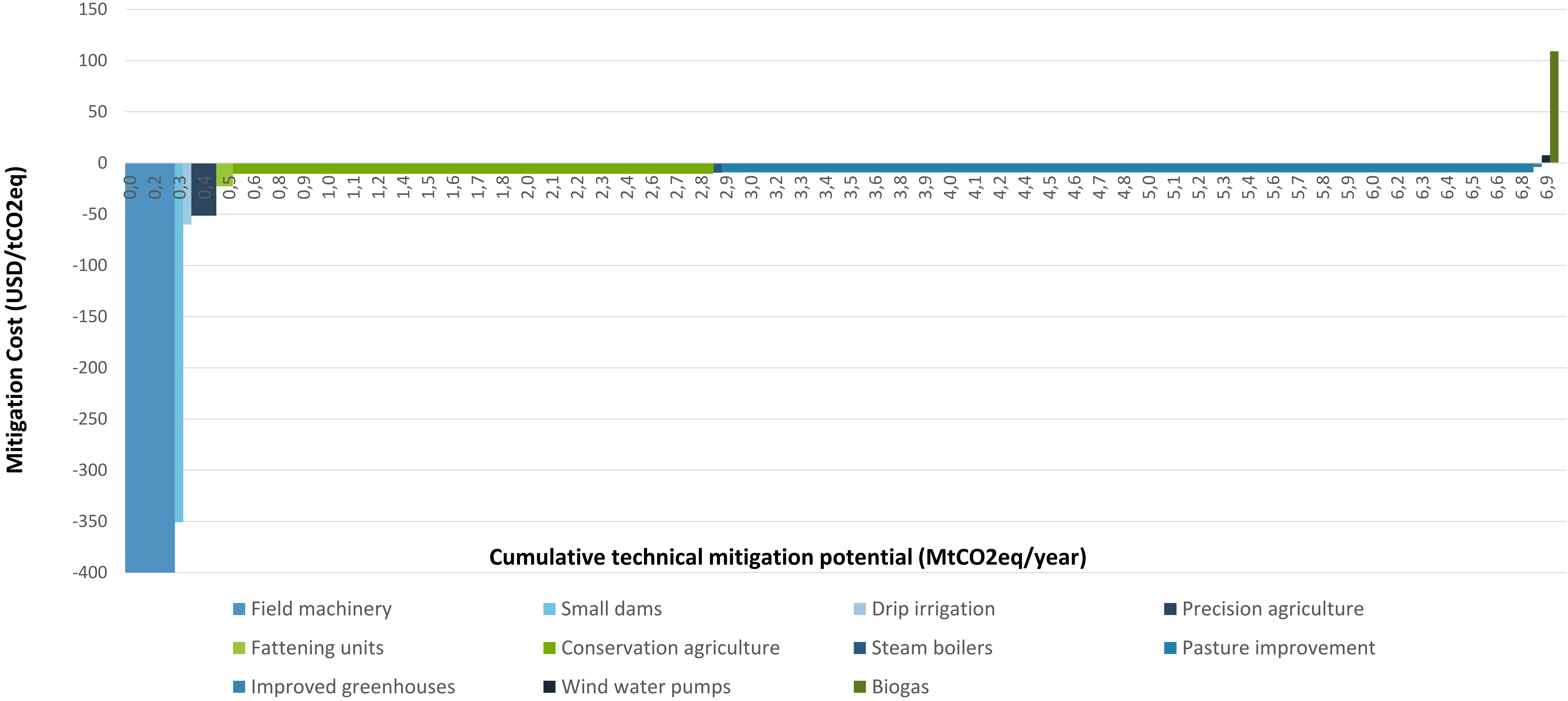
STEP	CRITERIA	HIGHLIGHTS
2 TECHNICAL & FINANCIAL	Performance compared to best practice Scores: 4 (PA and Drip) and 3 (CA, FM and GH)	• The five technologies are available and perform well when compared to IBP • **In PA and Drip**: imported technology is closer to IBP (imported from Europe and US) • **In CA, FM and GH**: farmers mainly use implements imported from Russia and Belarus and China (thermocover). Most FM technology is available but it is more costly and difficult to maintain
	Maturity of technical support services Scores: 4 (Drip), 3 (CA, FM and PA) and 2 (GH)	• Technical support services exist for all the five technologies. They are widespread and efficient for drip and available but not widespread for **CA, FM and PA**. For **improved GH**, few distributors provide the services for maintenance.
	Current adoption rate Range from 82% (FM), 36%(CA), 31%(Drip), 17% (PA) and 13%(GH)	• Quite low in **GH and PA** (13 and 17%, respectively) suggesting significant potential for deployment • Moderate in **CA** (36%) and drip (31%) and high in **FM** due to conservative assumptions of potential areas for adoption
	Trends in gap between uptake and potential Scores: 4(GH), 3 (CA, FM, PA) and 2 (Drip)	• **GH:** For the last 5 years around 90 ha of industrial GHs built and additional 150 by 2021. Trend in construction of more GH will not change • **CA, FM and PA:** The gap is large and has not been decreasing • **Drip:** Potential for installing drip irrigation is expected to grow!
	Financial returns Range from 27% (PA), 22% (CA and drip), 21%(GH) and 13% (FM)	• Very good financial returns to investments in **PA, CA, Drip and GH**. **FM** presents moderate returns because of limited diesel savings and reduction of harvest losses when investing in regionally produced machinery.

Economic and institutional assessment (Step 3 and 4)

STEP		
3 ECONOMIC & ENVIRONMENTAL	Potential to reduce annual GHG emissions	The five technologies combined represent 40% of the total potential estimated mitigation. **CA** has the largest GHG mitigation potential due to lower fuel consumption and soil carbon sequestration.
	Contribution to adaptation Scores: 5 (drip), 4 (CA and GH) and 3 (FM and PA)	Adaptation benefits of USD 436 million were quantified for these 5 techs. **CA and FM** represent most of the quantified benefits. Main quantified adaptation benefits were additional agricultural production, water availability and energy availability
	Mitigation cost From USD.tCO2eq : -4 (GH), -11 (CA) -51 (PA), -60 (drip), -400 (FM)	**FM** shows a high negative mitigation cost (-400 USD/tCO2) driven good economic returns on adoption and low mitigation potential. It is followed by **drip** (-60 USD/tCO2eq), PA (-51 USD/tCO2rq) , CA (-11 USD/tCO2eq) and **improved GH** (-4 USD/tCO2e).
	Negative externalities Scores: 5 (PA), 4 (CA, GH), 3 (FM and drip)	**CA:** Possible increases in herbicide use in the short term; **FM:** Manufacturing footprint of new tractors/harvesters; **Drip:** Labor impacts can be negative; tubing and others
	Positive externalities Scores 4 (all)	**All technologies** will increase food security in the long tem. Drip can lead to aggregate savings in water with appropriate regulatory/institutional setting.
4 INSTITUTIONAL	Policy reform requirements Score: 2 (CA), 3 (PA, GH) and 4 (Drip and FM)	Policy reform range from very high in **CA**, moderate in **PA** and **GH** and low in **Drip and FM**. The principle obstacles to the adoption of these five technologies are knowledge and information, regulatory and institutional issues and access to credit and cost of capital for smaller farmer (except for PA)

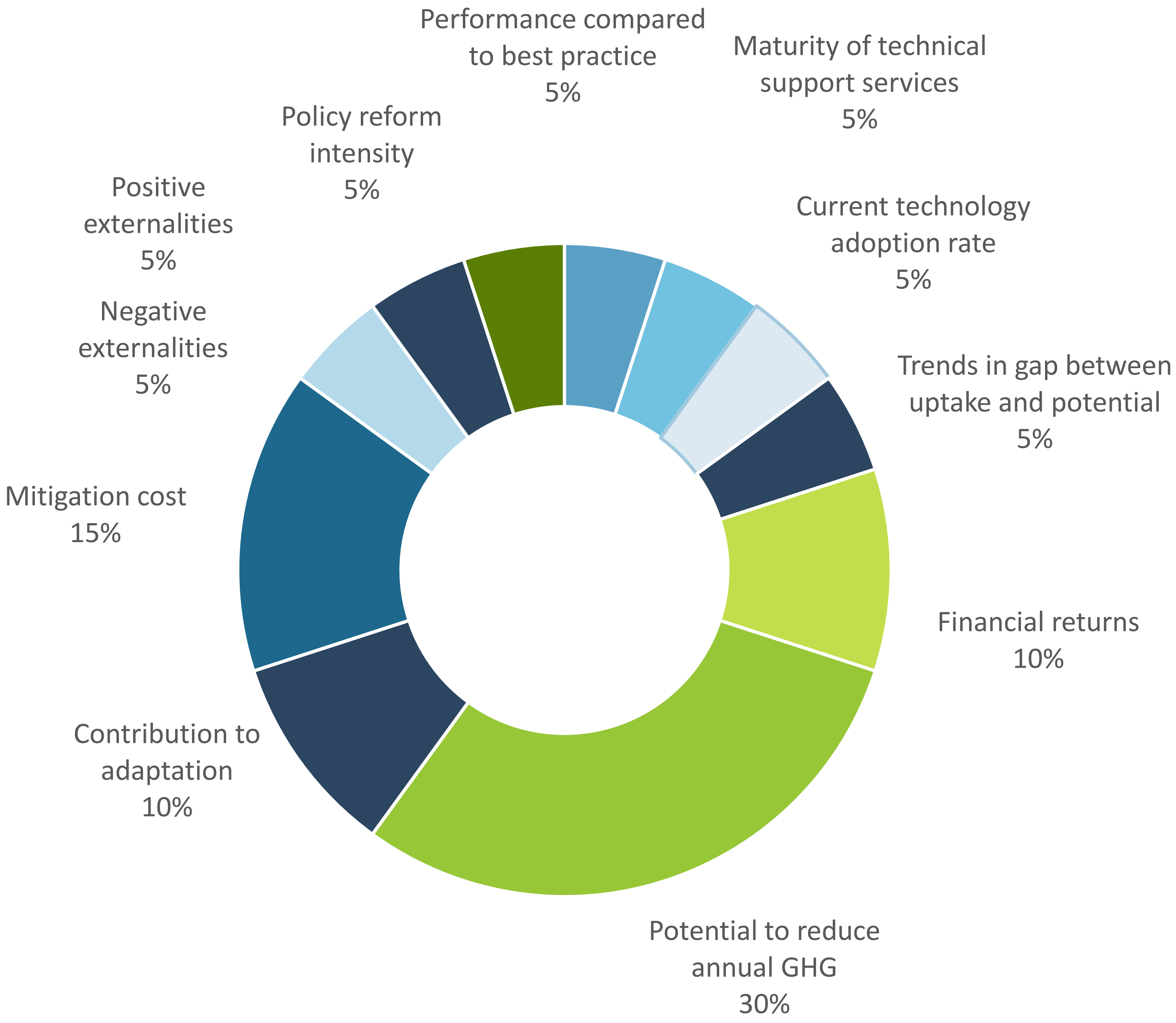
Estimated simplified MACC

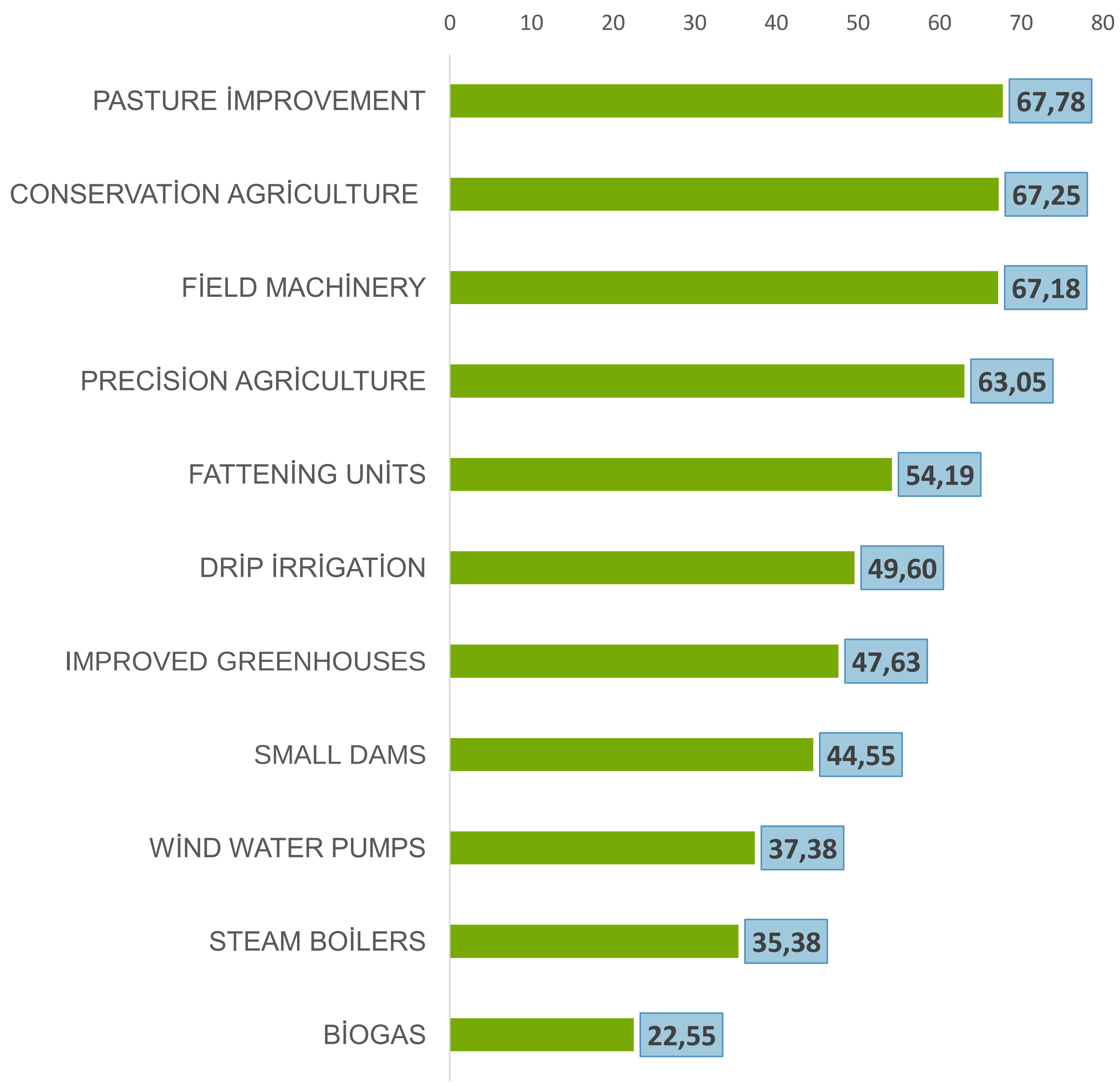
Pasture improvement with low mitigation cost and very high potential



Technology ranking (mitigation oriented scenario)

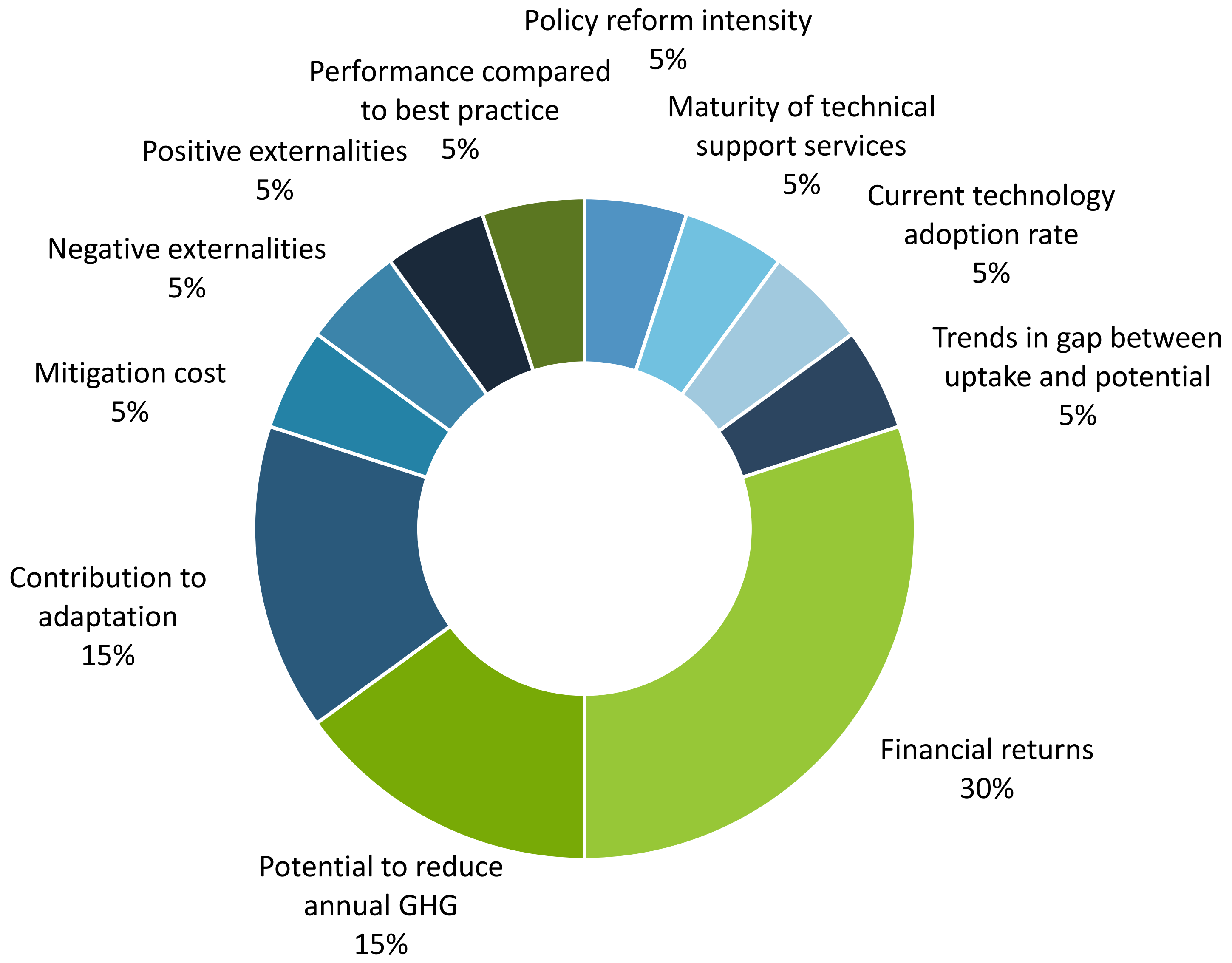
Weights, weighted scores and prioritized list

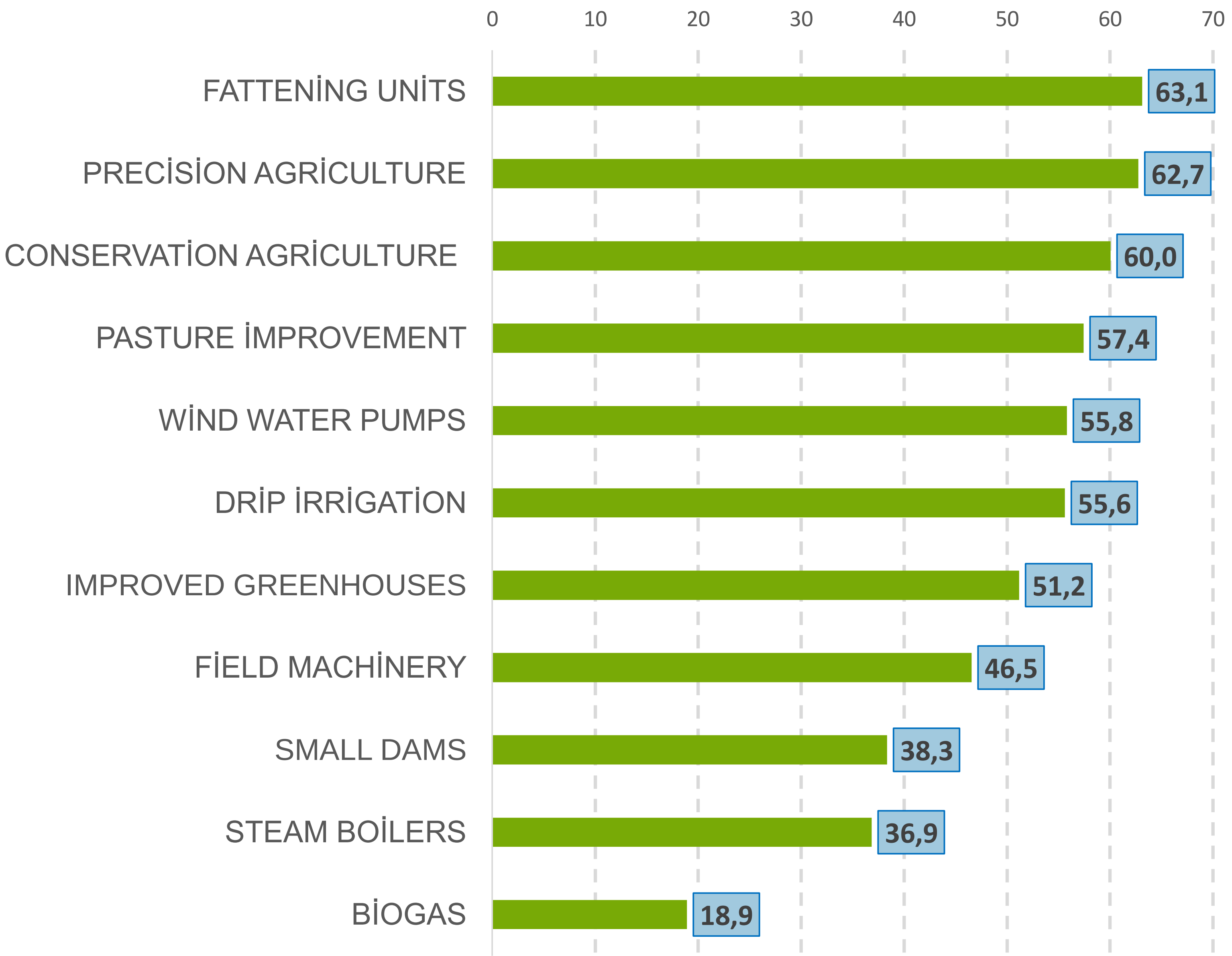




Technology ranking (Financial return oriented scenario)

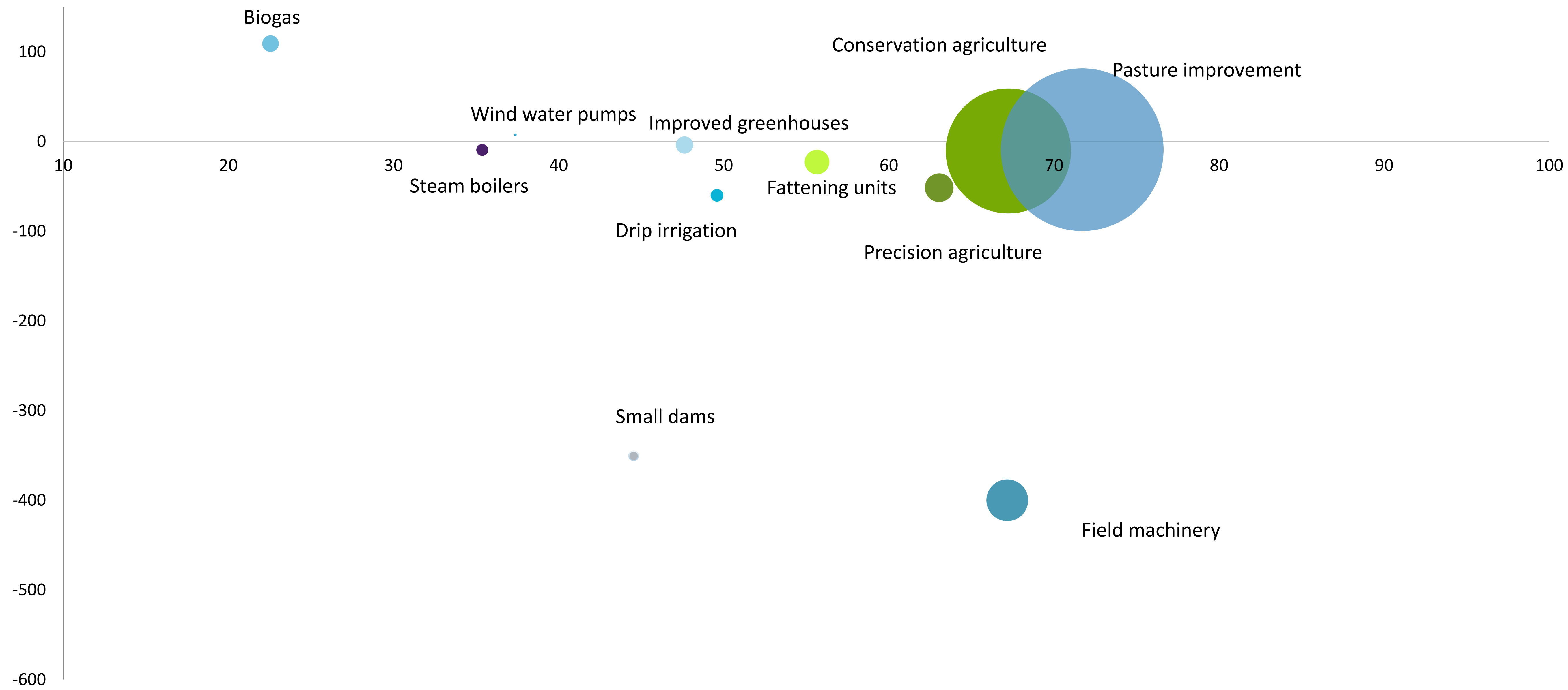
Weights, weighted scores and prioritized list



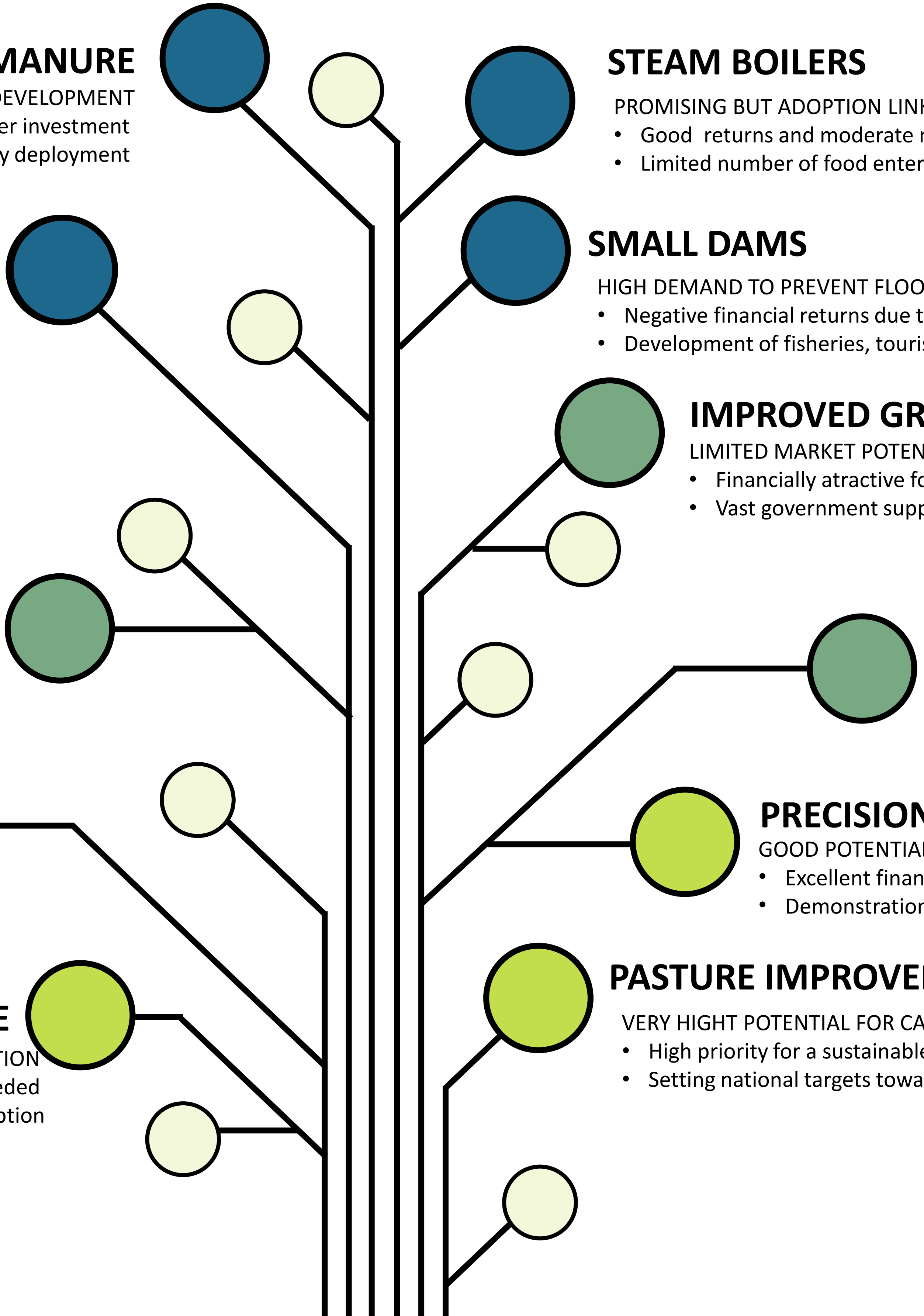


Mitigation costs, potential and weighted scores

Bubble size proportional to mitigation potential (ktCO2eq/year)



Technology tree



BIOGAS FROM MANURE
VERY HIGH POTENTIAL BUT INSUFICIENT GOVERMENT SUPPORT FOR A RAPID DEVELOPMENT
- Inefficient use of exisitng tech; premium for electricity generation is not enough to cover investment
- Servicing companies and manure management are pre-requirments for technology deployment

WIND WATER PUMPS
HIGH POTENTIAL IN REMOTE AREAS WITH ADAPTATION BENEFITS
- Very good financial return due to public support meassures
- Only interesting in areas where electicity is not available

DRIP IRRIGATION
ONLY A MITIGATION TECHNOLOGY IN SPECIFIC SITUATIONS
- Significant adaptation benefits if water scarcity and with appropiate governance
- Water/groundwater legislation, clear targets and incentives for water-saving

FIELD MACHINERY
GOOD POTENTIAL FOR FLEET RENOVATION
- Moderately good mitigation benefits through diesel savings
- Access to capital and availability of best technology concerns

CONSERVATION AGRICULTURE
VERY HIGH POTENTIAL FOR MITIGATION AND ALSO ADAPTATION
- Good financial returns; knowledge disemination and widespread support services needed
- Although an initial boom, policy reform and financial support needed to foster adoption

STEAM BOILERS
PROMISING BUT ADOPTION LINKED TO AGRIFOOD SECTOR TRANSITION
- Good returns and moderate mitigation benefits
- Limited number of food enterprises

SMALL DAMS
HIGH DEMAND TO PREVENT FLOODS AND IRRIGATE, BUT REQUIRES LONG-TERM INV.
- Negative financial returns due to high up-front investment and low level of water tariffs
- Development of fisheries, tourism, recreational services, biodiversity improvements

IMPROVED GREENHOUSES
LIMITED MARKET POTENTIAL BUT INTERESTING GREENING BENEFITS
- Financially atractive for industrial greenhouses that operate the entire year
- Vast government support and incentives may lead to new areas

EFFICIENT FATTENING UNITS
TACKLING LIVESTOCK PRODUCTIVITY ISSUES
- Good financial returns; can support sector modernization
- Capacity utilization is crucial for financial profitability

PRECISION AGRICULTURE
GOOD POTENTIAL AREA SERVED BY FIELD MACHINERY EQUIPPED WITH TECH
- Excellent financial returns due to less wasted seed, fertilizer, fuel, and time
- Demonstration farms and activities on promotion of technology are needed

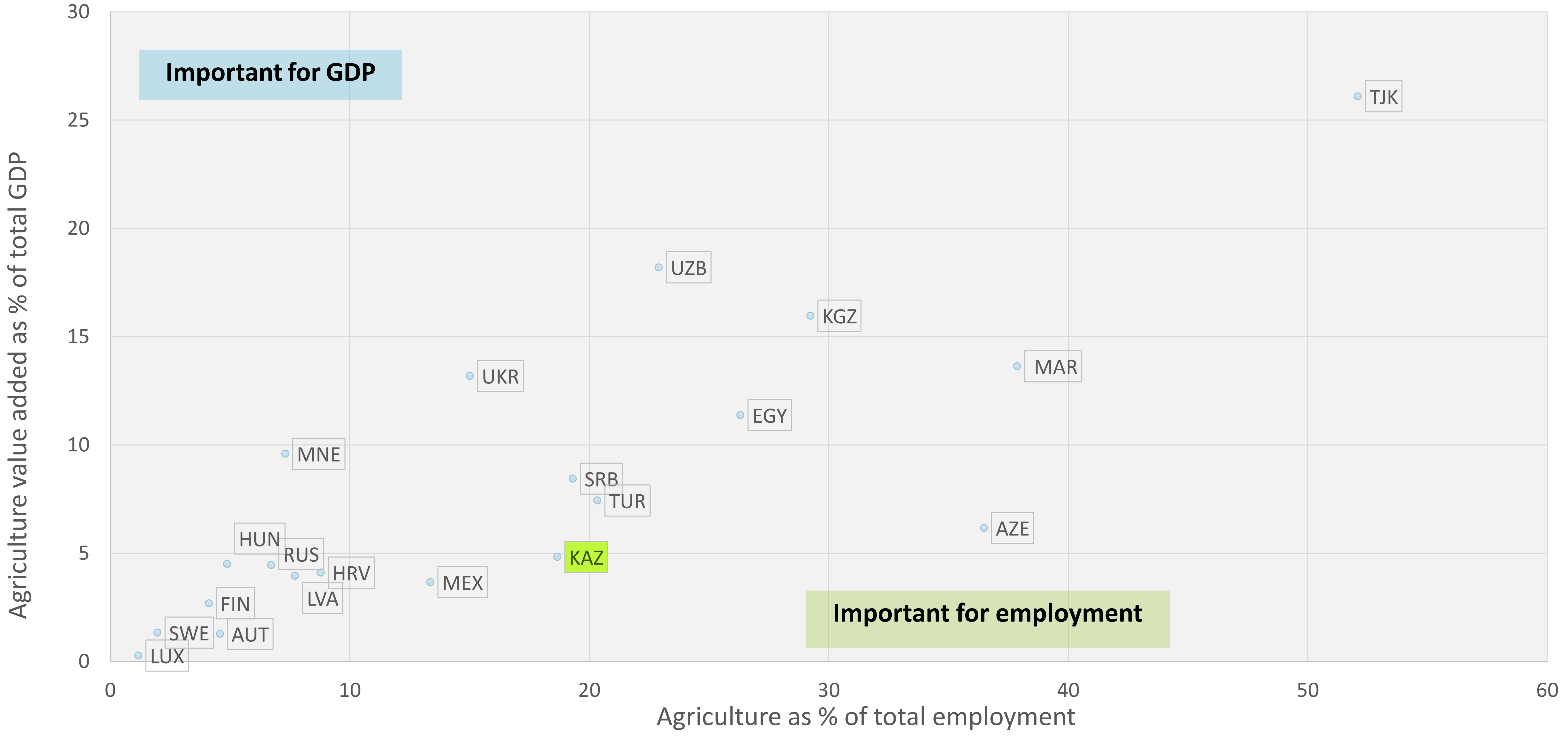
PASTURE IMPROVEMENT
VERY HIGHT POTENTIAL FOR CARBON SEQUESTRATION
- High priority for a sustainable development of livestock sector
- Setting national targets towards the recovery of degraded pasture needed

03
IN SUM

- Tool to support deployment of green technologies in the agrifood sector
- Provides basis for dialogue on sector emissions and vulnerabilities to Climate Change
- Identifies promising green technologies and can track adoption rates
- Provides insights into policy themes that may need to be addressed for accelerated tech adoption

Kazakhstan-agriculture employment and value added

Sector plays an important role in employment



Source: World Bank, average 2014-2016 data